Food and Agriculture Organization of the United Nations

THE ROLE OF SOCIAL PROTECTION IN STRENGTHENING AGRIFOOD SYSTEMS AND INCLUSIVE RURAL TRANSFORMATION

A CASE STUDY OF THE BANGLADESH ENHANCED COASTAL FISHERIES PROJECT (ECOFISH-BD)

THE ROLE OF SOCIAL PROTECTION IN STRENGTHENING AGRIFOOD SYSTEMS AND INCLUSIVE RURAL TRANSFORMATION

A CASE STUDY OF THE BANGLADESH ENHANCED COASTAL FISHERIES PROJECT (ECOFISH-BD)

Julian May, Myriam Velia and Omar Benammour
DSI-NRF Centre of Excellence in Food Security

Food and Agriculture Organization of the United Nations
Rome, 2023

Required citation: May, J., Velia, M. & Benammour, O. 2023. *The role of social protection in strengthening agrifood systems and inclusive rural transformation – A case study of the Bangladesh enhanced coastal fisheries project (ECOFISH-BD).* Rome, FAO. https://doi.org/10.4060/cc8127en

ISBN 978-92-5-138238-7

Cover photograph: © FAO/GMB Akash

Contents

Figures

Tables

Abstract

Enhanced Coastal Fisheries in Bangladesh (ECOFISH-BD) is a Payment for Ecosystem Services programme that focuses on establishing "collaborative science-based management", "co-management", or "adaptive co-management" to improve the stock of hilsa, a popular fish species. ECOFISH-BD Phase 1 was introduced in 2014 as a 5-year initiative that has been followed by ECOFISH-BD Phase 2 from January 2021 (WorldFish, 2021). The overall goal of both ECOFISH-BD Phase 1 and Phase 2 is to improve the resilience of the Meghna River ecosystem and communities reliant on coastal fisheries. This is to be achieved by assisting households as they have had to adapt to a series of fishing bans introduced by the Government. These measures are quite extensive, requiring households highly dependent on hilsa to comply an eight month ban between November and June each year of harvesting fish smaller than 25cm; a total two-month fishing ban in the six hilsa sanctuaries; and brood fishing ban for 22 days during spawning season to protect breeding areas.

A series of compensation and livelihood strategies is provided to help households adjust to this regulation. These include increasing the provision of the rice allowance from Bangladesh's SP framework via the Vulnerable Group Feeding Program, access to productive assets to generate alternative incomes, skills training, community savings groups for women with business training and soft loans. These components serve as the 'carrot', providing incentives to bring about compliance and community support (Rahman *et al.*, 2020). As the 'stick' component to ensure compliance, governance of the program included establishing conservation groups and fish guards. This extends to penalties such as imprisonment and fine through mobile court for non-compliance of the fishing ban periods.

Central to ECOFISH-BD's theory of change is that the combination of rising fishing household income through more diversified income sources, and through increased productivity would achieve the project's overall goal to reduce poverty and improve natural resource management. However, although conservation and income diversification are important, ECOFISH-BD moved beyond the conventions of PES, to include the establishment of local institutions and of adaptive co-management systems as central to the sustainability of the programme.

Conservation policies remain the bedrock informing the implementation of ECOFISH-BD. Monitoring, surveillance and enforcement of the fishing restrictions by law enforcement agencies continues and a Hilsa Conservation and Development Fund (HCDF) provides a trust fund for or hilsa conservation and development. The participatory management structure of ECOFISH-BD is key to the approach. Different levels of community management structures were established through a participatory community profiling exercise in 136 fishing villages located along the river courses of the six hilsa sanctuaries

(Islam *et al.* 2020). Fisheries Management Committees (FMC) were established in every village. This comprised members of the community structures as well as non-fisher stakeholders including the money-lenders and middlemen.

To ensure coordination across the local sites, three layers lie above the community structures. From the apex, these include district co-management committees headed by the district commissioner, the local co-management committee, and the fisher union co-management committee or a wharf co-management committee. Ultimately these feed into the central coordination responsibility of the Ministry of Fisheries.

The 'just reward' component for community ES included the provision of 20 kg of rice per household to 248 674 licensed fishers during the ban period. This was later increased to 40 kg of rice per household and raising the provision to 80 kg and including cash support is currently proposed. Although a component of ECOFISH-BD, the rice is provided under the Vulnerable Group Feeding (VGF) program.

ECOFISH-BD went well beyond the conventional policies adopted by Marine Protection Areas or by PES. From the outset, ECOFISH-BD included a gender perspective in its approach and included a focus on engaging women. This recognised the importance of broadening consultation and economic empowerment, and included activities to diversify livelihoods by increasing access to resources and technologies (Wahab *et al.*, 2021). One of our respondents remarked that in his experience, women are more concerned with compliance to the management rules that have been adopted, and when empowered through other activities, are better placed to influence the male fishers.

Furthermore, community involvement is a key feature for all aspects of the intervention, including its research component. For example, 60 boat captains received "citizen scientist" training to collect real-time catch data. This was done directly from boat to database using smartphones. Community facilitators were placed in fish landing stations to improve management and monitoring of the landed fish catch. An extensive awareness raising program contributed towards changing attitudes about observing ban periods and using legal fishing gear (Islam *et al.*, 2020).

Hilsa are usually traded whole, ungutted and without processing. Although this limits opportunities such as gleaning the by-products of processing, the value chain nonetheless generates multiple livelihoods in addition to that of the fishers. The AIGA component is intended to compensate for such livelihoods that may be lost, and has included the provision of input support, such as cattle, seeds and seedlings for small-scale farming. Training on income generating opportunities is also provided, including on vegetable farming; chicken, duck, and turkey rearing; goat, sheep, and cow husbandry; tailoring and toy making; pond/cage aquaculture; as well as in financial literacy (Abdul *et al.*, 2021). However, the reach of this component of the programme seems limited and according to Haque and Mahfuzu (2020) less than 4 300 Hilsa fishing households have been fully engaged in such AIGA.

In general, the assessments of ECOFISH-BD suggest that there is compliance with the regulations concerning the hilsa bans. Bladon *et al.* (2016: 26) report significant differences in the density of small and large fishing boats in the sanctuary areas during the ban and non-ban seasons. However, the evidence for behaviour change is less promising. Although 66 percent of respondents to a household survey of 600 households reported a change in the gear type that they were using, the reason for doing so was not attributed to the regulations, and almost half of those that had made a changed had reduced the mesh size rather than the desired increase in mesh size.

Despite this, it appears that there has been recovery in hilsa stock. Haque and Mahfuzu (2020) state that the co-management interventions helped in producing a 6 percent extra annual incremental production that comprised about 130,000 tons of hilsa worth about USD 1 040 million between 2016 and 2019. As a result, the maximum sustainable yield of hilsa increased significantly from 526 000 metric tons per year in 2016 to 690 000 metric tons per year in 2019.

Although, a higher catch does not necessarily mean improved fish stock, Karim et al (2019) conclude that there has been a recovery of the hilsa stock in Bangladesh while Bladon *et al.* (2016: 22) report on a household perception survey in which 69 percent of respondents reported that the regulations had a positive impact on the hilsa catch. Key respondents also reported a positive impact on fishing stocks. Nonetheless, it must be noted that in addition to poor baselines from which to judge impact (Bladon *et al.*, 2016), the population of hilsa are affected not only affected by overfishing. Pollution, upstream damming, and climate change are also important (BOBLME, 2010). Other factors include the closure of fish migratory routes and river siltation.

In this context, the scale up of the AIGA component could be essential to diversify source of income of fishers and limit the exposure to those additional shocks affecting fishers and other actors of the fish value chain. Additional social protection interventions, such as school feeding, child grants or social care services as part of the larger national social protection system can play a more important role in addressing the overall vulnerabilities of fishers, especially as those changes can lead to more hunger, child labour, forced migration, hazardous working conditions and further marginalization and under development of specific territories.

Consequently, the example of Bangladesh shows that the ECOFISH-BD associated to the VGF program play a key role in transforming the blue food systems. But, it can only partially solve a systemic challenge. Additional risks in fisheries remain and setting up a response through a larger number of social protection interventions, embedded into a national social protection system, would be required to address the overall risks and challenges of the blue food systems in the country.

Abbreviations

AIGA	alternative income-generating activity
BFRI	Bangladesh Fisheries Research Institute
CoE-FS	DSI-NRF Centre of Excellence in Food Security
CSG	community savings group
DoF	Department of Fisheries
ECOFISH-BD	Enhanced Coastal Fisheries in Bangladesh Project
FAO	Food and Agriculture Organization of the United Nations
GoB	Government of Bangladesh
HCG	Hilsa Conservation Group
HDDS	Household Dietary Diversity Score
HFMAP	Hilsa Fishery Management Action Plan
HGG	Hilsa Ghat Group
IIED	International Institute for Environment and Development
ILO	International Labour Organization
MoFL	Ministry of Fisheries and Livestock
PES	payment for environmental/ecosystem/ecological services
SP	Social Protection
USAID	United States Agency for International Development
VGF	Vulnerable Group Feeding Program

Acknowledgements

This document was written by Julian May and Myriam Velia of the DSI-NRF Centre of Excellence in Food Security (University of Western Cape), in collaboration with Omar Benammour of the Food and Agriculture Organization (FAO).

The different social protection and fisheries experts interviewed for the preparation of this paper are thanked for their generosity with their time.

This document benefited from peer review by: Alejandro Grinspun (Inclusive Rural Transformation and Gender Equality Division, FAO), Daniela Kalikoski and Daniella Salazar (Fisheries and Aquaculture Division).

The views and summary analysis expressed in this report are based solely on those of the authors and do not necessarily reflect those of stakeholders and partners associated with the Enhanced Coastal Fisheries Project (ECOFISH-BD).

1. Introduction

This case study is one of four undertaken by the Food and Agriculture Organization of the United Nations (FAO) and the DSI-NRF (Department of Science and Innovation and National Research Foundation) Centre of Excellence in Food Security (CoE-FS) at the University of the Western Cape, South Africa. The purpose of these studies is to review the design, outcomes and impact of social protection (SP) interventions on food system transformation. The overall aim is to identify options for a theory of change that links SP to food system transformation. These will guide the development of a conceptual framework for FAO.

As food systems have globalized and radically transformed, SP has emerged as a set of interventions that seek to reduce social and economic risks and to alleviate extreme poverty and deprivation, with profound outcomes documented particularly in terms of food and nutrition security. There remain important research gaps on how this process works. To fill this gap, FAO and the CoE-FS have undertaken a systematic literature review and case studies of SP interventions in Bangladesh, Kenya, Peru and Tunisia.

The focus of this paper is an examination of the project titled "Enhanced Coastal Fisheries in Bangladesh" (ECOFISH-BD), within the Hilsa Fishery Management Action Plan (HFMAP). The HFMAP was implemented from 2005 in five coastal regions of Bangladesh and is a payment-for-ecosystem-services (PES) social protection intervention that provides conditional in-kind assistance. In particular, the HFMAP provides rice to fishers in return for their compliance with fishing restrictions. ECOFISH-BD was initiated in 2014 and extends the HFMAP to include aspects of a "graduation" approach to SP by providing adaptive co-management of the resource, training, alternative livelihood opportunities and support to ensure the inclusion of women and youth in the protected areas. In 2019, ECOFISH-BD led the process of updating the HFMAP.

Six features of ECOFISH-BD are particularly salient:

- It is built upon an existing marine reserves conservation approach that focused on restricting utilization of the resource and providing compensation for the loss of income and livelihoods that ensued.
- The compensation component used an existing social protection instrument, the Vulnerable Group Feeding Program (VGF), that targets selected groups across Bangladesh.
- It was designed and implemented by fishery specialists concerned with rebuilding the Hilsa shad (*Tenualosa ilisha*) stock in coastal Bangladesh.

- ECOFISH-BD also includes support for alternative income-generating activities (AIGAs), in order to diversify livelihoods as well as community development and gender empowerment activities.[1]
- Gender was explicitly included as a concern in the design of the intervention and its implementation.
- The project was evaluated using both quantitative and qualitative methodologies, as well as in terms of outcomes related to the conservation of the marine resource and its socioeconomic outcomes.

The information reported in this paper draws on online engagement with experts in various fields based in Bangladesh and the United Kingdom of Great Britain and Northern Ireland using a semi structured interview schedule. Respondents were identified through recommendations and were selected based on their area of expertise. Four respondents were available and willing to be interviewed in the time available for the project: two fishery experts in Bangladesh, one international PES evaluator and one international expert on SP in Bangladesh. In addition, reports and assessments of ECOFISH-BD have also been summarized, and findings relating to the food systems outcomes of interest to the FAO/CoE-FS project are included. These outcomes are: food and nutrition security, livelihoods and rural development, environmental sustainability, and territorial balance and equity.

The case study does not seek to describe in detail the food system or SP system in Bangladesh. It is intended only to identify key points from ECOFISH-BD that illustrate opportunities to build a more inclusive food system and to contribute towards environmental sustainability through an SP intervention. What is sought through FS transformation is better production, better nutrition, an improved environmental base, and a better life.

The remainder of the document is structured as follows. Section 2 provides a definition of PES and describes its components. Section 3 outlines the country context and presents the elements of SP of most relevance to this study. Section 4 describes ECOFISH-BD and identifies its innovative components. Section 5 reviews findings from recent evaluations of the intervention. The conclusion follows in Section 6.

[1] In this respect, it includes actions that extend beyond the conditional grant, similar to Cash Plus SP in other contexts (Roelen *et al.*, 2017).

2. Payment for ecosystem services

2.1 Definition and components

For the purposes of this case study, PES is a form of SP that provides conditional incentives to beneficiaries in return for additional ecosystem services with respect to those that are already being provided. Updating his seminal 2005 definition, Wunder (2015, p. 8) defines PES as "voluntary transactions between service users and service providers that are conditional on agreed rules of natural resource management for generating offsite services." Both this and the earlier definition emphasize the components of voluntariness and conditionality. Beneficiaries are not compelled to participate and are not penalized if they do not. However, if they do participate, they must supply services in order to be eligible for the payment. These services may include behaviour change concerning resource extraction.

The theory of change underlying PES is that users of environmentally sensitive natural resources do not conserve them, because the benefits of short-term exploitation exceed their perceived future discounted value in the long term. Compensation for not using the resources is expected to persuade users to limit usage of the resource and to promote behaviours that conserve it, and perhaps regenerate it. The notion is that PES converts the external benefits of conservation into a direct private benefit for the beneficiary. This benefit may take the form of cash; however, in-kind benefits, including direct provisioning of food, are also used. The conditionality component is essential and ensures that appropriate behavioural changes are made. Other asset-building activities may be included, such as provision of support for alternative livelihoods and actions to promote the empowerment of selected groups.

This approach entailing voluntary participation with conditional incentives differs from traditional approaches consisting in preventing usage, such as the establishment of protected areas. Such restrictive approaches are difficult to enforce, can produce poverty, and result in conflict with local communities and resistance. In the case of marine resources, total fishing bans during certain periods mean that fishers are denied access to their main and sometimes only source of livelihood, with potentially severe implications for food and nutrition security (Westlund *et al.*, 2017). This results in noncompliance and the likely failure to attain the desired objectives. Conditionality sets PES apart from approaches that impose a ban on the use of the natural resource, and provides some form of unemployment benefit to compensate for lost livelihoods.

Commonly, PES schemes have been used for terrestrial conservation, serving the dual purpose of promoting environmental sustainability and preventing the loss of livelihoods arising either from ecosystem degradation or from the policies that seek to protect the environment. Key features of PES include explicit recognition of the importance of

addressing the potentially conflicting interests of those who make use of environmental resources and outsiders who are concerned with sustainability (Wunder, 2005). A further, perhaps more implicit, form of recognition consists in mitigating the conflicting short- and long-term interests of the resource users, who often must choose between their immediate consumption needs and investing the assets that they are using. As observed by Phan *et al.* (2018), poor producers and local residents often do not possess legal land or resource entitlements, and therefore have little incentive to invest in the quality of resources they do use, and possibly even less motivation to contribute to improving the local ecosystem. The approach argues that reconciling trade-offs and providing incentives can be achieved at least in part through compensation for effort and foregone incomes. This is described as a "just reward" for the mostly poor communities who carry these costs (Wunder, 2015). Although important, this notion is not well developed in the literature on PES.[2]

Sometimes, PES refers to a part of a suite of people-centred approaches to conservation. Given these origins in conservation, PES has less often been recognized as a form of SP. Indeed, neither of Wunder's most cited papers in the field mentions of PES as a form of SP, and the grants system through which people are paid is discussed only briefly (Wunder, 2005, p. 8; Wunder, 2015). However, Schwarzer, Van Panhuys and Diekmann (2016) discuss PES in some detail in an extensive review of social security interventions for environmental sustainability that was undertaken by the International Labour Organization.

2.2 Forms and objectives of payment for environmental services

Schwarzer, Van Panhuys and Diekmann (2016, p. 49) propose a spectrum of objectives for PES that ranges from a focus on being strongly pro-poor to being strongly conservationist. They note that PES programmes evolve over time, progressively incorporating more or less pro-poor elements.

Key decisions for a PES design involve choosing between:

- Single environmental services versus bundled environmental services (Wunder, 2005; Bladon *et al.*, 2016a): does the design include one or multiple services?
- Area- versus product-based schemes: does the PES address spatially bound units of an asset (for example, a forest or wetland that need protecting) or a particular product (for example, Hilsa shad)?

[2] Nonetheless, it resonates well with Richard Titmuss' well-known observation whereby grants are "part of the price that we pay to some people for bearing part of the costs of other people's progress" and thus "partial compensation for disservices, for social costs and social insecurities which are the product of a rapidly changing … society" (Titmuss, 1968, p. 133).

- Public versus private schemes: who is funding and who is implementing the intervention? This would depend on the centrality of the need to deploy pro-poor protection and whether a multitude of objectives are to be achieved.
- Use-restricting versus asset-building schemes: do the schemes limit resource extraction, or encourage regenerative practices?

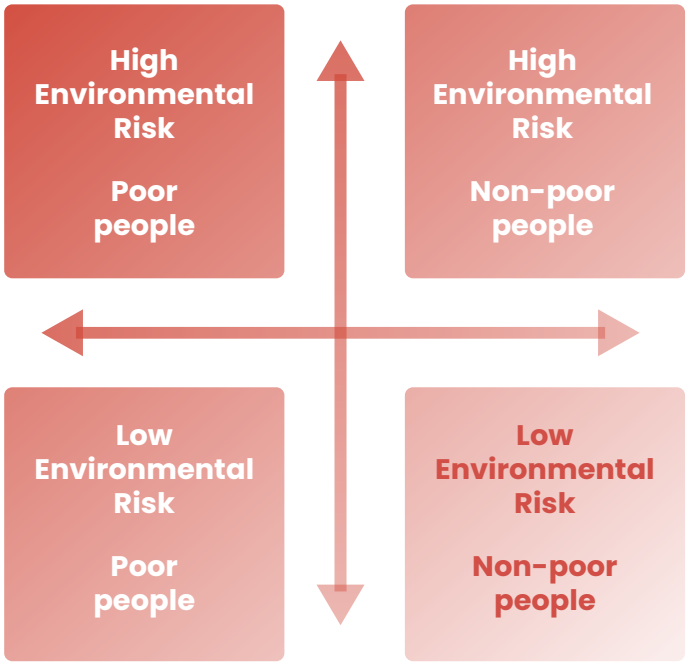
In practice, many schemes, including the case study, contain a mix of these different options. From Schwarzer, Van Panhuys and Diekmann (2016) and other literature, it is evident that PES programmes vary widely in terms of their main components. This includes the benefits, the type of environmental services offered, the geographical scope, etc. PES schemes can also be area- or product-based, or a combination of both, as is the case with ECOFISH-BD. Furthermore, funding for PES itself can be varied (public, private or a mix), influencing institutional arrangements in turn. An important stylized distinction is whether PES restricts use or builds assets, although in practice it can do both. In the case of the former, the focus is on compensation during the absence of the use of environmental services. Such compensation typically focuses on the restoration and use-improvement dimensions. Schwarzer, Van Panhuys and Diekmann (2016, p. 8) note that "in use-restricting schemes, compensation is usually in the form of direct cash payments, while in asset-building schemes direct compensation can also take the form of in-kind payments." In-kind payments take the form of the provision of assets (trees, tools, schools, health facilities, etc.) or of developmental activities with the prospect of new sustainable jobs. In both cases, whatever the form of the conditional compensation and supporting activities, the provision of an environmental service is key.

As more PES interventions have been underaken, additional considerations arise, such as the need to build institutional capacity; community participation to promote trust and social capital; empowering disadvantaged social groups, particularly women; and strengthening the socioeconomic benefits of the interventions. Furthermore, as with other developmental and environmental interventions, correct targeting of beneficiaries and stakeholders is essential.

Mechanisms for targeting differ across PES schemes, depending on the core objectives of the scheme at hand.[3] As with other SP measures that include targeting criteria, there is a risk of excluding some who need support but who do not meet – or cannot show that they meet – the selection criteria. Equally, there is a risk of including some who are not in need of support, but who are able to demonstrate that they meet the

[3] Although geographical targeting is frequently specified in PES, eligibility can be set around socioeconomic indicators, such as by using income data. In Brazil, the *Bolsa Verde* links to the *Bolsa Família* programme is part of the "Brazil without misery" (*Brasil sem Miséria*) plan. The official name is Programme of Support to Environmental Conservation. This programme aims to promote the conservation of ecosystems (caring for the environment and sustainable use of resources), to encourage citizenship, to improve the living conditions of households in extreme poverty, and to promote the participation of the recipients into environmental, social, educational, technical and professional actions. Alternatively, eligibility can take into account a mixture of complex elements. For example, in Mexico, the payment for hydrological environmental services (*Pago por Servicios Ambientales Hidrológicos*) incorporates not only numerous individual or community socioeconomic criteria (e.g. gender, ethnicity, presence of collective organizations) in its targeting, but also institutional, environmental and risk criteria.

Figure 1. Targeting priorities



Source:
Authors' elaboration adapted from Schwarzer, H., Van Panhuys, C. & Diekmann, K. 2016. On the management of single fish species of hilsa shad (*Tenualosa ilisha*) resources of Bangladesh, *Bangladesh Journal of Zoology*, 47(1): 173–183. https://www.researchgate.net/publication/334128325_On_the_management_of_single_fish_species_of_hilsa_shad_Tenualosa_ilisha_resources_of_Bangladesh

formal criteria. These elements influence impacts as well as other aspects, such as the fairness of the outcomes, the characteristics of participants and nonparticipants, and community-wide as opposed to individual- or household-level effects.

Because environmental vulnerability generally overlaps with socioeconomic vulnerability, it is unsurprising that PES are often designed to be pro-poor and to target those most vulnerable to adverse changes to the resource base. This pro-poor orientation defines PES as SP, in line with the FAO definition of SP as comprising "a set of policies and programmes that addresses economic, environmental and social vulnerabilities to food insecurity and poverty by protecting and promoting livelihoods" (FAO, 2017, p. 6). A final concern of relevance to this case study is the extent to which the focus of PES aligns with SP goals, including poverty alleviation and economic inclusion. The area of targeting priorities varies, depending on social objectives and environmental priorities (Figure 1).

Although the upper-left part of the figure aptly describes many PES that have been implemented, Wunder (2005) argues that goals of reaching the poor should not be the primary focus. In his view, the principal goal of PES should be the conservation of ecosystems. He argues that excessive dilution of the primary focus because of the inclusion of secondary goals risks failure to attain any of the desired objectives.

Studies of the impact of PES interventions in middle-income countries are emerging (Milder, Scherr and Bracer, 2010; Phan *et al.*, 2018). Results on these are mixed, even among similarly designed interventions. Some assessments find no evidence of environmental impact at all, while others report significant positive change (Daniels *et al.*, 2010; Pattayanka, Wunder and Ferraro, 2010). More precisely, for the purposes of this paper, there has been little research that provides evidence of impact on both environmental and socioeconomic dimensions (Phan *et al.*, 2018). When evaluations have been conducted, they have entailed mixed methods including satellite imagery, the collection of panel data and qualitative information.

2.3 Payment for environmental services in the context of marine resources

The decline in marine resources has heightened concern for ecosystem management internationally and generated a growing number of marine protected areas (MPAs). Although such interventions have produced successful results – not only in terms of the protection of species but also in terms of social impacts and governance (Bennett *et al.*, 2019), in many instances, the effects on fishers' livelihoods is unclear.[4]

When effects are adverse or below expectations, PES could offer an important option to address certain critical project shortcomings. However, marine PES are less common than terrestrial interventions because of the nature of the resources involved, the effort required to monitor outcomes, and the difficulty of assessing and attributing impact.[5] Despite their importance for livelihoods, food and nutrition security, and environmental sustainability, marine ecosystems present particular challenges for PES design. This is because of the "fluid, transboundary and often common pool nature" of the resource (Bladon *et al.*, 2016a, p. 839). Furthermore, in the case of fishers, the marine resource is often the main source of income, and increasing population pressure means that demand for fish is outstripping supply. Short-term exploitation then becomes a matter of necessity for households concerned with their immediate consumption needs and the imperative of servicing debt.

For fisheries-dependent communities, poverty is a particularly complex issue. In such communities, most of the income is dependent upon the size and composition of the resources that are harvested. These in turn are highly variable, influenced by seasonality, the state of natural resources, natural and human-made hazards and, increasingly, climate change. The result is that fisheries-dependent communities have varying and unpredictable incomes and livelihoods.

---

4 See Westlund *et al.* (2017). Yet, the fact that harvest is generally well above the level of biomass required to allow recovery for many critical fish species increasingly undermines fishers' livelihoods, notably for fishers that operate on a small scale.

5 In his review, however, Rasheed (2020) separately identifies that assessments of MPAs fail to properly take into consideration people's well-being.

The depletion of such resources exacerbates livelihood uncertainty and resilience. Even when protection policies exist, access to the resources tends to either remain insufficiently regulated or completely unregulated. The interests of large-scale fisheries and those of other economic sectors – such as tourism, agriculture, aquaculture, energy, mining and infrastructure development – all come into play in the general effectiveness of conservation. Finally, the poverty of fishers is also driven by structural factors that go beyond the sector. This includes their remoteness and isolation; their limited access to assets, natural resources, education and public services; and their lack of voice in political decision-making.

Whether terrestrial or marine, the design of PES schemes has conventionally addressed the four sets of choices mentioned earlier, i.e. single versus bundled environmental services, area versus product schemes, public versus private schemes, and use-restricting versus asset-building schemes. However, Bladon *et al.*'s (2016a) review of four marine-based PES programmes proposes six additional preconditions for effectiveness and viability:

1. There is a demand for ecosystem services and there is a threat to the sustainable use of fishery resources.
2. Appropriate historical and current data and potential management actions exist and are underpinned by robust science.
3. Property rights are clear and secure.
4. There is capacity for hybrid multilevel governance.
5. There exists capacity for rigorous monitoring, control, and surveillance.
6. There is potential for the scheme's financial sustainability.

Bladon *et al.*'s review shows that these preconditions were not met in the evaluated programmes. Notably, the study reports that among the four programmes reviewed, ECOFISH-BD fares poorly, although it was undertaken before the introduction of an extended PES programme. More recent evaluations are more favourable, as will be discussed later in this document.

Assessing the impact of marine PES interventions is particularly complex, because of the long timescale of most ecosystem change, the difficulty of identifying appropriate indicators, the choice of the baseline and the scope for benefit leakages and hidden costs. Also, PES interventions take place in the context of a specific mix of policy and governance actions that can influence outcomes, and thus confound attempts to measure impact (Milder, Scherr and Bracer, 2010). Those elements are relevant in the ECOFISH-BD evaluations as well as in other PES schemes.

3. Bangladesh country context

3.1 Context

Located in the delta region at the confluence of the Ganges, Brahmaputra-Jamuna and Meghna River systems, Bangladesh has a population currently estimated at just over 164 million people, and is one of the most densely populated countries in the world. Around 40 million people in the country live in extreme poverty, surviving on less than USD 1.90 per day. Of particular concern is the high share of the working-age population that is not in the labour force (over 40 percent). This level is driven mostly by a low rate of female labour force participation (around 37 percent in 2016), compared with almost 90 percent for males (World Bank, 2021, p. 34).[6] The rate of economic growth during the past decade has been substantial and has been accompanied with improvements in human development (World Bank, 2018).

The country remains predominantly rural, with approximately 62 percent of the population living in rural areas. The agriculture and fisheries sectors are pillars of the economy, employing more than half of the population (USAID, 2017). Around 24 000 km of rivers and 580 km of coastline provide approximately 1.2 million people with livelihoods in inland water fishing, and a further 300 000 people with livelihoods in sea fishing. Although the fisheries sector contributes just 3.8 percent of gross domestic product, fish provide 55 percent of the population's animal protein intake. Per capita annual consumption of fish was estimated at 19.7 kg in 2011 (FAO, 2022).

Most inland fisheries are small-scale, accounting for 93 percent of the marine catch (FAO, 2022). Although men dominate fishing from vessels, an increasing share of fishers are women, especially in the coastline and riverbank harvesting of marine resources such as shrimp (Deb, Haque and Thompson, 2015). About 2.7 million people are estimated to be directly and indirectly dependent on marine fisheries for their livelihoods in Bangladesh. Fishing communities are often marginalized and among the poorest, without secure rights to land or access to health facilities and education (Islam *et al.*, 2018; FAO, 2022).

Bangladesh's rapid economic growth has been accompanied by a high rate of urbanization, loss of arable land, pollution and mismanagement of natural resources, and increased demand for animal protein. These factors have created challenges for the provision of enough healthy, safe and nutritious food. There is widespread chronic malnutrition: the diets of more than half of Bangladesh's large and growing population are nutritionally inadequate. More than one-third of the country's young children

[6] About 60 percent of all employed women are engaged in the agriculture sector, while approximately 77 percent of all employed women work in the broader rural sector.

are chronically malnourished, more than half of pregnant women are anaemic and more than half of the population have nutritionally inadequate diets (FAO, 2020). Food insecurity has modestly increased recently, perhaps because of income losses and a decline in remittances. These tendencies have been exacerbated by the impact of the COVID-19 pandemic, although recent evidence suggests that this trend has stabilized (IFPRI, 2021).

Vulnerability to shocks is of particular importance in Bangladesh, with climatic disasters being a driver of poverty. Every year, a large proportion of the population is affected by climatic shocks, most notably flooding.

3.2 Social protection

Bangladesh has several social protection programmes in place. Recently, the ILO (2022) reported the existence of 119 different schemes under 25 ministries, most of which dealt with food distribution and cash transfers (GoB, 2022). Just under 18 percent of the budget of the Government of Bangladesh (GoB), or 3.1 percent of gross domestic product, is allocated to these programmes, with a few large interventions absorbing the bulk of expenditure (World Bank, 2021). The five largest programmes are the Pension for Retired Government Employees and their Families; the Old Age Allowance; the Rural Infrastructure Development Programme; the VGF and the Honorarium for Freedom Fighters (MoF, 2022).

In Bangladesh, SP initially focused on addressing food shortages following its liberation war and when facing multiple natural disasters. Of particular relevance to the current study is the VGF, a programme that emerged in the aftermath of the 1974 famine.[7] The VGF currently reaches around 9.9 million beneficiaries and provides between 10 kilograms (kg) and 30 kg of rice – typically procured domestically – per household per month.[8] It is means-tested with eligibility criteria that broadly span:

- The poor and extreme[ly] poor who are unable to have two square meals a day;
- People affected by natural disasters and in extreme need of food and financial support;
- People who are food insecure because of unemployment;

7 The Government of Bangladesh (GoB) in partnership with the World Food Program (WFP) introduced this program. It is currently administered by the Department of Disaster Management (DDM) under the relevant Ministry of Disaster Management and Relief (the MoDMR).

8 The VGF reached 16 percent of the population and 64 percent of the poor population in 2016 (World Bank, 2021). Rice is not the sole type of food grain under the VGF, however. For children the VGF covers several food types.

- Those who need to refrain from working, for greater public interest (e.g. fishermen [fishers] during the breeding season);
- Children who are malnourished (World Bank, 2021, p. 114).

Described by the World Bank as "a humanitarian program that provides food transfers to the poor during disasters and major religious festivals" (World Bank, 2016), the VGF is "expensive to administer and has significant scope for leakage", affected by errors of both inclusion and exclusion. Historically, the programme has placed great emphasis on prioritizing women.

Also of relevance to the current study is the concept of graduation, which envisages a ladder through which to escape from poverty, aided by programmes that support skills, microcredit and income-generating activities (SabatesWheeler and Devereux, 2013). Since the 1990s, conditional transfers have been introduced in Bangladesh as Food for Education (FFE) programs, and these programmes have had some success (Hulme, 2014). Most recently, a life cycle-oriented SP approach was followed: for example, the National Social Security Strategy was adopted in 2015 (World Bank, 2021).

In Bangladesh, regular increases in the SP budget have typically prioritized increases in coverage. The share of households benefiting from SP programmes more than doubled from 12 percent in 2005 to 28 percent in 2016. Nonetheless, the benefits provided by many SP programmes remain very low, which limits their impact on poverty. A World Bank Public Expenditure Review found that transfers under the SP programmes in Bangladesh were on average equivalent to only about 3 percent of the total income of a poor or extremely poor person, and are responsible for reducing the poverty or extreme poverty headcount by at most 2.4 percent (World Bank, 2021).

Environmental sustainability is an important goal for GoB. This is apparent in some key government planning documents, at times including ecological targets and actions.[9, 10] The protection of marine resources has received considerable focus in post-independence Bangladesh, through legislation such as the Territorial Waters and Maritime Zone Act (1974), the Protection and Conservation of Fisheries Ordinance (1982) and the Protection and Conservation of Fish Rules of 1985. The Bangladesh Fisheries Development Corporation was established in 1973; it owns fishing boats and constructs harbours and processing centres (Bladon *et al.*, 2018). In 1984, the Bangladesh Fisheries Research Institute (BFRI) was established as an autonomous government research institution. The BFRI has been involved with the design and implementation of

[9] The 7th Five Year Plan, which spanned 2016 to 2020, emphasized that broad-based and inclusive growth must be environmentally friendly. The next Plan (2020–2025) retained this emphasis, with sustainable natural resource use as a central component of the core themes of a sustainable development pathway.

[10] The Bangladesh Delta Plan 2100 includes targets for biodiversity and wildlife conservation, ecosystem productivity, increase of forest cover and improvement of livelihoods for local communities.

ECOFISH-BD, and has worked closely with the International Institute for Environment and Development (IIED) in evaluations of marine conservation policy in the country.

3.3 The Hilsa Fishery Management Action Plan

Hilsa shad (*Tenualosa ilisha*) is the largest and most valuable single-species fishery in Bangladesh. Its landed value exceeds USD 2.5 billion, equivalent to about 12 percent of total fish catch in the country (Sarker *et al.*, 2019). Additionally, hilsa is an important food in Bengali culture, with a strong local and international demand. Hilsa fishing provides direct livelihoods for about 1 million fishers and indirectly support the livelihoods of 3 million people in Bangladesh throughout the hilsa supply chain, including trade, transportation, marketing and processing (Ahmed *et al.*, 2021).

The large number of workers specified to operate in the hilsa supply chain is associated with a variety of marketing channels to final consumers (Porras *et al.*, 2017; Khan *et al.*, 2020). The value chain itself is basic. As hilsa is typically consumed undried, it is subject to limited processing shortly after it is caught. The chain is dominated by a few types of intermediaries. A first block of intermediaries operates around fish landing sites. This group consists of wholesalers who work as commission agents (*aratdars* or *arotders*) and *mahajons* or*mahajans*, who supply financial capital, manage boats and fishing equipment, and organize fishing trips. A second block is at the retail level and consists of distributors and retailers. Throughout the value chain are transporters and transport agents. One characteristic of the value chain pertains to the control exerted by *aratdars* who engage in advanced fish purchase and *mahajons*. These appear to extract an important rent in the chain, taking 46 percent of the final retail price. Once other intermediaries are accounted for, fishers only receive around 30 percent of the final price (Wahab, Beveridge and Phillips, 2019, p. 10).[11]

Although abundant in the 1960s and 1970s, a decline in hilsa stocks was experienced in 2000–2010 following a period of intense exploitation between 1996 and 2003 (Amin *et al.*, 2008). The output of hilsa fisheries declined particularly sharply during 2002–2003 because of a mix of overfishing and environmental degradation.

Bangladesh has a number of key fishery policies in place. From as early as the mid-1980s, the New Fisheries Management Policy (1986) addressed the overexploitation of fisheries and the inequality of fishing rights, and adopted conservation measures to safeguard marine resources. Subsequently, the National Fisheries Policy (1998),

[11] In terms of cost structure, transport accounts for a large share of cost – possibly about 35 percent.

recognizing the importance of fishers' participation in fisheries management, sought to address poverty reduction by creating employment opportunities and improving the socioeconomic condition of fishers, in addition to conservation measures.

To reverse the trends of significantly declining hilsa stocks, the government introduced the HFMAP. The HFMAP was published under the Fourth Fisheries Project of the Department of Fisheries (DoF) in 2003 and was implemented in 2005 through a *jatka* (juvenile hilsa) protection project.[12] The HFMAP comprised the declaration of five sanctuaries in the strategic hilsa breeding and nursing sections along the Meghna River (including the Padma River) and its tributaries.[13] In addition, the HFMAP included regulation of illegal equipment and specified various bans. These bans are:

- A 22-day hilsa fishing ban in October each year with the motivation of protecting brood (i.e. gravid) hilsa;[14]
- A nationwide ban on catching juvenile hilsa between November and June to stop the harvesting of hilsa below a certain size;
- An all-out fishing ban in the sanctuaries, typically during March and April each year.

Vulnerable fishing households are compensated through the provision of rice, where the effect of the ban is perceived to be particularly harmful (that is, in the sanctuaries and other main spawning ground areas). This rice is provided under the GoB's VGF, which targets food insecurity. This "just reward" component for beneficiary communities of the PES includes the monthly provision of rice to households of 248 674 licensed fishers (according to 2018/2019 figures) during the *jatka* ban period. From 10 kg between 2004 and 2009, the amount was increased to 30 kg until 2013, before being increased again to 40 kg of rice per household per month. The rice is provided for four months, covering the ban period and 1 month before and after it. When the breeding fish are protected during the peak spawning season, poor fisher households are further compensated with an extra 20 kg of rice (Nahiduzzaman, Islam and Wahab, 2018; Mahmud, 2020). In 2018/2019, almost 396 000 fisher households obtained this compensation.

Despite the severity of the restrictions, the initiative is believed to have led to only a gradual annual increment of hilsa production by up to 5 percent, until 2015. While fish stocks improved markedly from that year onward, Abdul, Sharmin and Haque (2021) attributed the modest results to the top-down imposition of government rules and regulations through fining non-compliant fishers without engaging communities, and a

12 In parallel, in 2006, the National Fisheries Strategy reaffirmed the importance of collaboration and fishers' participation.

13 Figure A1 in the Annex illustrates the location of the sanctuaries, including the one set up after the initiation of ECOFISH-BD.

14 The ban applies to specific spawning grounds. These spanned 29 districts in 2018/2019 (Mahmud, 2020). The spawning grounds include most sanctuaries, according to press reports.

lack of awareness raising on the fisheries bans. Noncompliance took the form of using illegal gear, such as monofilament nylon nets and bag nets. As an anadromous species, hilsa present a particular challenge for control and protection. The fish migrate up to 1 200 kilometres (km) from marine waters to estuaries and rivers for spawning, and as such, are extracted by both riverine and marine fisheries in Bangladesh. Hilsa fishing is widely spread, covering eight different zones.[15]

[15] Besides the marine ecosystem, these zones are the Meghna estuarine system, the upper Meghna River, the lower Padma River, the upper Padma River, the Jamuna River, the Brahmaputra River and the Sundarban ecosystem.

4. The Enhanced Coastal Fisheries in Bangladesh Project

To improve management of the HFMAP and to give further impetus to production increases, the DoF and WorldFish Cent jointly implemented the Enhanced Coastal Fisheries in Bangladesh (ECOFISH-BD) project.[16] ECOFISH-BD Phase 1 was introduced in 2014 as a 5-year initiative that ended in 2019. ECOFISH-BD Phase 2 followed from January 2021 and ran throughout 2021 (WorldFish, 2021a). The objective of the programme was to improve household and community resilience by strengthening livelihoods and coping capacities, and to reduce the risk to households of ecosystem threats.[17] Although the Ministry of Planning is an important partner, the project is centrally coordinated by the Ministry of Fisheries and Livestock (MoFL) and ECOFISH-BD and is implemented through the DoF and local communities. It focuses on establishing what has variously been termed by the GoB as "collaborative science-based management", "co-management" or "adaptive co-management". The BFRI plays a central role in providing scientific guidance for the project.

ECOFISH-BD has put in place numerous subprogrammes and has developed specific institutional arrangements and partnerships. The subprogrammes can be grouped into three interlinked components: (i) a specific structure designed to enhance the sharing of rights and responsibilities with regard to the conservation of hilsa; (ii) changes that help strengthen compliance with fishing rules and regulations; and (iii) interventions to complement the food support provided by GoB and meant to compensate fishers for foregone production during the fishing bans.[18]

The programme supported an advancement in fisheries science. In terms of structure, specific partnerships were set up for technical assistance, e.g. with the BFRI and its network of national scientists, universities and large international environmental and conservation agencies. ECOFISH-BD also involved a core set of experts in assessment and evaluations. In addition, the programme is also partnered with several relevant

16 WorldFish is a member of the Consultative Group for International Agricultural Research (CGIAR) and is the lead implementing partner of ECOFISH-BD. ECOFISH-BD was funded by the United States Agency for International Development (USAID).

17 ECOFISH-BD also saw the establishment in 2017 of a sixth sanctuary at the confluence of the Meghna, Kalabadar and Gajaria Rivers in Barishal district. Table A1 in the Annex reports on the location of the sanctuaries, the areas they cover and the durations of the all-out fishing bans.

18 In the programme the main components are: improved fisheries science for decision-making; strengthened fisheries adaptive co-management; enhanced resilience of hilsa fisher communities; and improved policy, power and incentives (WorldFish, 2020).

government departments.[19] This is to develop and advance the policies required to incentivize fisheries conservation. At its core, however, the project's pathway to change was, as noted above, through establishing adaptive co-management in hilsa sanctuaries. This feature defines the type of new institutional structures created around the programme. In this respect, ECOFISH-BD moved beyond the PES conventions to include the establishment of local institutions, as well as adaptive co-management systems, as central elements of its sustainability.

The first layer of institutions operates at the community level. Groups were established through a participatory community profiling exercise in 136 fishing villages located along the river courses of the six hilsa sanctuaries (Islam, Nahiduzzaman and Wahab, 2020).[20] The groups, defined as co-management building blocks, serve a variety of functions but act as the entry-level platform for fisheries co-management (WorldFish, 2020, and respondent interviews).

The programme facilitated the establishment of the following: community savings groups (CSGs) to enhance resilience in the fishing villages; hilsa conservation groups (HCGs) in fishing communities to support conservation efforts, in partnership with DoF staff; and hilsa ghat groups (HGGs),[21] the main role of which was to engage those directly involved in fishing with key middlemen and other influential local participants to strengthen the hilsa value chain.

Table 1 details those directly engaged with the main grassroots-level groups, as well as the scale and scope of the groups.

When it comes to the various levels of decision making, ECOFISH-BD deployed a particular institutional structure. Layers of stakeholders' groups were organized reflecting a bottom-up process of formal decision making and influence. Committees were set up to engage with the various entities at the subdistrict and district levels.

19 For example, the Ministry of Health and Family Welfare is the implementing agency for the Jatka Protection and Alternative Employment for Fishermen programme. Noticeably absent in reports on ECOFISH-BD are the Ministry of Social Welfare, the Ministry of Health and Family Welfare, the Ministry of Disaster Management and Relief and the Department of Social Services. Nevertheless, our respondents confirmed that these agencies were also involved in the project.

20 The programme was broadly geographically deployed in the Meghna River ecosystem and communities reliant on coastal fisheries. The location of all ECOFISH-BD villages is detailed in the Annex (Figure A1).

21 A term referring to a landing station or wharf.

Table 1. Key elements of ECOFISH-BD community groups

Groups	Participants	Scale	Scope/role
Hilsa conservation groups (HCGs)	Each HCG is made up of 30 to 40 fisher-dependent households Miscellaneous but progressive growth in terms of the presence of women (almost 40 percent of members)	Often three to five per (target) village, in 136 fishing communities In the villages, 575 HCGs involving 19 534 fishers have been formed	Sharing information on data on the state of the ecosystem/hilsa stock Matters of enforcement: awareness-raising role and responsibility of shareholders during bans, or identification of illegal fishing gear Matters of sanitation and hygiene Focus on programme details and input on new livelihood opportunities Sharing learning experiences across districts Help with the appointment of guards
Community savings groups (CSGs) or hilsa savings groups	Fishers' women (set up with around 30 – 40 women; however, up to 50 percent of village women are involved in a CSG)	At least 1 CSG established in each village 148 groups formed There are fluctuations in the number of members; however, there were 4 125 members in 2020 Savings: BDT 4 150 978 (equivalent to approximately USD 52 000) as of September 2017, increasing to BDT 13 373 705 (USD 159 000) in 2020	Loan fund development & microfinance development for own small-scale businesses and other self-help projects Empowerment Trust building Information sharing & business and financial guidelines development
Hilsa ghat groups (HGGs)	Various buyers and trading agents, e.g. *aratdars* and others who act as auctioneers, wholesalers, commission agents (see text) Moneylenders Persons in charge of vessels Fishing labourers Local leaders/influential community actors	63 HGGs (formed at landing sites or centres (the *ghat*)	Capacity development Information sharing on fisheries rules & regulations Awareness raising on biodiversity conservation Trust building Informal sector support, e.g. around matters of lending/boat access; help with administrative or bureaucratic matters

Sources:
Authors' own elaboration adapted from Nahiduzzaman, M., Islam, M.M. & Wahab, M.A. 2018. Impacts of Fishing Bans for Conservation on Hilsa Fishers Livelihoods. In: B. Nishat, S. Mandal & G. Pangare (eds), *Conserving Ilish, Securing Livelihoods – Bangladesh-India Perspectives*. New Delhi. Academic Foundation. https://www.researchgate.net/publication/330633659_Impacts_of_fishing_bans_for_conservation_on_hilsa_fishers'_livelihoods_Challenges_and_opportunities.

Figure A2 in the Annex schematically represents the various levels of governance. At the bottom of the decision-making ladder were the fisheries management committees (FMCs). These were established in every village and comprised members of the main local groups (the CSGs, HCGs and HGGs) as well as other influential actors. Between the FMCs and the subdistrict committees was a layer of committees with sector leaders and local administrative and political representatives. At the apex was the district co-management committee, which included district officials who *de facto* represented the national government and fed into the central coordination responsibility of the Ministry of Fisheries and Livestock and the BFRI.

WorldFish (2020, p. 23) summarizes the role of these bodies as follows:

> *The main terms of reference of the co-management bodies were to conserve fish biodiversity in the rivers, increase hilsa and other fisheries production, build awareness on complying with government rules and regulations, generate supplementary or alternative income, and implement government directives. In addition, the committees played an important role in recruiting CFGs [Community Fish Guards], conducting boat and net censuses and assisting the government to provide boat licenses and government IDs. They also helped with rice (food incentive) distribution and conflict resolution.*

In terms of compliance, this is ensured both through information sharing and large-scale awareness-raising activities in the villages, but also by establishing fish guards. The penalties such imprisonment and fines for noncompliance are enforced through mobile courts and by a surveillance force of 400 community fish guards, formed by selecting fishermen and youth (see Barisal, 2018). These guards are integrated into the DoF as an auxiliary force.

Conservation policies remain the bedrock informing the implementation of ECOFISH-BD. Monitoring, surveillance and enforcement of fishing restrictions by law enforcement agencies continues and the Hilsa Conservation and Development Fund (HCDF), a trust fund, serves to support hilsa stock expansion efforts and development. Central to ECOFISH-BD's theory of change is that the combination of rising fishing household income through more diversified income sources, and through increased productivity (improved catch per unit effort), would reduce poverty and improve natural resource management.

To help households adjust to the shock induced through bans, ECOFISH-BD introduced a series of compensation and livelihood strategies.[22] Besides those already provided under HFMAP, ECOFISH-BD measures included increasing the rice allowance, providing access to productive assets to generate alternative incomes, providing skills training and establishing CSGs with business training and soft loans.[23] The AIGA component is intended to offer incentives to diversify livelihoods away from reliance on marine resources by providing input support, such as cattle, seeds and seedlings for small-scale farming. Training on income-generating opportunities is also delivered, including on vegetable farming; chicken, duck and turkey rearing; goat, sheep and cow husbandry; tailoring and toy making; pond or cage aquaculture; as well as financial literacy (Abdul, Sharmin and Haque, 2021).

ECOFISH-BD placed strong emphasis on the participation of youth and, notably, women. For the purposes of food system transformation, women's empowerment was sought from the onset. This was done in various ways, including bringing women together in the villages and across larger zones as actors of change in relation to economic and cultural activities. Such initiatives were undertaken through the CSGs with only women members, as well as through events such as fisherwomen's congress and hilsa breeding festivals.

The programme also offers numerous training activities in matters of conservation, as well as new technologies and expanded finance through the groups,[24] building and strengthening local institutions and enhancing the social capital of fisher communities accordingly.

Financial and business literacy are important aspects unlocked through the programme. Access to subsidized loans through microfinance has been deployed to help reduce dependency on high-interest loans from external informal credit providers.[25] The CSGs were designed to support diversification; it allows funds to be re-invested in microentrepreneurship development. In addition, loan repayment is not activated during the fishing ban. Communal savings are rewarded: ECOFISH-BD directly matches the saving when a CSG reaches its savings target. This component is not confined to fishing households only.

22 This has happened with other partners, including NGOs that have a presence in the fishing communities and a private-sector partner – Falcon International Ltd – that has been working to develop and expand seaweed, green mussel farming and creating market linkages for fishers' livelihood improvement.

23 The component has included the provision of input support, such as cattle, seeds and seedlings for small-

24 Group members receive extensive training on the importance of sustainable management of hilsa for their livelihoods and well-being. Training is provided over a period of three years.

25 Abdul, Sharmin and Haque (2021) report that 7 380 household members of the fishing communities received training on financial management and on on-farm and non-farm technologies, of which 59 percent were women.

5. Evaluations of ECOFISH-BD

The full final evaluations of ECOFISH-BD are not publicly available. While the ECOFISH-BD programme would have reached 20 000 households, that is, around 100 000 people by its completion (WorldFish, 2020), around 220 000 fishing households would have received VGF food grain support.[26] This section describes the impacts of ECOFISH-BD on fishery, socioeconomic conditions, and institutional arrangements.

5.1 Fishery outcomes

An important outcome identified in both documents reviewed and by respondents is ECOFISH-BD's contribution to the advancement of fisheries science. This has generated a comprehensive picture of the hilsa fishery and has assisted policymakers in formulating best management practices. Generating high-quality and reliable fisheries science has supported fishery stakeholders in planning how to better manage the hilsa fishery. Scientific inputs also guided ECOFISH-BD to recommend an increase in the allowable mesh size to 6.5 cm for hilsa gillnets, which has been endorsed by GoB.

In general, research results indicate that there has been some compliance with the regulations concerning the hilsa bans. Bladon *et al.* (2016, p. 26) report significant differences in the density of small and large fishing boats in the sanctuary areas during the ban and non-ban seasons. However, catch composition information indicates that there is some compliance with the regulations, albeit less than was envisaged. Moreover, evidence of positive behaviour change across fishers is lacking; although 66 percent of respondents to a survey of 600 households reported a change in the type of gear that they were using, the reason for doing so was not attributed to the regulations, and almost half of those that had made a change had reduced rather than increased the mesh size as desired. Abdul, Sharman and Haque (2021) reported that fishers extracted juvenile hilsa and brood hilsa even during ban periods, and despite law enforcement patrols throughout the sanctuary and non-sanctuary sites.

Nevertheless, it appears that there has been recovery in the hilsa stock. Haque and Mahfuzu (2020) state that the co-management interventions helped in producing an additional 130 000 tonnes of hilsa worth about USD 1,040 million between 2016 and 2019. In parallel, the maximum sustainable yield of hilsa rose from about 526 000 tonnes per

[26] Higher figures are occasionally reported (e.g. 350 000 fishing households under the VGF [Nahiduzzaman, Islam and Wahab, 2018]).

year in 2016 to 690 000 tonnes per year in 2019.[27] This is a significant increase in the stock of hilsa throughout the waters of Bangladesh. The DoF (2021) confirms that the increase continued into 2020.

The recorded hilsa catch in 2019 showed a 37 percent increase from 2015 levels. Although a higher catch can be the result of increasing fishing intensity, Karim *et al.* (2019) conclude that there has been a recovery of the hilsa stock in Bangladesh. Separately, Bladon *et al.* (2016, p. 22) report from a household perception survey that 69 percent of respondents considered that the regulations had a positive impact on the hilsa catch.[28]

Further improvements of fishery practices are possible. As noted above, mesh size is an important management consideration, and there is incomplete compliance with the regulations. Nevertheless, an extensive awareness-raising programme contributed towards changing attitudes about observing ban periods and using legal fishing gear (Islam, Nahiduzzaman and Wahab, 2020). Bladon *et al.* (2016) found that awareness-raising efforts (not compensation) appear to positively influence compliance, suggesting that conservation principles have been absorbed by people in the fishing communities. One of the respondents to the interview undertaken for this study remarked that in his experience, women were more concerned with compliance with the management rules adopted, and when empowered through other activities, were better placed to influence the male fishers. This view echoes that of Abdul, Sharman and Haque (2021).

External environmental factors influence the number of juvenile and adult fish. Because of the lack of baseline information (Bladon *et al.*, 2016) it is difficult to accurately judge the impact of the program. The population of hilsa is not only affected by overfishing but also influenced by pollution, upstream river damming and climate change (BOBLME, 2010). Other factors that have an impact on the fish population include the closure of fish migratory routes and river siltation. Levels of sea fishing activities beyond Bangladesh also affect the number of fish in national waters and those reaching the country's sanctuaries to spawn. Consistent production growth over a 5-year period suggest that ECOFISH-BD helped grow the fish stock through its various interventions, and the key respondents to the interview undertaken for this case study supported this position.

---

27 These are the data for the level of first capture, reflecting that the fish are doing well biologically. That is in relation to the catch of hilsas of at least 25 cm in length, the size threshold below which the fish is defined as a juvenile.

28 Implicitly, there are clear indications that the stock of fish that can be harvested increased and was gradually moving toward optimum levels. This is technically described as an increase in the threshold exploitation level with reference to the size of catch that can be harvested sustainably.

5.2 Socioeconomic changes

The scale of the rice programme has been substantial, growing over time (see Table A2 in the Annex). However, it was found that the provision of rice and variable support for small-scale alternative livelihood activities prior to ECOFISH-BD was insufficient to compensate for the lost income arising from the fishing bans. This effect extends in the early phase of ECOFISH-BD.

Through focus group discussions, Mohammed, Ahmed and Ali (2014) identify a variety of economic impacts associated with both the provision of rice and the fishing bans. Local rice producers experienced declining prices when rice was distributed to households. As fishers became non-fishers during the fishing bans, a temporary expansion of labour was triggered. This led to a decline of local wages by as much as 40 percent. The ban also caused additional expenditure, as households purchased the food items required to partially complement the protein lost from not consuming fresh fish in that period – a feature that persisted, as evidenced in subsequent studies (Porras *et al.*, 2017; Mahmud, 2020). Mohammed, Ahmed and Ali (2014) found that demand for credit – typically from *aratdars* – increased by 20 percent, with an associated 20 to 30 percent increase in the interest rate during the bans. These effects occurred in a context in which few household members earned income outside fishing; only one member per fisher household earned any income at all, according to Porras *et al.* (2017). Thus, unsurprisingly, Nahiduzzaman, Islam and Wahab (2018) report results from an early ECOFISH-BD survey in which almost 60 percent of fishers "strongly agreed" and another 9 percent "agreed" with the position that the bans had caused a decline in income and that the compensation was insufficient to cover the revenue lost from the bans. Moreover, while compensation for the fishing ban was relatively extensive, it did not cover all those affected.[29]

When considering the impact of the ban, many researchers emphasize that household debt has a dampening effect on household welfare. Increased borrowing at high interest rates is frequently found in the socioeconomic studies that examine the impact of bans. In a perception study spanning 2015 to 2017, Islam *et al.* (2018) established that indebtedness was the second major constraint on fishers' livelihoods, after poverty and lost income. The constraint was reported by 76 percent of respondents from among a list of factors, and affected more than 85 percent of fishers, according to van Brakel *et al.* (2018). Indebtedness undermines the income of the fishers during the ban as well as beyond. In terms of interest rates, Porras *et al.* (2017) report that lending rates from *aratdars* were 10 percent. There were large variations on this rate, however. Nahiduzzaman, Islam and Wahab (2018) describe how rates of interest confronting fishers from informal sources could reach a high 60 to 120 percent per year. A lower figure of 25 to 40 percent was quoted in that source for microfinance institutions.

[29] Typically, approximately 70 to 80 percent of those affected by the fishing regulations are identified in surveys as receiving compensation, although the figure has improved since the mid-2010s, when 45 to 65 percent were compensated (Bladon *et al.*, 2016, p. 37).

The high repayment rate needs to be further considered, in a context in which the intermediaries (boat owners or commission agents) with whom the fishers engage organize advanced fish purchases at prices that are highly unfavourable to the fishers. Boat captains are overburdened with credit and loans (Porras *et al.*, 2017). Such a situation locks the fishers into a cycle of indebtedness. In this regard, van Brakel *et al.* (2018) found in their own survey that more than 50 percent of sanctuary households were indebted to fish traders.

Incorporating changes in income derived from fishing activities did not alter the overall initial results on ECOFISH-BD. Only 40 percent of respondents in the survey conducted by Bladon *et al.* (2016) stated there had been improvements in both their livelihood status and their household income from fishing. This figure was obtained from retrospective questions that referred to AIGAs prior to ECOFISH-BD and those set up under ECOFISH-BD as its implementation started.[30] Looking more closely at the results reveals that spatial dimensions strongly influence the results. More broadly, in a review of research on bans and compensation, Reid and Ali (2018) argue that, while improved catches did enhance various types of capital and thereby local adaptative capacity, the incentives might not have consisted in financial benefits to the fishing communities. This was despite a basic cost–benefit analysis undertaken by the GoB that the authors reported to show that the compensation provided to each fisher household was well above the value of the loss faced by such households from the *jatka* and brood fishing bans. In a later study, Wahab and Rahman (2020) mention that fishers often complained that the compensation package was inadequate. Fishers would argue that they needed cash support to buy other necessities in addition to the rice that was provided. Fishers also needed cash to service debt, and indebtedness to informal credit providers persisted, as noted during the interviews, by selling their rice below market value.

The above discussion suggests that rice support, together with ECOFISH-BD activities, in the early phase of the programme at least, did not benefit many small fishers and their households sufficiently. Focusing on AIGAs separately, this component was a relatively small aspect of the compensation to the fishers and a low fraction of the total programme costs at the beginning of ECOFISH-BD. During this phase, AIGAs played a limited livelihood support role, and Bladon *et al.* (2016) did not find a significant relationship between the AIGA interventions and alternative livelihoods. Afterwards, this component progressively expanded in reach and scale over time and seems to have shown more positive results, as WorldFish (2020, p. 27) reports that 19 800 households had been engaged in "sustainable AIGAs".[31]

[30] In that study, 95 percent of fishers reported that compensation benefited *communities*. The gap between the situation of the individual or household and that of the community is not discussed in the report.

[31] In contrast, according to Haque and Mahfuzu (2020), less than 4 300 hilsa fishing households have been fully engaged in AIGAs.

Table 2. Average income per fisher household from fishing and other sources

Source	Baseline – 2016 (n=1 217)		Endline – 2019 (n=1217)		Change	
	Amount (BDT/ household)	Percentage of income	Amount (BDT/ household)	Percentage of income	Amount change (BDT/ household)	Period change (%)
Fishing income	64 913	76	108 175	77	43 262	67
On-farm income	7 479	9	16 124	11	8 645	116
Non-farm income	12 644	15	16 295	12	3 651	29
Total income	**85 036**	**100**	**140 594**	**100**	**55 558**	**65**

Notes: BDT: Bangladeshi taka; 1 USD = BDT 78.5 in 2016 and 1 USD = BDT 84 in 2019.
The data are nominal rather than real. Inflation has been at 5.5 to 5.7 percent a year between 2016 and 2019.

Source:
Authors' own elaboration from WorldFish. 2020. *Enhanced Coastal Fisheries in Bangladesh Project (ECOFISH): Completion Report*. Penang, Malaysia. WorldFish. https://digitalarchive. worldfishcenter.org/bitstream/handle/20.500.12348/4543/271b15027aeecfd5dd7e34bd3d9d53c4.pdf

However, the latter was observed through the growth in income from activities other than fishing (see Table 2, which reports the main results of ECOFISH-BD at the project completion phase), notably on-farm with some food and nutrition security benefits in turn (Nahiduzzaman, Islam and Wahab, 2018). In parallel, Dewhurst-Richman *et al.* (2018) established that AIGAs were preferred over rice, by those who received compensation. This was for the following reasons: fishing is a risky activity; fish catch levels are uncertain; and there are some issues in terms of rice compensation (in the form of amounts received being below the entitlement[32] and the rice not reaching households in a timely manner). The fact that a value could be specified for the preference suggested that some thought had been given to the trade-off.

However, little information can be found to assess whether the diversification of activities and income sources translate into a sustainable income shift. In fact, AIGA projects are small and constrained in scale: fishers have limited access to land and many fishing communities are remote, poorly connected or disconnected from markets of a significant scale.

There are limited options along the value chain for generating value addition from hilsa. Hilsa are usually traded whole, ungutted and without processing. This limits opportunities

[32] Some sources stated that some rice is withheld by local leaders involved in the procurement and distribution, as compensation for transport and delays in receiving the funds required to pay for the supplied rice. Moreover, there are some anecdotal reports of corruption around rice distribution.

such as gleaning the by-products of processing. This is compounded by the lack of infrastructure development, which is not a core aspect of ECOFISH-BD. For example, cold storage facilities are lacking, yet would allow choice in terms of when fishers can sell (Porras *et al.*, 2017; Mozumder *et al.*, 2018).

ECOFISH-BD Phase 2 (2021) has identified opportunities to expand fisher livelihoods that make use of more sustainable marine resources. These include mussels and seaweed farming, crab fattening, dry fish production, etc. However, from Table 2, it can be seen that although incomes have grown across all main types of activities, fishing income remains the dominant income source. As a result, the sustainability of the hilsa stock remains critical for the future of the fishing communities.

Perceptions of stock improvements through ECOFISH-BD are generally positive, not only for hilsa but also for other fish species (Talukdar *et al.*, 2022). Khan *et al.* (2020) argue that despite prices declining along the value chain over the year 2015–2016, when fish production grew markedly, demand is such that increasing sales compensate for lost profit. Consequently, fishers' incomes then increased, positively affecting hilsa fish consumption by fishers' households. The authors also found that credit repayment was accelerated in the process. The latter is important, as fishers have limited assistance regarding debt; yet, indebtedness affects a large proportion of fishers, as mentioned above. Here, however, although CSGs may have helped reduce the levels and scale of indebtedness, there was no analysis of the matter. Moreover, NGOs operating outside of ECOFISH-BD's ambit provide microcredit support in the fishing communities.

Overall, the ECOFISH-BD programme has not yet fully addressed the low socioeconomic status of fishers (Islam *et al.*, 2018). In 2019, incomes remained below the extreme poverty threshold of USD 1.90 per person per day (Table 2) (van Brakel *et al.*, 2018).

One detailed evaluation of the ECOFISH-BD project did focus on resilience and household wellbeing. Béné and Haque (2022) measured household resilience to negative shocks. The study consisted of a baseline and endline survey of 600 treatment and control households, surveyed three years apart, and a difference-in-difference impact assessment design. A range of food and nutrition security indicators were collected, as well as information concerning livelihood shocks and the responses of households to these shocks. Three main shocks are considered: the fishing bans, serious illness, and the loss of an asset. Two outcomes and one impact are estimated:

- The intermediate outcome – the authors found that ECOFISH-BD beneficiaries showed a lower propensity to adopt negative coping strategies than households in the control group. Further, ECOFISH beneficiaries showed a higher propensity to adopt positive (adaptive/transformative) responses than the control group. Examples of the negative coping strategies considered were changes in the type of food consumed, borrowing, expenditure cuts, and a depletion of the stock of household assets. The positive strategies involved improvements to the house, time-saving activities, contributions to collective work, etc.

- The ultimate outcome – ECOFISH-BD beneficiaries also showed higher rates of recovery in the face of adverse events than households in the control group (all else being equal).
- The long-term impact – ECOFISH-BD beneficiaries showed higher levels of well-being than households in the control group (all else being equal).

Despite these positive findings, the authors also found that the programme did not significantly get households to shift away from detrimental strategies.[33] Béné and Haque (2022) propose that it is easier for projects like ECOFISH-BD, which seek to build resilience to create positive (adaptive) responses rather than to eliminate more negative (absorptive) responses.

Over the longer term, the authors' analysis reveals that the programme had not been fully successful in improving the participants' well-being. This result is deduced by looking at changes in the following three indicators: the Household Food Insecurity Access Scale (HFIAS); the Household Dietary Diversity Score (HDDS) and the Food Consumption Score (FCS). In that period, the study only found the HDDS to be positive and statistically significant for intervention households. Béné and Haque (2022) offer no explanation for this particular change, and it may be a result of measurement error or the possibility that the changes in the HDDS were short-term and did not indicate longer-term structural changes.

Applying a gender lens to the impact of the programme, women were important participants in ECOFISH-BD, with a greater presence in local decision making than was initially anticipated. In the aggregate, women accounted for 40 percent of household members that directly benefited from both livelihood and AIGA support; they benefited economically from such support (USAID, 2018; van Brakel *et al.*, 2018). In terms of income improvement, however, women still lagged behind men (Bladon *et al.*, 2016). However, this was an early project result that may have changed subsequently. Furthermore, women involved with CSGs saw their household savings significantly increase compared to those who were not involved (Haque and Mahfuzul, 2020).

The CSGs improved women's access to finance and to technologies. This is believed to have further incentivized savings and brought about sustained behavioural change. The interviews stressed the importance of these groups for the empowerment of women and as a way of ensuring compliance with the marine resource management systems. In regard to women's empowerment objectives, Abdul, Sharmin and Haque (2021) found that women in Chandpur and Bhola Districts reported feeling more comfortable sharing their opinions with their husbands after ECOFISH-BD's interventions and having a larger role in household decision making. They also state that women are participating in meetings and sharing their opinions in meetings at all levels. However, it is not clear if

[33] This finding echoes that of Islam *et al.* (2018), who emphasize the dominance of negative coping strategies during bans.

this evidence is simply anecdotal, and it is not apparent whether an evaluation of some kind informs these statements.

Although Mozumder *et al.* (2018) observe that child labour is relatively common among Bangladeshi fisher households, none of the evaluations comment on the impact of ECOFISH-BD on this issue. It is possible that there is a positive but indirect contribution through the project's gender empowerment dimensions. Of note, however, is that fisher households have access to SP for children in the form of cash for education. About one-third of respondents in the study by Islam *et al*. (2018) reported receiving such support.

5.3. Power relations

Institutional arrangements were an important aspect of ECOFISH-BD. It is worth noting that co-management has generally displayed some weaknesses. The arrangements and institutions developed through the project have failed to link communities with government (Talukdar *et al*., 2022). Engagement between citizens and officials operates according to top-down rather than bottom-up principles, affecting accountability and information flows (Mozumder *et al*., 2018; van Brakel *et al*., 2018; Reid and Ali, 2018; van Brakel, 2018).

Local power structure dynamics might have also been little altered through ECOFISH-BD, as there are comments to the effect that it has been hard to convince the larger boat owners and larger fishers to support the bans (Islam, Mohammed and Ali, 2016). Likewise, the bans have exacerbated the position of fishers against that of nonfishers within the communities, and there are reports that some nonfishers (e.g. land labourers) have turned to fishing to receive compensation.

Also, van Brakel *et al*. (2018) conclude that important threats have not been addressed by ECOFISH-BD, as it failed to "disrupt trap dynamics perpetuating the cycle of poverty, social exclusion, and political disempowerment in which fishing households are entrenched." (p.1).

6. Conclusion

ECOFISH-BD is a multifaceted, multiyear programme that has supported the national hilsa fishery plan, the HFMAP, via a government social protection intervention in place, the VGF, to help hilsa fishing households cope with fishing bans. The GoB provides food compensation to vulnerable fishing households during the periodic fishing bans that are designed to protect the fish breeding and development process. In local fishing communities, the ECOFISH-BD component sought to develop a series of initiatives: access to finance via the establishment of CSGs, local resource management committees, and committees to enhance relations between the fishers and other influential participants in the value chain, among others. The ECOFISH-BD programme placed a strong emphasis on women's economic empowerment. Its activities did result in increased compliance and a process of livelihood diversification that would allow households to reduce their reliance on fishing.

The main elements and outcomes of ECOFISH-BD were reviewed in Sections 4 and 5. The programme has been associated with a pronounced recovery of the hilsa stock, which has benefited fisher households overall. However, the in-kind compensation provided to the households is commonly considered insufficient to maintain living standards during the bans.

An extensive network of CSGs has been established through the project, with a view to activate community savings and new investment opportunities specifically for women. A notable amount of savings has been generated through this innovative aspect of the programme, and there are indications that the CSGs have offered a firm alternative microfinance platform in the fishing communities. This is important in a context of widespread indebtedness and poverty. The impact of the CSGs has not, however, been evaluated yet and CSGs operate in a context in which NGOs already extensively provide microfinance (Islam *et al.*, 2018).

In terms of livelihood diversification and transitions to alternative sources of employment, progress has occurred, albeit on a very limited scale. The AIGAs available pertain to small farming projects and to very small-scale off-farm initiatives. Where these have been set up, they have provided some additional income; however, this has failed to make a significant impact on the reliance on fishing income. Such AIGAs are constrained by contextual elements, such as lack of access to land and to markets. Although on-farm AIGAs have experienced a growth of income, they contribute little to food and nutrition security. In parallel, there has been little investment in basic public facilities in the fishing communities.

Taking a food system transformation approach, ECOFISH-BD has also advanced environmental outcomes. It has raised awareness in regard to the preservation of

fish stocks, and groups as well as individuals in the communities are taking part in conservation efforts. By ensuring that resource users are also resource managers, local communities have become empowered to use marine resources more sustainably and share responsibility for monitoring and enforcing regulations.

A strength of ECOFISH-BD is that it has operated as a project embedded in the overall framework of the HFMAP while making use of the SP procedures and institutional structures of the VGF programme. The mid-term review of ECOFISH-BD conducted by WorldFish (2018) states that there has been close alignment and a strong working relationship between the implementing partners and the DoF at all levels. This includes the comprehensive public awareness campaign that was conducted through ECOFISH-BD and the collaborative working relationships established by the implementing partners with the communities that were involved.

In the dimensions outlined above, ECOFISH-BD has contributed to enhanced resilience. The programme also seems to have built positive (adaptive) resilience. This suggests that the programme has been effective in strengthening the capacities of households to recover from adverse events. However, it has not evidently eliminated negative coping strategies. It has made very little impact overall in reducing poverty. There is also no evidence that ECOFISH-BD has enhanced food and nutrition security, although there is little specific research on this theme.

These limitations are acknowledged going forward. An updated version of the HFMAP, prepared in 2019 with the support of the Consultative Group for International Agricultural Research (CGIAR) Research Program on Fish Agri-Food and the BFRI, proposed raising the rice provision to 80 kg and including cash support (Wahab and Rahman, 2020).[34] This revision adopts an ecosystem approach to fisheries management that considers both ecological and social well-being, as well as the governance of fisheries resources. These measures would entail an expansion of SP. However, actions to facilitate access to social insurance to protect livelihoods in case of idiosyncratic shocks such as theft, injury or death were not included in ECOFISH-BD. This gap remains.

Nevertheless, limitations of the programme will need to be resolved. Policy engagement with fisheries-dependent communities requires a coherent framework in which livelihood needs are balanced with environmental considerations. This seems to be the case in this project, and coordination between different ministries has resulted in mutual reinforcement and complementarities. However, the mid-term review noted national coordination as a potential weakness. Despite the relatively well-developed structures at the local level, similar coordination does not appear to take place at the level of the national government. As noted earlier, the extent to which national SP institutions were involved in the design and implementation of ECOFISH-BD is not apparent from the reports consulted. Certainly, coordination across institutions and with policies other

[34] This is currently under review, and if accepted will span the 2020-2030 period.

than those that relate to the environment is required for coherence and effectiveness. In the case of ECOFISH-BD, opportunities were provided for multiple feedback and feed-forward linkages between the institutions attempting to induce behaviour change and those involved in fisher livelihoods. Care was taken to ensure that these structures did not only include the mostly male fishers, but also the women directly and indirectly affected by changes in fisher livelihoods, as well as other stakeholders.

The above weaknesses are compounded given the context of hilsa fisheries. Most fishing vessels remain unregistered, and in many cases, may not be owned by the crew making use of them. Although identification cards are being issued that enable authorities to distinguish genuine fishers from those claiming to be fishers to access the grant, leakages are still possible (Amin *et al.*, 2008). The revised HFMAP seeks to close this gap by giving food incentives to all hilsa fishing families and by regularly updating the fishers list (Wahab and Rahman, 2020).

Marine resources are frequently exploited by fishers from more than one country. A cooperative transnational PES system could assist if issues of governance and coordination can be addressed. Although complex, transboundary ecosystem management is increasingly being proposed as a solution to this problem. In the case of the hilsa sanctuaries, this is being discussed by the Bay of Bengal Large Marine Ecosystem Project for both resource management and the social policy interface (BOBLME, 2015).

Finally, the VGF's weaknesses will also need to be addressed. The World Bank (2021) notes that the VGF faces challenges of targeting, both excluding those who are eligible and including those that are not. The VGF is also regarded as being expensive to administer.

Overall, the evidence concerning the process of asset building in ECOFISH-BD is insufficient to assess the programme's impact on poverty reduction and the long-term sustainability of the marine resources. This is a strong candidate for more detailed analysis, but requires further collection of primary data from the beneficiaries. The evaluation reports that were examined are careful not to claim any significant changes in this regard, but it seems that the information that would be required for this analysis may not have been collected.

References

Abdul, W.M., Sharmin, R. & Haque, A.M. (2021). *Women's Economic Empowerment and Hilsa Fisheries: Experience in ECOFISH Activity*. Penang, Malaysia, WorldFish. Cited 14 March 2022. https://hdl.handle.net/20.500.12348/5051

Ahmed, M.; Mitu, S.J.; Schneider, P.; Alam, M.; Mozumder, M.M.H. & Shamsuzzaman, M.M. *Socio-Economic Conditions of Small-Scale Hilsa Fishers in the Meghna River Estuary of Chandpur, Bangladesh.* Sustainability 2021, 13, 12470. Dhaka, MDPI. Cited 22 June 2023. https://www.mdpi.com/2071-1050/13/22/12470

Amin, S.M.N., Rahman, M.A., Haldar, G.C., Mazid, M.A. & Milton, D.A. 2008. Catch per unit effort, exploitation level and production of hilsa shad in Bangladesh waters. *Asian Fisheries Science*, 21(2): 175–187.

Barisal, M.J. 2018. Ecofish's new venture: Hilsa protection team, *The District*, 12 December 2017. Dhaka, MDPI. Cited 11 March 2022. https://www.mdpi.com/2071-1050/13/22/12470

Béné, C. & Haque, M.A.B.M. 2022. Strengthening the Resilience of Vulnerable Communities: Results from a Quasi-experimental Impact Evaluation in Coastal Bangladesh, *European Journal of Development Research*, 34: 843–868.

Bennett, N.J., Di Franco, A., Calò, A., Nethery, E., Niccolini, F., Milazzo, M. & Guidetti, P. 2019. Local support for conservation is associated with perceptions of good governance, social impacts, and ecological effectiveness, *Conservation Letters*, 12: e12640.

Bladon, A.J., Short, K.M., Mohammed, E.Y. & Milner-Gulland, E.J. 2016a. Payments for ecosystem services in developing world fisheries, *Fish and Fisheries*, 17(3): 839–859.

Bladon, A., Syed, M.A., Hassan, S.M.T., Raihan, A.T., Uddin, N., Ali, L., Ali, S. *et al.* 2016b. *Finding evidence for the impact of incentive-based hilsa fishery management in Bangladesh: combining theory testing and remote sensing methods*. IIED Working Paper. London, IIED (International Institute for Environment and Development).Cited 22 June 2023. http://pubs.iied.org/16625IIED

Bladon, A.J., Mohammed, E.Y., Ali, L. & Milner-Gulland, E.J. 2018. Developing a frame of reference for fisheries management and conservation interventions, *Fisheries Research*, 208: 296–308.

BOBLME (Bay of Bengal Large Marine Ecosystem Project). 2010. *Status of hilsa (Tenualosa ilisha) management in the Bay of Bengal: an assessment of population risk and data gaps for more effective regional management*. BOBLME-2010-Ecology-01. Clayton South, Australia, BOBLME.

BOBLME. 2015. Preliminary assessment of the regional science-policy interface for ocean governance in the Bay of Bengal. Phuket, Thailand, BOBLME. Cited 10 February 2022.

Daniels, A.E., Bagstad, K., Esposito, V., Moulaert, A. & Rodriguez, C.M. 2010. Understanding the impacts of Costa Rica's PES: Are we asking the right questions?, *Ecological Economics*, 69(11): 2116–2126.

Deb, A.K., Haque, C.E. & Thompson, S. 2015. 'Man can't give birth, woman can't fish': gender dynamics in the small-scale fisheries of Bangladesh. *Gender, Place & Culture*, 22(3): 305–324.

Dewhurst-Richman, N., Mohammed, E.Y., Ali, M.L., Hassan, K., Wahab, M.A., Ahmed, Z.F., Islam, M.M. *et al.* 2016. *Balancing Carrots and Sticks: Incentives for Sustainable Hilsa Fishery Management in Bangladesh*. London, IIED.

ECOFISH. 2020. *Enhanced Coastal Fisheries in Bangladesh Project (ECOFISH): Completion Report*. Penang, Malaysia, ECOFISH. Cited 15 April 2022. https://digitalarchive.worldfishcenter.org/bitstream handle/20.500.12348/4543/271b15027aeecfd5dd7e34bd3d9d53c4.pdf

FAO (Food and Agriculture Organization of the United Nations). 2017. *FAO social protection framework: promoting rural development for all.* Rome, FAO.

FAO. 2020. *Country Programming Framework for Bangladesh 2019–2020*. Dhaka, FAO. Cited 9 February 2022. boblme.org/documentRepository/BOBLME-2010-Ecology-01.pdf.

FAO. 2023. Fishery and Aquaculture Country Profiles. Bangladesh, 2010. Country Profile Fact Sheets. Bangladesh, FAO. Cited 30 June 2023. https://www.fao.org/fishery/en/facp/bgd?lang=en

FAO.2023. Suite of Food Security Indicators. In: *FAOSTAT.* Rome, FAO. fao.org/faostat/en/#data/FS/visualize

GoB (Government of Bangladesh). 2022. *Social Security Policy Support Progamme* online. Bangladesh, GoB. Cited 12 February 2022. https://socialprotection.gov.bd/en/.

Haque, A.B.M. & Mahfuzul, I. 2020. *Hilsa Production and Fishers' Income Increased due to co-management strategies aimed to enhance the socio-economic resilience of fishing communities in Bangladesh*. Penang, Malaysia, WorldFish. Cited 22 June 2023. https://mel.cgiar.org/projects/ecofish/214/hilsa-production-and-fishers-income-increased-due-to-co-management-strategies-aimed-to-enhance-the-socio-economic-resilience-of-fishing-communities

Hulme, D. 2014. Consolidating Nets and Promoting Ladders in Bangladesh: From Social Safety Net Programmes to a National Social Protection System. In. H.Z. Rahman, D. Hulme, M. Maitrot & L.P. Rango (eds), *Social Protection in Bangladesh*: *Building Effective Social Safety Nets and Ladders Out of Poverty*, pp. 3-20. Dhaka, University Press Limited.

IFPRI (International Food Policy Research Institute). 2021. Latest food security situation in Bangladesh (data collection ongoing). In: *IFPRI Bangladesh*. Washington, D.C, IFPRI. Cited 14 March 2022.https://bangladesh.ifpri.info/2021/10/latest-food-security-situation-in-bangladesh-data-collection-ongoing/.

ILO (International Labour Organization). Undated. Social Protection in Bangladesh. In: *International Labour Organization.* Bangladesh, ILO. Cited 12 February 2022. ilo.org/dhaka/Areasofwork/social-protection/lang--en/index.htm

Islam, M.H., Mohammed, E.Y. & Ali, L. 2016. Economic incentives for sustainable hilsa fishing in Bangladesh: an analysis of the legal and institutional framework, *Marine Policy*, 68: 822.

Islam, M.M., Aktar, R., Nahiduzzaman, M., Barman, B.K. & Wahab, M.A. 2018. Social considerations of large river Sanctuaries: A Case Study from the Hilsa Shad Fishery in Bangladesh, *Sustainability*, 10: 1254.

Islam, M.M., Nahiduzzaman, M. & Wahab, M.A. 2020. Fisheries co-management in hilsa shad sanctuaries of Bangladesh: Early experiences and implementation challenges, *Marine Policy*, 117: 103955.

Karim, E., Liu, Q., Sun, M., Barman, P. P., Hasan, S. J. & Hoq, M.E. 2019. Assessing recent gradual upsurge of marine captured Hilsa stock (Tenualosa ilisha) in Bangladesh, *Aquaculture and Fisheries*, 4(4): 156–165.

Khan, M.A., Wahab, M.A., Haque, A.B.M.M., Nahiduzzaman, M. & Phillips, M.J. 2020. Value chain impact of the increased shad (*Tenualosa ilisha*) harvest in Bangladesh, *International Food and Agribusiness Management Review*, 23(3): 355–368.

Mahmud, Y. (ed.) 2020. *Hilsa Fisheries Research and Development in Bangladesh*. Bangladesh Fisheries Research Institute (BFRI), Hilsa Research Strengthening Project. Dhaka, Momin offset Press.

Milder, J.C., Scherr, S.J. & Bracer, C. 2010. Trends and future potential of payment for ecosystem services to alleviate rural poverty in developing countries, *Ecology and Society*, 15(2).

MoF (Ministry of Finance, Bangladesh). 2022. Social Safety Net: 2019-20 & 2020-21 Financial Year. In: *https://mof.portal.gov.bd.* Dhaka, MoF. Cited 12 February 2022. https://mof.portal.gov.bd/sites/default/files/files/mof.portal.gov.bd/page/672e3d4d_09bb_4205_9afd_843de55481d1/Safety%20Net%2020-21_English_2020-11-16.pdf

Mohammed, E.Y. & Wahab, A. 2013. *Direct Economic Incentives for Sustainable Fisheries Management: The Case of Hilsa Conservation in Bangladesh*. London, IIED.

Mohammed, E.Y., Ahmed, C.S. & Ali, M.L. 2014. *Mitigating unintended local economic impacts of the compensation scheme for hilsa management. IIED Briefing*. London, IIED.

Mozumder, M.M.H., Wahab, M., Sarkki, S., Schneider, P. & Islam, M.M. 2018. Enhancing social resilience of the coastal fishing communities: A case study of hilsa (Tenualosa ilisha H.) fishery in Bangladesh. *Sustainability*, 10(10): 3501.

Mustafa, M.G. 2020. Sustainable inland and coastal fisheries: key lessons drawn from community-based fisheries management in Bangladesh. *Journal of Applied Sciences International*, 23(2): 1-17.

Nahiduzzaman, M., Islam, M.M. & Wahab, M.A. 2018. Impacts of Fishing Bans for Conservation on Hilsa Fishers Livelihoods. In: B. Nishat, S. Mandal & G. Pangare (eds), *Conserving Ilish, Securing Livelihoods – Bangladesh-India Perspectives*. New Delhi, Academic Foundation.

Pattayanka, S.K., Wunder, S. & Ferraro, P.J. 2010. Show me the money: do payments supply environmental services in developing countries?, *Review of Environmental and Economic Policy*; 4: 254–274.

Phan, T.H.D., Brouwer, R., Hoang, L.P. & Davidson, M.D. 2018. Do payments for forest ecosystem services generate double dividends? An integrated impact assessment of Vietnam's PES program, *PloS one*, 13(8): e0200881.

Porras, I., Mohammed, E. Y., Ali, L., Ali, M. S., & Hossain, M.B. 2017. Power, profits and payments for ecosystem services in Hilsa fisheries in Bangladesh: a value chain analysis, *Marine Policy*, 84: 60–68.

Rahman, M.J., Wahab, M.A., Nahiduzzaman, M., Haque, A.B.M.M. & Cohen, P. 2020. Hilsa fishery management in Bangladesh. *IOP Conference Series: Earth and Environmental Science*, 414(1): 012018.

Rasheed, A.R. 2020. Marine protected areas and human well-being–a systematic review and recommendations, *Ecosystem Services*, 41: 101048.

Reid, H. & Ali, L. 2018. Ecosystem-based approaches to adaptation: strengthening the evidence and informing policy, Research results from the Incentive-based Hilsa Conservation Programme, Bangladesh, International Institute for Environment and Development. London, IIED.

Roelen, K., Devereux, S., Abdulai, A-G., Martorano, B., Palermo, T. & Ragno, L.P. 2017. *How to Make 'Cash Plus' Work: Linking Cash Transfers to Services and Sectors.* Innocenti Working Paper 2017-10. Florence, Italy, UNICEF Office of Research.

SabatesWheeler, R. & Devereux, S. 2013. Sustainable graduation from social protection programmes, *Development and Change*, 44(4): 911–938.

Sarker, M.N., Naser, M.N., Uddin, M.S., Das, N.N. & Humayun, M. 2019. On the management of single fish species of hilsa shad (Tenualosa ilisha) resources of Bangladesh, *Bangladesh Journal of Zoology*, 47(1): 173–183.

Schwarzer, H., Van Panhuys, C. & Diekmann, K. 2016. *Protecting people and the environment: lessons learnt from Brazil's Bolsa Verde, China, Costa Rica, Ecuador, Mexico, South Africa and 56 other experiences*. International Labour Office, Social Protection Department (SOCPRO), Extension of Social Security Series Working Paper No. 54. Geneva, Switzerland, ILO. Cited 1 March 2022.ilo.org/wcmsp5/groups/public/---ed_protect/---soc_sec/documents/publication/wcms_538815.pdf

Sunny, A.R., Hassan, M. N., Mahashin, M. & Nahiduzzaman, M. 2017. Present status of hilsa shad (Tenualosa ilisha) in Bangladesh: A review, *Journal of Entomology and Zoology Studies*, 5(6): 2099–2105.

Talukdar, A., Schneider, P., Begum, A., Kawsar, M.A., Sultana, M.A., Sumon, T.A., Nabi, M.R-U-. *et al*. 2022. The premium of Hilsa sanctuary: a socio-economic and ecological evaluation from the Meghna Estuary, Bangladesh. *Sustainability*, 14: 7782.

Titmuss, R.M. 1968. *Commitment to Welfare*. New York, USA, Pantheon Books.

USAID (U.S. Agency for International Development). 2017. *Country Profile: Bangladesh*. Washington, D.C, USAID. Cited 12 January 2022. https://feedthefuture.gov/country/Bangladesh

USAID. 2018. *Midterm performance evaluation report of USAID/Bangladesh Enhanced Coastal Fisheries (ECOFISH) project: February 2018*. Washington, D.C, USAID. Cited 14 March 2022. https://pdf.usaid.gov/pdf_docs/PA00T4ZD.pdf

van Brakel, M.L., Nahiduzzaman, M., Haque, A.B.M.M., Mustafa, M.G., Rahman, M.J. & Wahab, M.A. 2018. Reimagining large-scale open-water fisheries governance through adaptive comanagement in hilsa shad sanctuaries, *Ecology and Society*, 23(1): 26. CITED 22 June 2023. https://doi.org/10.5751/ES-09917-230126

Wahab, M.A., Beveridge, M.C.M. & Phillips M.J. (eds.). 2019. *Hilsa: Status of fishery and potential for aquaculture*, Penang, Malaysia, WorldFish Proceedings: 2019-16.

Wahab, M.A. & Rahman, M.J. 2020. *Hilsa Fisheries Management Action Plan (HFMAP) (2020-2030). Enhanced Coastal Fisheries in Bangladesh (ECOFISH-BD*). Dhaka, Department of Fisheries and Ministry of Fisheries and Livestock.

Westlund, L., Charles, A., Garcia, S.M. & Sanders, J. 2017. *Marine protected areas: Interactions with fishery livelihoods and food security.* FAO Fisheries and Aquaculture Technical Paper No. 603. Rome, FAO.

World Bank. 2016. *Program Brief: Vulnerable Group Feeding, Bangladesh*. Washington, D.C, World Bank. Cited 14 March 2022. https://documents1.worldbank.org/curated/en/461531552967731486/pdf/135379-BRI-PUBLIC-18-3-2019-10-13-54-ProgrambriefonVGFF.pdf

World Bank. 2018. *The World Bank in Bangladesh*. Washington, D.C., World Bank. Cited 22 June 2023. worldbank.org/en/country/bangladesh/overview

World Bank. 2021. *Bangladesh Social Protection Public Expenditure Review (PER).* Dhaka and Washington, D.C., World Bank.

WorldFish. 2020. *Enhanced Coastal Fisheries in Bangladesh Project (ECOFISH): Completion Report*. Penang, Malaysia, WorldFish. Cited 16 March 2022. https://digitalarchive.worldfishcenter.org/bitstream/handle/20.500.12348/4543/271b15027aeecfd5dd7e34bd3d9d53c4.pdf

WorldFish. 2021a. *USAID_Enhanced Coastal Fisheries in Bangladesh Phase 2 (Ecofish II) Quarterly Report January 1, 2021 – March 31, 2021*. Penang, Malaysia, WorldFish. Cited 14 March 2022. worldfishcenter.org/publication/usaidenhanced-coastal-fisheries-bangladesh-phase-2-ecofish-iiquarterly-reportjanuary-1

WorldFish. 2021b. *Enhanced Coastal Fisheries in Bangladesh (ECOFISH—Bangladesh): Project brief with accomplishments as of December 1, 2019–December 31, 2020*. Penang, Malaysia, WorldFish. Cited 15 March 2022. https://digitalarchive.worldfishcenter.org/bitstream/handle/20.500.12348/4703/32a7f10bcf6c70ab4e88d603314acebf.pdf?sequence=3&isAllowed=y

Wunder, S. 2005. *Payments for environmental services: some nuts*. CIFOR Occasional Paper No. 42. Bogor, Indonesia, CIFOR (Center for International Forestry Research).

Wunder, S. 2015. Revisiting the concept of payments for environmental services, *Ecological Economics*, 117: 234–243.

Annex

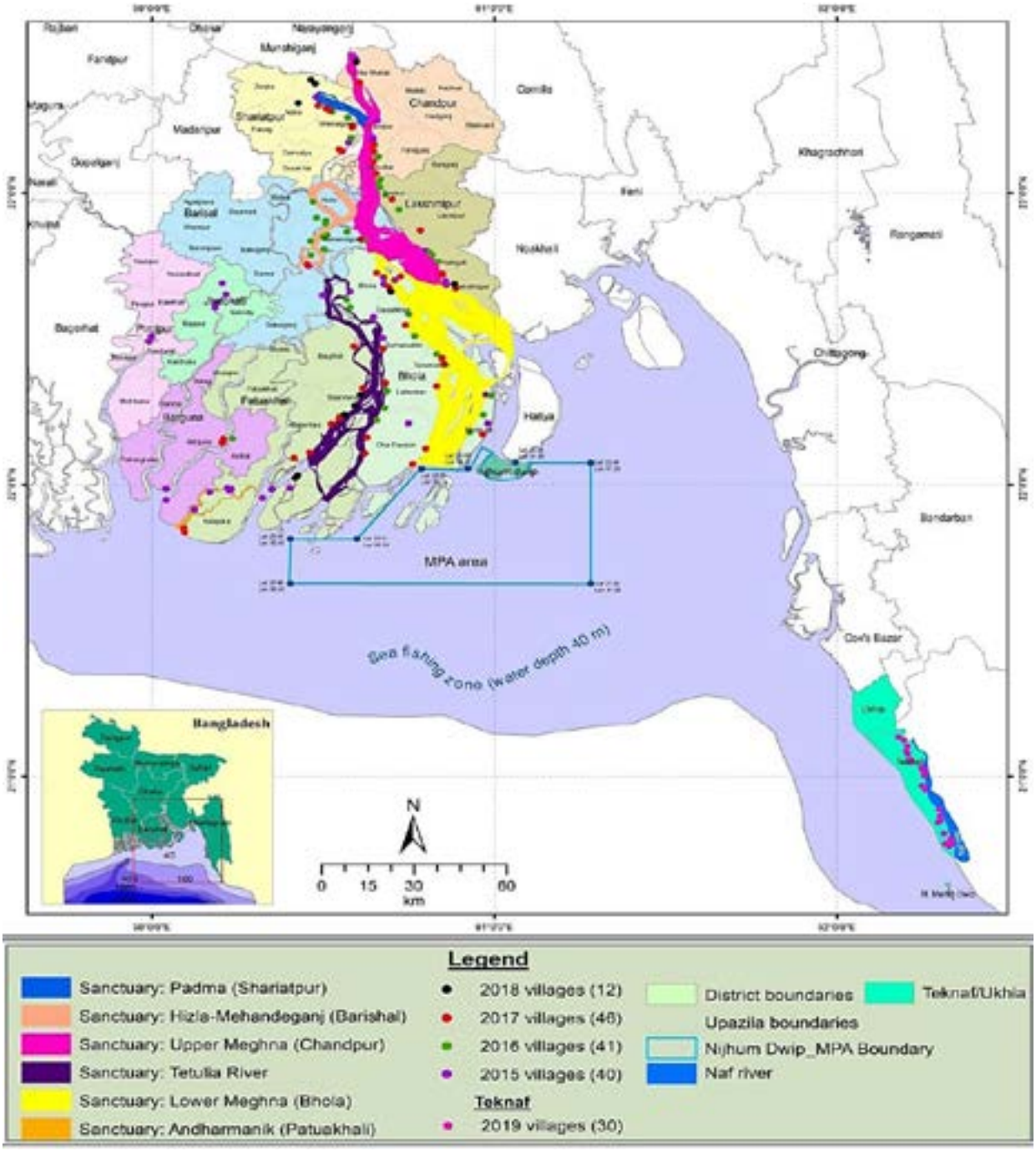
Table A1. Hilsa sanctuaries in Bangladesh

Location	Area	Fishing ban
From Shatnol in Chandpur District to Char Alexander in Laxmipur District	Meghnar River (100km)	March–April
From Madanpur/Char Ilisha to Char Pial in Bhola District	Shahbajpur channel of the Meghnar River (90km)	March–April
From Bheduria in Bhola District to Char Rustom in Patuakhali District	Tentulia River (100km)	March–April
Andharmanik River route along Kalapara Upazila in Patuakhali District	Andharmanik River (40km)	November–January
Naria Upazila to Bhedarganj Upazila along the Padma River in Shariatpur District	Lower Padma River (20km)	March–April
Hizla, Mehendiganj and Barishal sadar upazilas in Barishal District	Kalabadar, Gazaria and Meghna rivers (82km)	March–April

Note: The ban period specified is for the peak juvenile hilsa period but is an all-out fishing ban. In the Andharmanik sanctuary, the ban period differs due to its unique river ecosystem and the role this system plays for newly hatched hilsas.

Source:
Authors' own elaboration from Wahab, M.A. & Rahman, M.J. 2020. *Hilsa Fisheries Management Action Plan (HFMAP) (2020-2030). Enhanced Coastal Fisheries in Bangladesh (ECOFISH-BD)*. Dhaka, Department of Fisheries and Ministry of Fisheries and Livestock. https://digitalarchive.worldfishcenter.org/bitstream/handle/20.500.12348/3879/1f352cdd0c24d721be0860e11d7635f3.pdf

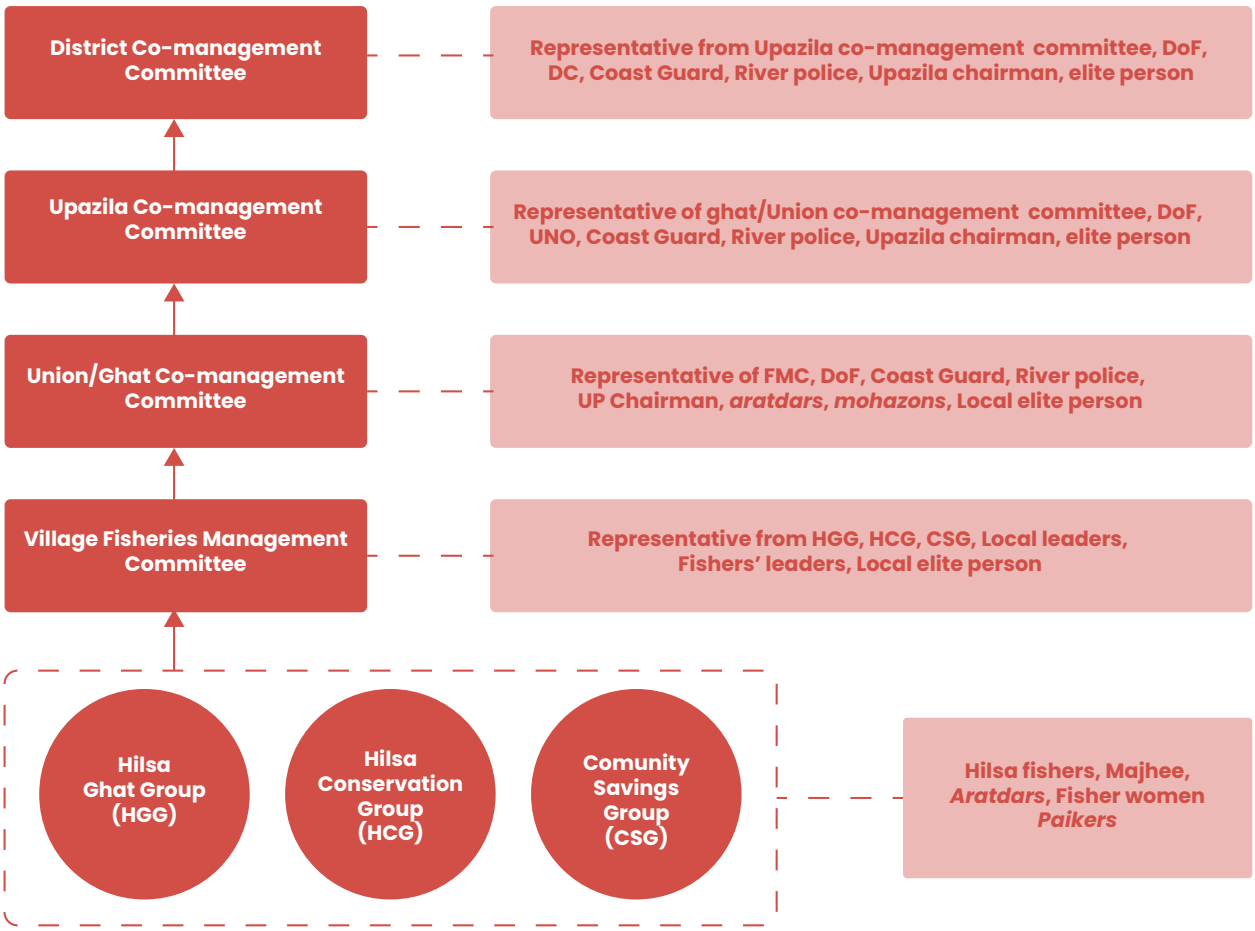
Figure A1. Geographical location of hilsa sanctuaries and of ECOFISH-BD villages



Note: Teknaf is part of a zone of resilience. Since 2017, a river fishing ban has been in place in this area following illegal smuggling activities.

Source:
WorldFish. 2020. *Enhanced Coastal Fisheries in Bangladesh Project (ECOFISH): Completion Report,* Penang, Malaysia, WorldFish. Cited 16 March 2022. https://digitalarchive. worldfishcenter.org/bitstream/handle/20.500.12348/4543/271b15027aeecfd5dd7e34bd3d9d53c4.pdf

Figure A2. ECOFISH-BD institutional structure



Notes: The figure describes the various institutional layers established through ECOFISH-BD to help unlock coordination across the local sites.

The term *upazila* refers to an administrative region of Bangladesh that is effectively a subdistrict; *paikers* are local wholesalers; other specific terms are explained in the main body of this paper.

Abbreviations: DC – District Commissioner; UP – *Union Parishad*, the local government administrative unit that operates at the lowest level.

Source:
WorldFish. 2020. *Enhanced Coastal Fisheries in Bangladesh Project (ECOFISH): Completion Report,* Penang, Malaysia, WorldFish. Cited 16 March 2022. https://digitalarchive. worldfishcenter.org/bitstream/handle/20.500.12348/4543/271b15027aeecfd5dd7e34bd3d9d53c4.pdf

Table A2. Food assistance to hilsa fishers (2006–2018)

Year	Fisher families	Amount allocated (tonnes)
2006/07	103 000	1 546
2007/08	145 335	4 360
2008/09	143 252	5 730
2009/10	164 740	19 768
2010/11	186 264	14 470
2011/12	186 264	22 351
2012/13	206 229	24 747
2013/14	226 852	36 296
2014/15	226 852	36 296
2015/16	236 176	37 144
2016/17	238 673	38 188
2017/18	248 674	39 788

Source:
Mahmud, Y. (ed.) 2020. *Hilsa Fisheries Research and Development in Bangladesh*. Bangladesh Fisheries Research Institute (BFRI), Hilsa Research Strengthening Project. Dhaka, Momin offset Press. https://fri.portal.gov.bd/sites/default/files/files/fri.portal.gov.bd/page/7e157a49_1314_454f_b37c_11ef1a6c8f32/2022-06-02-06-48-f84a7dfde3747fa83187378fbd0506e1.pdf

ISBN 978-92-5-138238-7

9 789251 382387

CC8127EN/1/10.23