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Enhanced Coastal Fisheries in Bangladesh II

Annual Report

January 1 - December 31, 2022

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ENHANCED COASTAL FISHERIES IN BANGLADESH II (ECOFISH II)

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List of abbreviations

AIGA	Alternative Income Generating Activity
BFRI	Bangladesh Fisheries Research Institute
BFDC	Bangladesh Fisheries Development Corporation
BORI	Bangladesh Oceanographic Research Institute
BSMRAU	Bangabandhu Sheikh Mujibur Rahman Agricultural University
CVASU	Chattogram Veterinary and Animal Sciences University
CFG	Community Fish Guard
CS	Citizen Scientist
CSG	Community Savings Group
DOF	Department of Fisheries
EAFM	Ecosystem Approach to Fisheries Management
ECOFISH-BD	Enhanced Coastal Fisheries in Bangladesh
ECOFISH II	Enhanced Coastal Fisheries in Bangladesh II
FCG	Fisheries Conservation Group
FMC	Fisheries Management Committee
EMMP	Environmental Mitigation and Monitoring Plan
GIS	Geographic Information System
GOB	Government of Bangladesh
GSI	Gonadosomatic Index
HCDF	Hilsa Conservation and Development Fund
HFMAP	Hilsa Fisheries Management Action Plan
HCG	Hilsa conversation group
HGG	Hilsa Ghat Group
IUU	Illegal, Unreported and Unregulated
IRs	Intermediate Results
IUCN	International Union for the Conservation of Nature
LCF	Landing Center Facilitator
MEL	Monitoring, Evaluation and Learning
MPA	Marine Protected Area
MRE	Meghna River Ecosystem
MSP	Marine Spatial Plan
MoFL	Ministry of Fisheries and Livestock
MoFECC	Ministry of Forest, Environment and Climate Change
NGO	Nongovernmental organization
NSTU	Noakhali Science and Technology University
PES	Payment for Ecosystem Services
SUST	Shahjalal University of Science and Technology
USAID	United States Agency for International Development
USG	United States Government
ZOR	Zone of Resilience (Cox's Bazar)

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I Program overview/summary

Program name:	Enhanced Coastal Fisheries in Bangladesh II (ECOFISH II)
Activity start and end date:	December 1, 2019 to November 30, 2024
Name of prime implementing partner:	WorldFish
[Contract/Agreement] number:	PIO Grant BFS-G-11-00002
Name of subcontractors/sub-awardees:	BSMRAU, CVASU, NSTU, SUST, IUCN and Shushilan
Major counterpart organization:	Department of Fisheries (DOF), Ministry of Fisheries and Livestock, Government of Bangladesh (GOB) <i>Barishal Division:</i> Barishal, Patuakhali, Barguna and Bhola districts <i>Dhaka Division:</i> Shariatpur District <i>Chattogram Division:</i> Chandpur, Lakshmipur, Noakhali and Cox's Bazar districts
Geographic coverage:	
Reporting period:	January 1 – December 31, 2022

I.I Program description/introduction

1.1.1. Introduction

ECOFISH II Activity is a five-year long transformative project of ECOFISH^{BD} that solely funded by the United States Agency for International Development (USAID), and implemented by WorldFish in collaboration with the Department of Fisheries (DoF), Bangladesh. Aside from the DoF, the project includes collaborations with universities, conservation organizations, and non-governmental organizations (NGOs). ECOFISH II is assisting the DoF and local fishing communities in establishing collaborative management (co-management) in accordance with the [Ecosystem Approach to Fisheries Management \(EAFM\)](#) framework, with a focus on Hilsa, river catfish, and other major coastal and marine fisheries resources. Project also assists the host-fishing communities in the USAID's Zone of Resilience (ZOR), Cox's Bazar-Teknaf peninsula, Saint Martin and Maheshkhali island, coastal fishing communities in the Meghna River Ecosystem (MRE), and the Nijhum Dwip Marine Protected Area (MPA)¹.

ECOFISH II aiming at enhancing **ecosystem** resilience through establishing effective co-management of coastal fisheries resources in those areas focusing on Hilsa shad, river catfish and other commercially important coastal and marine fish species for the communities reliant on it. Following the pathway of ECOFISH^{BD}, ECOFISH II has been enhancing artisanal **fishing community** resilience by improving the food, nutrition, livelihood and coping strategies of marginalized and poor host fishing communities in the ZOR, Cox's Bazar, in the MRE and MPA. The project emphasizes on the

¹ Marine protected areas (MPA) are specially demarcated protected areas of seas, oceans, or coastal region for better biodiversity and/or socio-ecological conservation. As per **Convention on Biological Diversity**, MPA can be defined as any area within or adjacent to the marine environment, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by legislation or other effective means, including custom, with the effect that its marine and/or coastal biodiversity enjoys a higher level of protection than its surroundings.

sustainability of the ECOFISH^{BD} interventions and adopts its best practices in the ZOR, Cox's Bazar and in the Nijhum Dwip MPA and some important area of MRE regions under the new ECOFISH II Activity.

1.1.2. Objective and theory of change

The overarching goal of ECOFISH II is improved social and ecological resilience of coastal fisheries securing equitable food, nutrition and livelihood benefits for fishing communities. The project would maintain or increase the productivity of fisheries, conserve biological diversity, and enhance ecosystem productivity and economic wellbeing of fishers in the ZOR and MRE. The project focuses on improved management of natural resources targeting biodiversity conservation leading to indirect adaptation benefits and enhanced adaptation capacity and resilience to shocks and stresses of the reliant communities. To achieve the goal, the project would achieve two Intermediate Results (IRs) and four Sub-IRs, which are as follows:

IR1: Improved management and governance of natural resources that form the foundation of fisheries

- Sub-IR1.1: Improved science outputs for decision-making (ecosystem health assessed; biodiversity assessed and conserved; fisheries dynamics monitored).
- Sub IR1.2: Improved adaptive co-management and fisheries governance (co-management institutions strengthened; EAFM mainstreamed and strengthened; fisheries governance improved).
- Sub IR1.3: Improved policy support (HFMAP implementation ensured; MPA legal framework formulated; Hilsa Conservation & Development Fund and Payment for Ecosystem Services introduced, and transboundary legal framework formulated).

IR2: Improved equity and resilience of food, nutrition and livelihood benefits

- Sub-IR 2.1 Improved livelihood resilience of coastal fishing communities (Livelihood capacity and options diversified; women's access to finance improved; access to improved technologies and market linkages strengthened, adaptive capacities to climate change and resilience improved).

The ECOFISH II activity will contribute directly towards DO1 and DO3 of the [USAID Bangladesh CDCS Results Framework](#). Through addressing the Results Framework, the ECOFISH II Theory of Change (ToC) will achieve the project goal of 'improved social and ecological resilience focusing on the climate adaptation of coastal fisheries securing equitable food, nutrition and income benefits for fisheries communities' by achieving the two intermediate results. These are, IRs: improved management and governance of natural resources that form the foundation of fisheries (IR1); and improved equity and resilience of food, nutrition and livelihood benefits from fisheries (IR2). These mean, for the sake of improved governance and management of fisheries resources (IR1), equity and resilience of fishers in terms of food, nutrition and livelihood benefits to be ensured (Figure 1). After achieving the specific objectives or IRs, the immediate outcomes would be improved fish stocks, improved ecosystems that are more resilient, strengthened fisheries governance, and improved biodiversity that would ultimately improve the livelihoods and resilience of the communities. Moreover, the project has been improving gender equity, creating opportunities for youth and improving environmental compliance in all the implementation stages for all the stakeholders, communities and habitats involved (Figure 1). The focused intervention areas are shown in Figure 2.

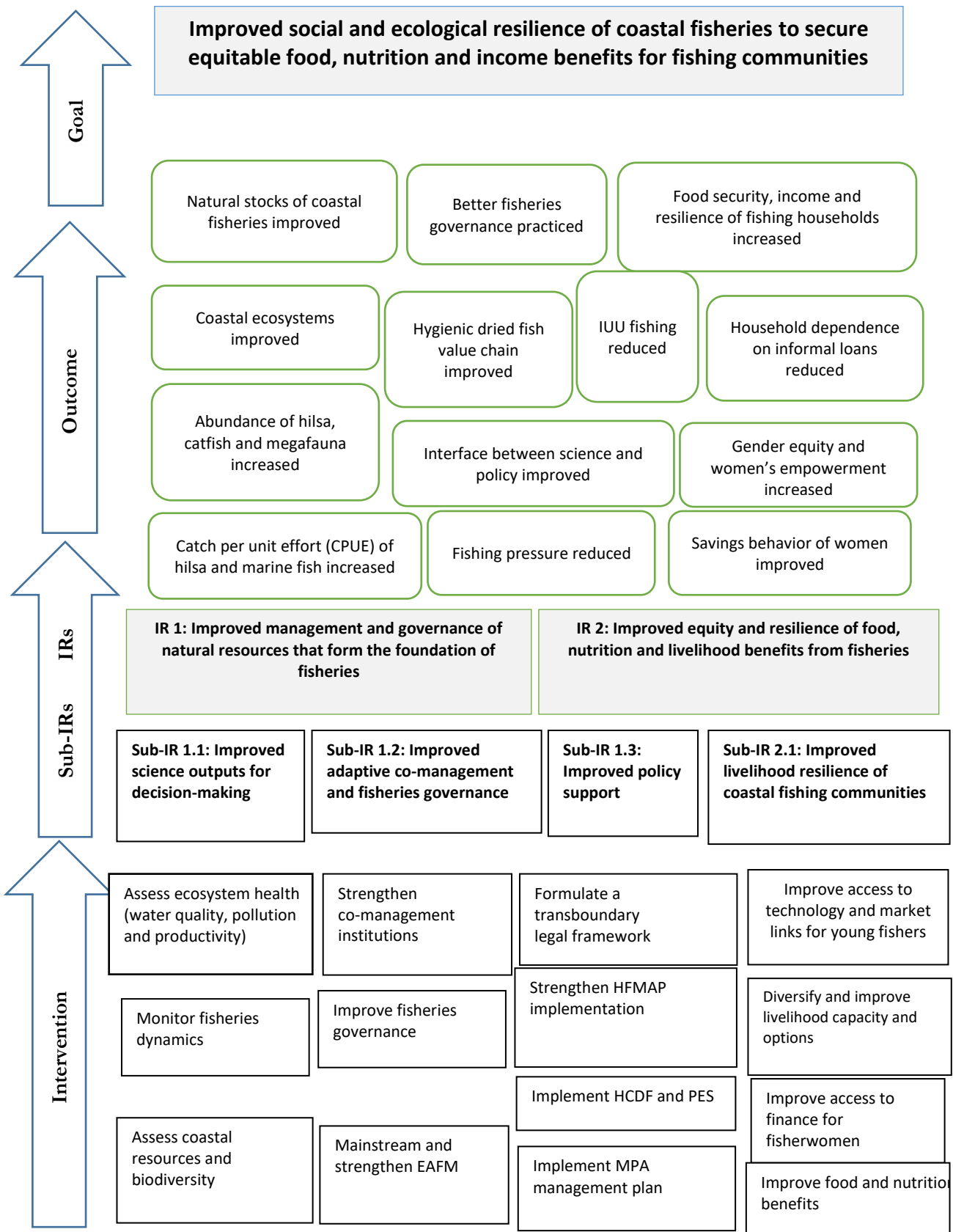


Figure 1. ECOFISH II's Theory of Change (ToC) (Version 1).

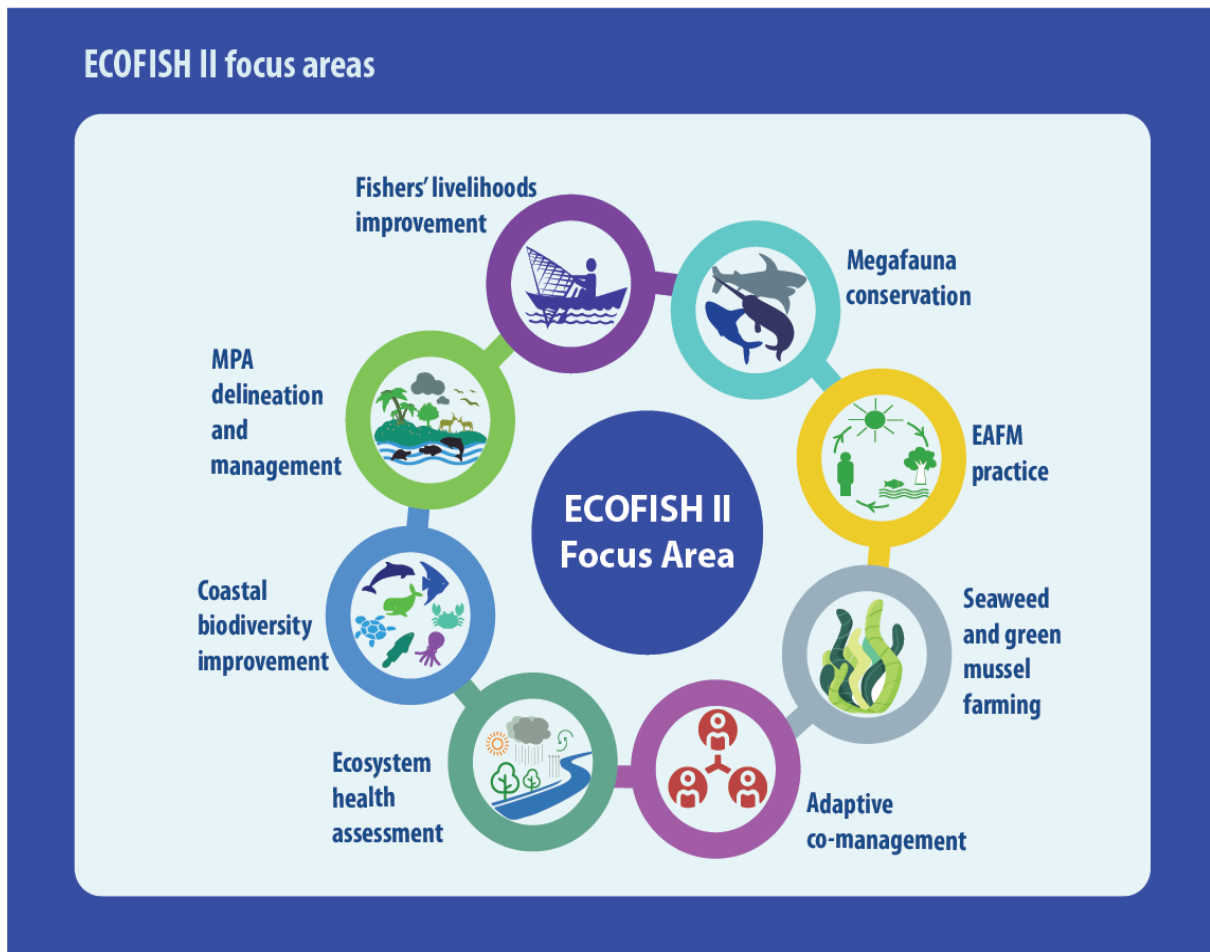


Figure 2. ECOFISH II's focus areas of interventions.

1.1.3 Theater of operation

The ECOFISH II Theater of Operation (ToO) has mainly covered the Zone of Resilience (ZOR), Cox's Bazar, Meghna River Ecosystem (MRE) and the Nijum Dwip MPA (Figure 3). The ZOR includes the Cox's Bazar-Teknaf coasts, the Naf River/Estuary Ecosystems, the St. Martin and the Maheshkhali Island. The MRE includes the Hilsa sanctuary areas located in the Meghna, Tetulia, Gajaria and Andharmanik Rivers in Chandpur, Laxmipur, Barishal, Bhola and Patuakhali districts. The Nijum Dwip MPA covered a wide area of 3,188 km² seascape along the coasts of Noakhali, Bhola and Patuakhali districts.

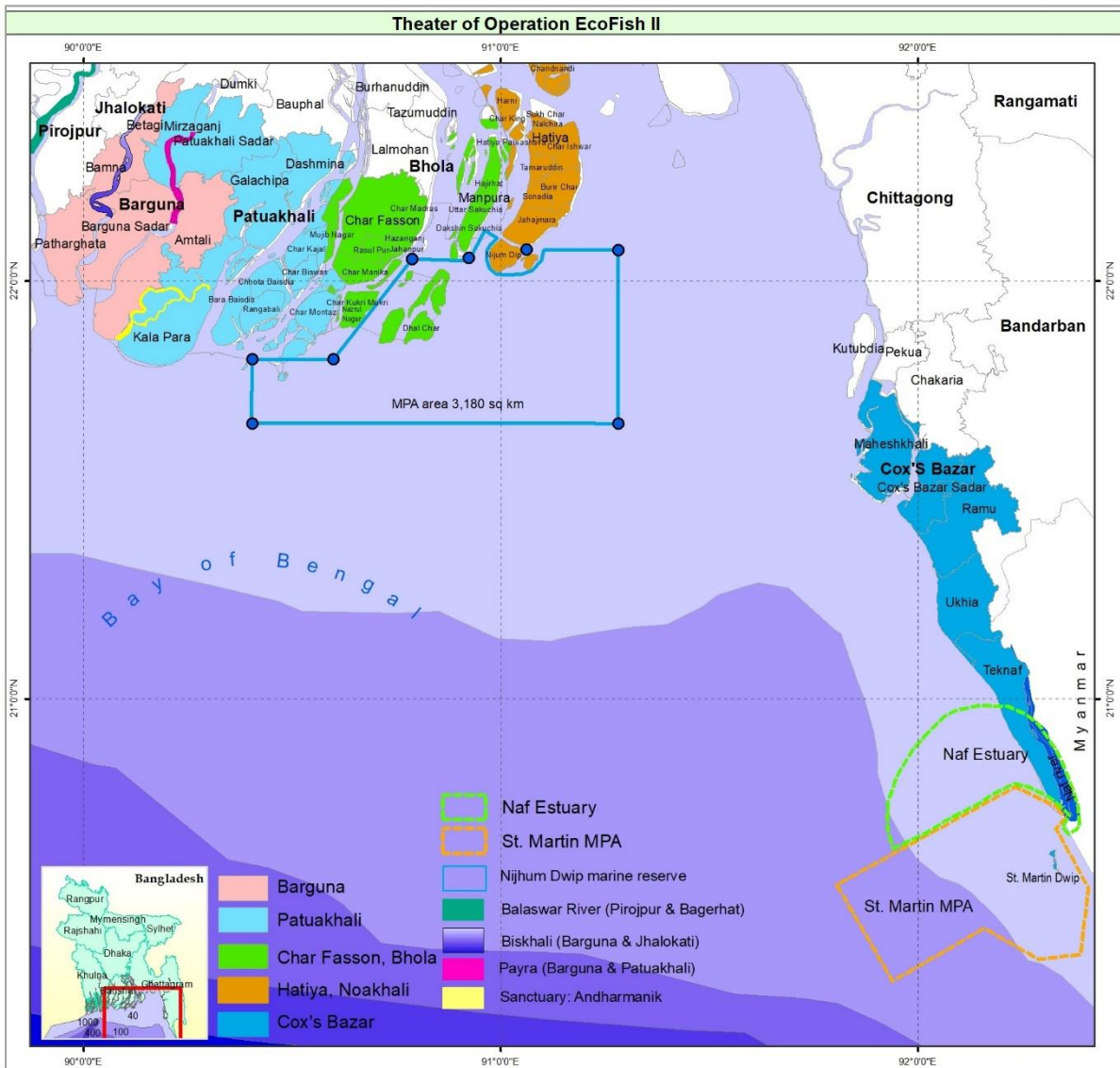


Figure 3. ECOFISH II Theater of Operations (ToOs) in the MRE, MPA and ZOR.

2 Activity implementation progress

2.1 Progress narrative

This annual report describes the accomplishments and achievements of ECOFISH II from January to December 2022. Activities were implemented using key partnerships with the NGO Shushilan, Chattogram Veterinary and Animal Sciences University (CVASU), Shahjalal University of Science and Technology (SUST), Noakhali Science and Technology University (NSTU) and Sher-E-Bangla Agricultural University (SAU).

Target activities on ecosystem health management, coastal biodiversity conservation and monitoring coastal fisheries dynamics were achieved under the first Sub-IR1. Three universities (CVASU, SAU and SUST) played important roles in achieving the science outputs.

To improve coastal ecosystem health, ECOFISH II field teams collected 9,012 kg of plastic, nets and other garbage from the beaches and other coastal shore areas by engaging 100 local youths as Blue Guards. In partnership with the CVASU, ECOFISH II assessed fish biodiversity using DNA barcoding technology. Through barcoding, the identification of 33 species were confirmed.

In ZOR, fish landing records of six LCFs indicated 49 predominant species/groups in the commercial marine fishery that contributed 14,246 tons (t) of fish landing in Cox's Bazar during the reporting quarter. Hilsa dominated in the landings, and large Hilsa (1 kg size) was the highest contributor (1,787 t), followed by medium sized Hilsa (<500g size, 1,375 t). Other important contributors were Anchovy, Bombay duck, Ribbonfish, Pomfret, Croaker, Sea catfish and Shrimps.

The project engaged 35 Citizen Scientists (CSs) of which 25 CSs used to work in ZOR covering Cox's Bazar Sadar, Ukhiya, Moheshkhali and Teknaf and the remaining 10 CSs collected catch data from the Nijhum Dwip MPA. Based on the CS's data, catch per unit efforts (CPUEs) of Hilsa and other species/groups in major intervened areas were estimated. The highest CPUE was found in Cox's Bazar Sadar (1,589 kg/boat/day), followed by Moheshkhali (1,260 kg/boat/day) and MPA (548 kg/boat/day), while the overall average value was 786 kg/boat/day.

As a part of stakeholder's capacity building for co-management, ECOFISH II trained 2,315 beneficiaries from Y3 in biodiversity conservation in 2022. Additionally, 22 Fisheries Conservation Groups (FCGs) were formed. Executive members of these groups are expected to disseminate biodiversity conservation messages throughout the communities. The team also provided biodiversity conservation training to 97 FCG groups from Y2 beneficiaries consisting of 2,468 participants.

Total 16 Ghat group consultation meetings were conducted in ZOR area alongside four awareness events with elite and powerful stakeholders of different fish landing centers. A 13-member executive committee was formed in Moheshkhalipara Ghat in the presence of SUFO-DoF, other Ghat based stakeholders and officials from WorldFish.

Environmental stewards such as boat skippers and Citizen Scientists helped to facilitate community-led conservation initiatives. As of this year, 28 megafauna were released by trained fishers, including 24 turtles, one skate, one shark, one dolphin and one porpoise.

ECOFISH II adheres to an EAFM approach and tries to involve government and non-government stakeholders in the decision-making process and implementation of fisheries governance. ECOFISH II hired an international consultant to conduct training on EAFM in February 2023. Participants in the training program will include relevant representatives from the Department of Fisheries, BORI, universities, and NGOs.

For improved fisheries governance, total 13 batches of boat skipper training were conducted this year. The majority of boat skippers are unaware of the rules and regulations of the government. SUFO/UFO from DoF, Coast Guard Commander, Navy personnel from Bangladesh, and the president

and secretary of the press clubs in different regions facilitated these sessions alongside ECOFISH II staffs.

ECOFISH II conducted 31 awareness events related to 65-day marine fishing ban, 22-day brood hilsa ban, Jatka conservation, megafauna conservation, and catfish conservation. Team provided 379 life jackets to boat skippers who had been trained on marine biodiversity conservation and responsible fishing. Further, the team successfully conducted FirstAid training events and distributed FirstAid Kits to 93 selected fishers from the working area. This year, ECOFISH II distributed 4,000 posters and 20,000 leaflets on Jatka conservation, 5,000 posters and 20,000 leaflets on the 65-day marine fishing ban, and 5,000 posters and 20,000 leaflets on the Hilsa fishing ban.

The United Nations General Assembly has declared 2022 to be the International Year of Artisanal Fisheries and Aquaculture (IYAFA 2022). On 29 May 2022, ECOFISH II recognized the contribution of artisanal fishers to food security and employment, particularly those involved in reviving the hilsa fisheries by celebrating IYAFA 2022 at Kuakata, Patuakhali.

To provide policy support to DoF, delineation activities for a new marine protected area (MPA) in the Naf River Estuary were conducted in partnership with SUST. Based on the socioecological assessment and stakeholder consultations, the project proposed 860 km² area of the Naf River Estuary for delineating a potential new MPA. Three options for restriction zones: entry/no-take, partial reserve, general reserve were also suggested. SUST arranged an expert consultation workshop and revised the proposal incorporating the recommendations from the workshop and re-submitted to DoF. SUST also proposed a management framework focusing on stakeholder integration, livelihood safety of local communities, trans-boundary issue, governance and effective biodiversity conservation through zonal management, monitoring and evaluating the success of MPA declaration.

ECOFISH II is helping small-scale fishing households to increase livelihood resilience for reducing fishing pressure in the Bay of Bengal and coastal riverine ecosystems. The team selected 19 new and 8 existing villages of 09 upazila in ZOR (Teknaf, Ukhiya, Ramu, Cox's Bazar Sadar, and Moheshkhali), MPA (Hatiya, Charfasson, and Rangabali), and MRE (Barguna) under the ECOFISH II intervened areas. After community profiling and beneficiary selection, ECOFISH II provided livelihood support to 2,429 fishing households out of the targeted 2,500 in 2022 (Year 3). Sixty-seven percent of the beneficiaries received goats, 20% received poultry (duck, penguin, and chicken), and the rest received agriculture farming (4%), small business (2%) and other non-farm businesses. These start-up livelihood support helped fishing households to generate income. The team has organized 37 goat husbandry and other AIGA trainings for 1,038 participants (50% women). ECOFISH II organized "Livestock Treatment and Vaccination Campaigns" in 15 intervened fishing villages in ZOR, MPA, MRE region with the Department of Livestock Service (DLS).

To support fisher's women access to finance 17 new Community Savings Groups (CSG) were formed with 532 fisher's women of ZOR and MPA in Year 3. Team conducted 351 CSG mobilization meetings with 8,109 participants. Up to December 2022, 2,082 members from 69 CSGs have savings BDT 3.73 million including their own savings (BDT 2.55 million) and matching fund (BDT 1.18 million). Most of the matured CSGs have started different AIGAs by taking loans from CSGs savings and distributed BDT 540,000 among 84 CSG members to support goat rearing, chicken rearing, agriculture, dry fish business, grocery and tailoring business.

An assessment was conducted to better understand the local level climate change perception, impact, and adaptation strategies of fishermen in Bangladesh's ZOR and MPA coastal villages. The ECOFISH II team organized eight focus group discussions (FGD) with community members for the Community Risk Assessment (CRA) and Risk Reduction Action Planning (RRAP) to address climate change adaptation.

Seaweeds are a form of marine autotrophic macroalgae prevalent in coastal waters and are of both ecological and economic importance. Considering these blue economic importance, ECOFISH II, with

the assistance of CVASU, introduced seaweed farming in the coastal waters of Cox's Bazar, Bangladesh. The objective of this initiative was to develop a production and economically efficient seaweed farming technology through a trial and error process engaging fishing households. CVASU identified four potential seaweed culture species (*Gracilaria* sp., *Ulva* sp., *Hypnea* sp., and *Enteromorpha* sp.). CAVSU also developed habitat suitability maps to select the best suitable site for better growth rate and culture method for seaweed with a view to expand the floating culture system. However, in order to ensure the financial viability of the floating lone line system, a complete economic analysis of the system is required, and this evaluation will take place during the next year.

ECOFISH II also piloted green mussel (*Perna viridis*) farming as another natural solution for the coastal men and women in Cox's Bazar. Preliminary observations suggested that spat attachments would improve following the breeding season.

ECOFISH II distributed micronutrient rich vegetables seeds to 3,337 and 3,623 HHs of Year 2 and 3 during summer and winter season, respectively. The beneficiaries (>70% women) were oriented on nutrition-sensitive homestead gardening and HH nutrition during seed distribution in winter. Total 1,338 beneficiaries were supported to improve HH income and nutrition through the production and marketing of safe and hygienic dried fish. NSTU assessed the nutritional efficacy of fish powder by a trial with the complementary foods of children and draft report has been prepared on it, developed a SoP for seaweed powder preparation, and prepared eleven food items from the seaweed powders.

The project's Monitoring, Evaluation and Learning (MEL) team generated community-level information covering all the villages where the project is working in and integrated the information into the GIS map, Google Earth maps and maintained offline-online database. The MEL team conducted periodic and annual assessments to assess project performance against six standard USAID indicators and seven custom indicators and submitted the PIRS report to USAID. MEL team conducted internal Data Quality Assessment (DQA) for ZoR and MPA sites to assess the data quality and performance of the ECOFISH activities in the field levels.

As communication outcomes, the project produced 60,000 leaflets and 14,000 posters on Jatka conservation, 65-day marine fishing ban, and 22-day brood Hilsa fishing ban; achieved 184 media coverages; published 05 op-eds in leading media and organized a live TV talk show on "Socio-economic Improvement of fishers". Total 24 pieces of content for social media on various aspects of key interventions and thematic issues were created. A video documentary on biodiversity conservation and fisher livelihoods was produced and organized Blue Food Festival & Artisanal Fishermen Congress.

2.2 Implementation status

2.2.1 IR1: Improved management and governance of natural resources that form the foundation of fisheries

To achieve the IR1 component, science outputs for decision-making (Sub IR1.1), steps were taken to assess coastal ecosystem health, marine biodiversity and conservation, and marine fisheries dynamics activities in line with improving the country's Blue Economy initiatives. Co-management building blocks were formed and skill development activities were implemented to improve adaptive co-management and fisheries governance (Sub IR1.2) in the ZOR and MRE, focusing on the Hilsa, catfish and other important coastal fisheries. For effective fisheries resource management, some policy support activities, focusing on the delineation of a new MPA and management of the Nijgum Dwip MPA were conducted. The achievements of various IR1 activities from January to December 2022 (Year 3) are summarized in Table 1.

Table 1 Summary of progress under IR1. (■ completed ■ in progress ■ yet to start)

Activities	Progress	Status
Sub-IR1.1: Improved science outputs for decision-making		

Activities	Progress	Status
Ecosystem health assessment	<ul style="list-style-type: none"> • ECOFISH II team in partnership with CVASU monitored 05 water quality parameters (salinity, pH, dissolved oxygen, alkalinity and temperature) at 05 coastal sites. All the parameters were found within healthy level of the ecosystem, except pH in the St. Martin Island coast. • Collection and safe disposal of plastic, net and other garbage materials were continued, and 9,012 kg of the waste materials from the sea beaches and MPA areas were removed engaging 100 local youths as Blue Guards. 	
Biodiversity assessment and conservation	<ul style="list-style-type: none"> • CVASU continued the larval fish biodiversity assessment in the six sites covering Moheshkhali-Cox's Bazar-Teknaf coasts, the St. Martin's Island and the Sundarbans areas. Microscopic identification has been continued in CVASU and DNA barcoding activity for 33 species has been done in SAU. 	
Fisheries dynamics assessment	<ul style="list-style-type: none"> • In ZOR, fish landing records of six LCFs revealed 49 predominant species/groups in the commercial marine fishery that contributed 14,246 t of fish landing in Cox's Bazar area in 2022. • On-board real-time fish catch was monitored engaging 35 Citizen Scientists (CSs) of which 25 CSs have worked in ZOR covering Cox's Bazar Sadar, Ukhiya, Moheshkhali and Teknaf, and the remaining 10 CSs collected data from the Nijhum Dwip MPA. • Based on the CS's data, catch per unit efforts (CPUEs) of Hilsa and other species/groups in major intervened areas were estimated. The highest CPUE for Hilsa was found in Cox's Bazar Sadar (1,589 kg/boat/day), followed by Moheshkhali (1,260 kg/boat/day) and MPA (548 kg/boat/day). Other important species were Anchovy, Bombay duck, Ribbonfish, Sea catfish, Croakers, Pomfret, Sharks, Rays and Shrimps. 	
Sub-IR1.2: Improved adaptive co-management and fisheries governance		
Form and strengthen co-management institutions	<ul style="list-style-type: none"> • ECOFISH II trained 76 batches (2,315 beneficiaries) from Y3 in biodiversity conservation. • Total 22 villaged based Fisheries Conservation Groups (FCGs) were formed, each of which consisted 07-11 executive committee members. • 97 FCG groups from Year 3 were trained on biodiversity conservation involving 2,468 participants. • Total 16 Ghat group consultation meetings were conducted involving 341 participants. • A Ghat-based co-management committee (GCC) was formed at Moheshkhalipara Ghat. • Trained fishers released 28 megafauna, including 24 turtles, one skate, one shark, one dolphin and one porpoise. 	
Strengthen EAFM	<ul style="list-style-type: none"> • ECOFISH II collaborated with IUCN and SUST to help managing the Nijhum Dwip MPA through updating MSP. • Developed and submitted a proposal for establishing a marine protected area (MPA) that followed the principles of EAFM. • Hired an international consultant to conduct training on EAFM in February 2023. 	

Activities	Progress	Status
Improve fisheries governance	<ul style="list-style-type: none"> 13 batches of boat skippers were trained on biodiversity conservation and responsible fishing and provided 379 life jackets. Conducted 31 awareness building programs related to 65-day marine ban, brood-hilsa ban, Jatka conservation, megafauna conservation, and catfish conservation. 	
	<ul style="list-style-type: none"> Successfully conducted FirstAid training events and distributed FirstAid Kits to 93 selected fishers. Distributed 14,000 posters and 60,000 leaflets on Jatka conservation, 65-day marine fishing ban, and Hilsa fishing ban. Celebrated the International Year of Artisanal Fisheries and Aquaculture 2022 with participations of all important stakeholders. Boat and net census was conducted in the Nijhum Dwip MPA and the data revealed 11,386 different types of fishing boats along with the dimensions of those boats. 	
Sub-IR1.3: Improved policy support		
Support HFMAP implementation	<ul style="list-style-type: none"> Submitted a revised version of HFMAP to the DoF and recently DoF suggested to organize a nationwide stakeholders meeting and present the key points of the HFMAP. 	
MPA assessment and management	<ul style="list-style-type: none"> Proposed a new MPA in the Naf Estuary and an expert consultation workshop was arranged and the recommendations of the workshop incorporated in the proposal. In the proposal, a management framework for the MPA focusing on stakeholder integration, livelihood safety of local communities, trans-boundary issue, governance and effective biodiversity conservation was recommended. 	
HCDF and PES introduction	<ul style="list-style-type: none"> Assisted the Department of Fisheries (DoF) in revising the HCDF operational guideline. 	
Transboundary legal framework formulation	<p>ECOFISH II has taken steps to strengthen the efforts for transboundary Hilsa conservation initiative and raised the issue through a Speed Talk' in the Bay of Bengal Conversation organized by the Center for Governance Studies (CGS).</p>	

2.2.1.1 Sub-IR1.1: Improved science outputs for decision-making

To generate high quality scientific information to support decision-making for sustainable fisheries management and biodiversity conservations supporting fisheries blue economy as well as mitigation and adaptation of the climate change impacts on the resources. The outputs will help to optimize a marine fishing ban, delineate a new MPA in the Naf River Estuary, form a management plan and prepare megafauna conservation guidelines.

2.2.1.1.1 Ecosystem health assessment and improvement

Ecosystem health assessment

In partnership with CVASU, ECOFISH II assessed coastal ecosystem health by evaluating the spatial and seasonal variation of water quality parameters in the ZOR and the St. Martin's Island coasts. The climate change indicating five parameters (Temperature, salinity, pH, DO and alkalinity) were monitored in the five sites, viz the Bakkhali estuary, the Rezu Khal estuary, Moheshkhaliapara coast, the Naf estuary and the St. Martin's Island areas (Table 2). All the parameters were found

within healthy level of the ecosystem, except low pH in the St. Martin Island coast. However, for final conclusion, the parameters will be monitored in the St. Martin Island coast in the next year.

Table 2. Climate change indicating water quality parameters in the Cox’s Bazar-St. Martin coasts

Months in 2022	Sampling Site	Average Parameters’ Value				
		Salinity (ppt)	pH	DO (mg/L)	Alkalinity (mg/L)	Temperature (°C)
Jan-Feb	Naf River estuary	32.3	8.4	6.7	119.0	25.1
	Moheshkhaliapara	33.8	8.3	6.5	120.0	25.5
	Rezukhal Estuary	33.3	8.4	5.0	110.0	25.5
	Bakkhali River estuary	35.7	8.4	5.5	112.0	25.9
	St Martin’s Island	36.0	8.4	6.7	108.0	26.1
Mar-Apr	Naf River estuary	35.5	8.3	5.4	168.0	30.9
	Moheshkhaliapara	34.0	8.4	6.9	104.0	29.7
	Rezukhal Estuary	36.0	8.4	6.8	114.0	30.9
	Bakkhali River estuary	34.8	8.4	6.2	108.5	30.5
	St Martin’s Island	34.0	8.4	6.4	116.0	31.2
May-Jun	Naf River estuary	24.3	8.4	6.4	99.0	29.9
	Moheshkhaliapara	25.5	7.9	6.8	98.0	30.5
	Rezukhal Estuary	24.8	8.4	6.4	91.0	29.9
	Bakkhali River estuary	22.8	8.0	7.4	99.0	30.3
	St Martin’s Island	33.0	8.3	6.3	102.0	29.7
Jul-Aug	Naf River estuary	22.3	8.0	5.8	87.0	27.0
	Moheshkhaliapara	28.6	8.2	6.9	98.0	28.0
	Rezukhal Estuary	24.0	8.2	7.8	93.0	27.8
	Bakkhali River estuary	26.3	7.7	7.4	88.0	28.0
	St Martin’s Island	28.0	8.3	6.8	104.0	30.0
Sep-Oct	Naf River estuary	20.1	8.0	6.9	146.0	29.5
	Moheshkhaliapara	23.0	8.4	7.8	148.0	29.8
	Rezukhal Estuary	19.1	8.3	7.0	184.0	29.7
	Bakkhali River estuary	20.3	7.9	7.1	140.0	28.8
	St Martin’s Island	26.4	7.9	7.4	147.5	27.2
Nov-Dec	Naf River estuary	28.3	8.0	7.1	91.0	27.2
	Moheshkhaliapara	29.7	7.1	7.0	88.0	28.2
	Rezukhal Estuary	33.8	8.2	8.0	95.0	29.7
	Bakkhali River estuary	32.6	8.3	6.7	102.0	25.3
	St Martin’s Island	30.9	6.5	7.8	92.0	26.1

Ecosystem health improvement

For ecosystem health improvement, the project interventions concentrated on reducing the amount of plastic and net materials from the coastal areas focusing on the Cox’s Bazar and Kuakata beaches as well from the Nijhum Dwip MPA. To accelerate the pollutants reduction activities, 100 local youths,

25% of whom were women, were engaged and trained as volunteer Blue Guards. In 2022, total 9,012 kg of plastic, polythese, nets and other garbage were removed from the beaches and coastal areas covering Cox’s Bazar Sadar, Moheshkhali, Ramu, Ukhiya, Teknaf, Kuakata and the Nijhum Dwip MPA coasts (Table 3).

The collected re-cyclable plastic materials, especially plastic bottles were linked to local waste collectors, so that the materials reach to the local recycle centers and/or dumped in safer areas to make better aquatic ecosystem (Figure 4). In the coming years, this effort will be strengthened and the recycled/reused materials will be quantified.

Table 3. Amount (kg) of different types of waste collected from various coastal regions.

Area	Type of waste				Total
	Plastic bottles	Polythene	Nets	Garbage	
Cox’s Bazar Sadar	282	309	908	576	2075
Moheshkhali	164	187	54	518	922
Ramu	97	243	206	251	797
Ukhiya	410	695	888	815	2808
Teknaf	67.5	85.5	285	271	709
Kalapara (Kuakata)	139	236	451	267	1093
Nijhum Dwip MPA	112	137	165	193	607
TOTAL	1271	1893	2957	2891	9012



Figure 4. A group of trained ECOFISH Blue Guards who are engaged in the Nijhum Dwip MPA region sold collected plastic materials to the vendors connected to the re-cycle/re-use the materials.

2.2.1.1.2 Biodiversity assessment and conservation

Ichthyoplankton (fish larvae) assessment

In partnership with the CVASU, the project used bongo nets to sample fish larvae monthly in order to assess biodiversity in the Naf river estuary, Bakkhali river estuary, Rezukhal estuary, Moheshkhaliapara coasts, St. Martin’s Island coast and the Sundarban areas. In 2022, 33 larval species were identified using DNA barcoding technique (Annex 1). The analysis of the remaining samples will be completed in the first quarter of the next year. The presence of fish larvae is directly related to the spawning season of the fish. This assessment will help in policy formulation on marine fisheries management in the Bay

of Bengal targeting to the main larval season of the important species.

Biodiversity assessment for the suitability of MPA

In partnership with SUST, ECOFISH II assessed the suitability of delineating a new MPA around the Naf river estuary and the Teknaf Peninsula in the southeast coastal zone of Bangladesh. The assessment was conducted considering biophysical and socioecological characteristics and stakeholder consultations. SUST also conducted an assessment on the species diversity in the commercial catch in the Naf-St. Martin area and identified 35 species/group covering finfish, shrimps and prawns, crabs, mollusks and other aquatic species (Figure 5). These species include *Mugil* sp., *Liza* sp., *Lates calcarifer*, *Harpodon nehereus*, *Pampus argenteus*, *P. chinensis*, *Arius* spp., *Mystus gulio*, *Gymnothorax punctatus*, *Tetrodon* sp., *Pagasius pangasius*, *Paraplagusia bilineata*, *Panna microdon*, *Sillago domina*, *Coilia* spp., *Satipinna tatty*, *Sardenella* sp., *Ilisha megalopa*, *Hilsha kelee*, *Cynoglossus* spp., *Raja* sp., *Penaeus japonicas*, *P. monodon*, *P. indicus*, *P. merguensis*, *Acetes* sp., *Macrobrachium rosenbergii*, *Squilla* spp., *Sagitta* sp., *Oliva* sp., *Scylla* sp., *Octopus* spp., *Loligo* sp. and *Sepia* sp. Finfish, shrimps and crabs, mollusks accounted for about 12%, 35% and 8%, respectively of the total identified species, while other species altogether covered about 45% of the identified species.



Figure 5. Freshly caught commercial species in the Naf estuarine area.

After completing the assessment, SUST proposed a new MPA with an area of 860 km² mainly targeting the protection of the rich fish diversity, megafauna conservation as well as enhancement of other aquatic biodiversity in the Naf River estuary (more details in Section IR1.3).

2.2.1.1.3 Fisheries dynamics monitoring

Species compositions of harvested fish covering bony fishes, cartilaginous fishes and shellfishes were monitored round the year in the ZOR and the Nijhum Dwip MPA. The dynamics of the status of the fisheries were monitored basically in two ways- through fish landing monitoring in the major fish landing stations and secondly, through on-board real-time catch monitoring using Citizen Science approach. Details of those approaches are described below.

Fish landing monitoring

In ZOR, six trained Landing Center Facilitators (LCFs) have been engaged to monitor fish landings in 5 major landing centers using Smartphone with Bangla apps. They record species-wise landing and approximate wholesale price of those species. Fish landing records of six LCFs revealed 49 predominant species in the commercial marine fishery that contributed 14,246 t of fish landing in Cox's Bazar in 2022 (Figure 6). Hilsa dominated in the landings, and large Hilsa (more than 1 kg size) was the highest contributor (1,787 t), followed by medium sized Hilsa (<500g size, 1,375 t). Other important contributors were Anchovy, Bombay duck, Ribbonfish, Pomfret, Croaker, Sea catfish and Shrimps (Figure 6).

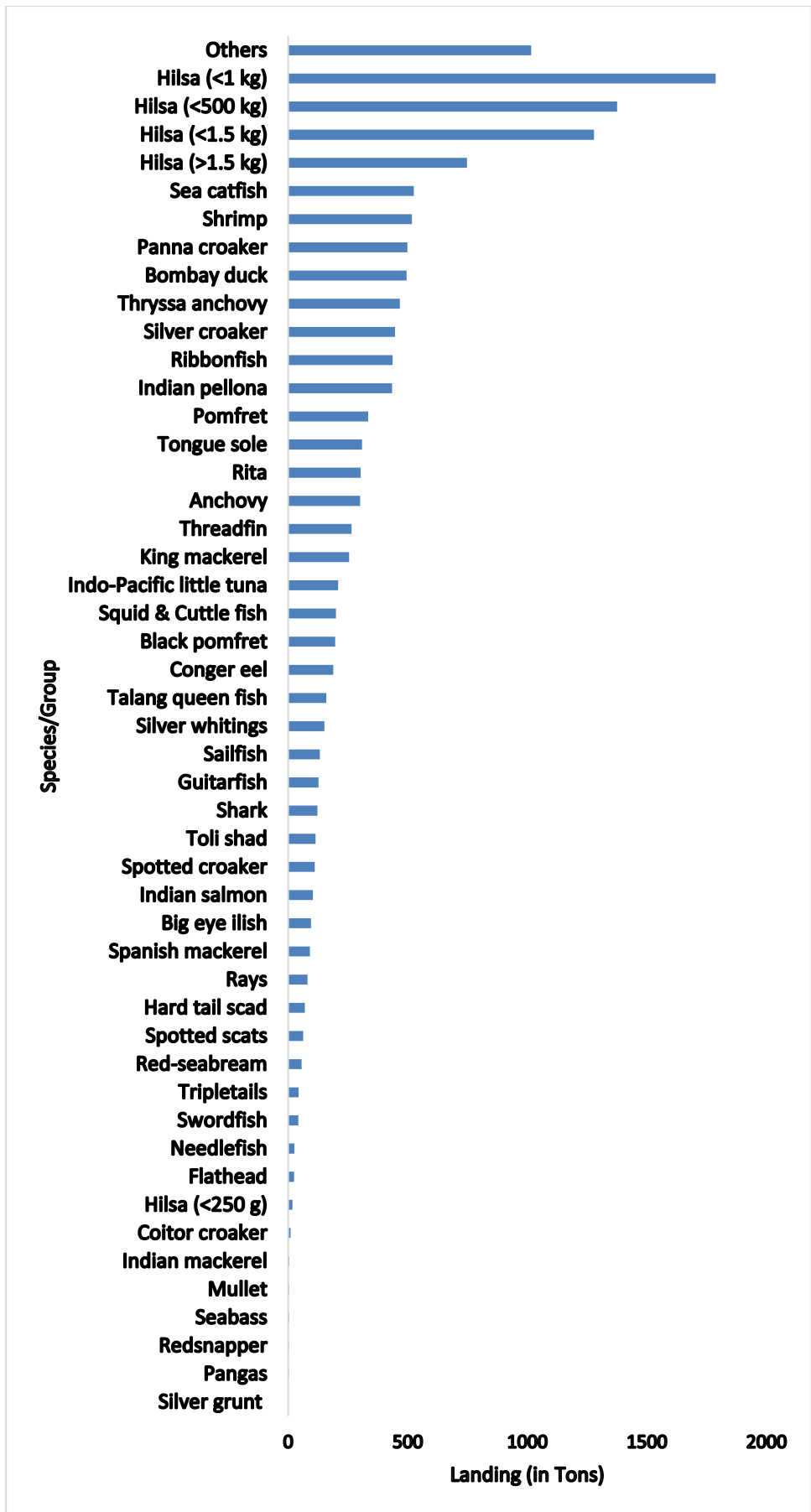


Figure 6. Different sizes of Hilsa and other marine fish landed in the major landing stations in ZOR in 2022.

On-board catch per unit effort (CPUE) monitoring

The real-time on-board fish catch was monitored in the five major ECOFISH II areas: Cox’s Bazar Sadar, Moheshkhali, Ukhiya, Teknaf and the Nijhum Dwip MPA. To do so, the project engaged 40 experienced boat skippers and trained them as CSs, of which 35 CSs provided catch information. The CSs were equipped with smartphones and provided with the KoBo ToolBox of the Open Data Kit mobile app in Bangla. Analysis of the data revealed the CPUE for each of the 40 major species/groups harvested. Cox’s Bazar Sadar had the highest daily CPUE per boat (1,589 kg) followed by Moheshkhali (1,260 kg), while Teknaf had the lowest (188 kg) and Ukhiya the second-lowest (344 kg). For Hilsa, the highest daily CPUE was 248 kg per boat in the MPA and the average value was 107 kg/boat/day (Table 4). The variations in the CPUEs are mostly associated with the boat length, type of gear used, area of operation, season and engine power. This information would be valuable to compare the abundance of different species in different areas, seasons and years as a result of different situations, harvesting gear and management interventions.

Table 4. Average daily CPUE (kg) per boat in ECOFISH II areas in Year 3.

Species ↓	Cox's Bazar	Moheshkhali	Ukhiya	Teknaf	N Dwip MPA	Average
Hilsa	11.9	121.8	122.7	32.0	247.9	107.3
Anchovy	97.8	61.4	25.6	12.0	6.5	40.6
Big eye ilish	0.6	6.1	2.3	0.2	4.0	2.7
Black pomfret	0.4	3.3	1.1	0.2	5.0	2.0
Bombay duck	421.4	206.8	22.2	6.7	61.9	143.8
Coitor croaker	0.2	0.9	0.6	1.7	4.9	1.7
Conger eel	0.0	0.1	0.1	0.0	0.1	0.1
Flathead	13.6	0.4	0.4	1.0	1.6	3.4
Grunter	0.2	4.8	0.0	0.0	0.4	1.1
Hard tail scad	0.3	8.1	0.2	0.0	1.1	1.9
Indian mackerel	0.5	2.9	1.4	3.2	1.2	1.8
Indian pellona	17.4	36.6	2.8	9.3	1.5	13.5
Indian salmon	0.1	1.2	0.1	0.0	0.2	0.3
Indian threadfish	0.0	0.0	0.4	0.0	0.8	0.3
King mackerel	4.4	28.0	15.2	2.3	14.7	12.9
Little tuna	0.3	28.8	2.6	0.1	8.7	8.1
Needlefish	0.2	4.5	5.9	1.2	1.4	2.6
Panna croaker	7.1	17.6	8.2	11.4	5.4	9.9
Pomfret	0.6	0.5	0.2	0.5	0.7	0.5
Queen fish	0.5	4.0	0.8	2.8	3.8	2.4
Rays	23.5	26.1	1.2	1.7	4.0	11.3
Red-seabream	0.0	0.8	0.3	2.8	1.9	1.2
Redsnapper	0.4	8.7	0.0	0.0	0.2	1.9
Ribbonfish	96.2	101.5	30.1	12.6	13.8	50.8
Sea catfish	19.8	19.4	19.1	18.5	24.4	20.2
Shark	9.4	23.4	0.2	0.8	1.7	7.1
Shrimp	182.7	109.5	0.1	2.8	7.3	60.5
Silver croaker	17.8	26.4	6.2	19.5	12.1	16.4
Silver grunt	197.0	103.2	0.6	8.1	38.5	69.5
Silver whittings	25.1	11.7	4.9	2.7	13.1	11.5
Spanish mackerel	0.2	13.3	1.8	0.3	1.8	3.5
Spotted croaker	7.9	9.8	0.6	3.2	2.6	4.8

Species ↓	Cox's Bazar	Moheshkhali	Ukhiya	Teknaf	N Dwip MPA	Average
Spotted scats	0.0	0.2	0.2	0.2	2.4	0.6
Squid/Cuttle fish	8.2	23.3	1.0	2.9	1.7	7.4
Threadfin	4.2	27.2	9.1	1.7	2.3	8.9
Thryssa anchovy	97.8	61.4	25.6	12.0	6.5	40.6
Toli shad	0.7	5.8	6.9	2.7	12.8	5.8
Tongue sole	40.8	29.3	7.2	7.7	1.8	17.4
Tripletail	1.7	7.9	0.2	0.3	1.9	2.4
others	278.1	113.7	15.6	2.8	24.9	87.0
TOTAL	1589	1260	344	188	548	786
Boat length (m)	14	19	19	12	15	16
Boat width (m)	5	6	3	4	5	5
Engine power (hp)	76	81	24	23	161	73

Fish size monitoring for stock assessment

ECOFISH II started stock assessment activities of five important marine species other than Hilsa. The species are Pomfret, King mackerel, little tuna, Croaker and Threadfin. As a part of stock assessment activities, ECOFISH II field teams have been collecting morphometric data such as total length (TL), standard length (SL), fork Length (FL) and weight (W) of the species (Figure 7). As a representative, size compositions of Indo-Pacific King Mackerel in 2022 is graphically shown (Figure 8). The dominant size group was found between 37.4 and 42.0 cm, which consists of 20% of the population. The data along with catch data will be analyzed to predict, the status of stocks of the five species. Achieving the MSY (maximum sustainable yield) would be the management target, which will lead to formulate a sustainable management measures of those species.



Figure 7. A scene of fish measurement for stock assessment.

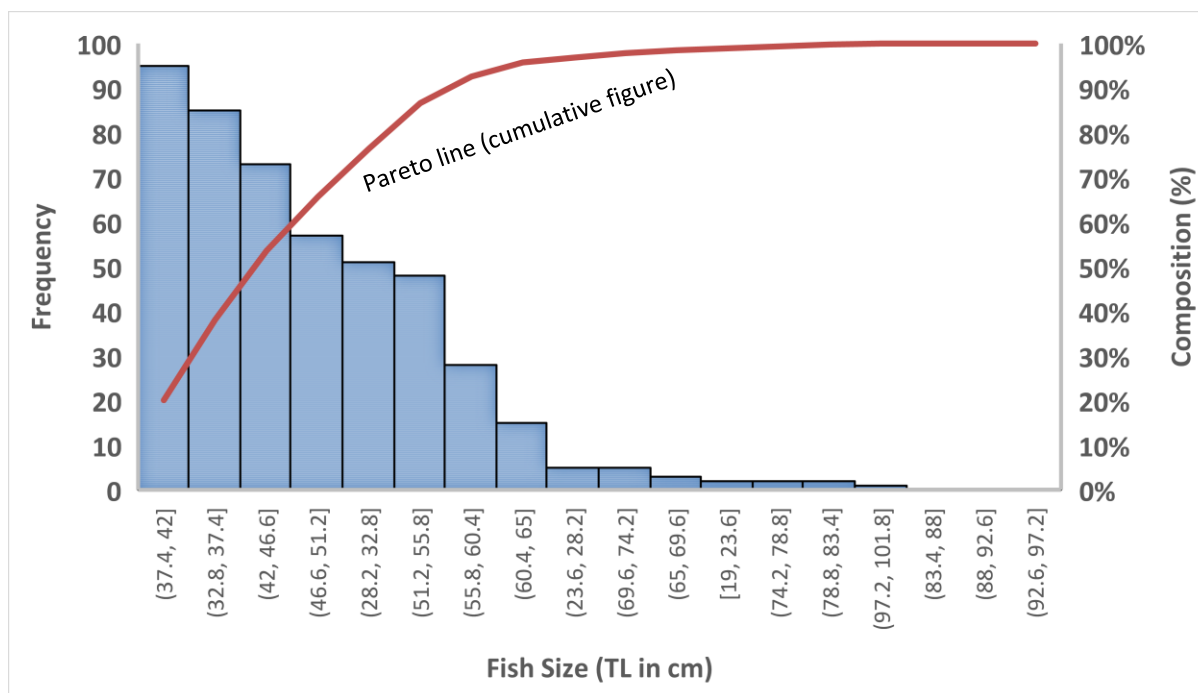


Figure 8. Graph showing size compositions of Indo-Pacific King Mackerel in 2022.

2.2.1.2 Sub-IR1.2: Improved adaptive co-management and fisheries governance

Fisheries co-management can play an essential role in conserving the biodiversity of fish and megafauna in the Bay of Bengal and its associated coastal ecosystems. ECOFISH II plans to establish village and landing center based conservation groups to promote biodiversity conservation during the third year. The following are the brief description of the important activities under Sub-IR1.2.

2.2.1.2.1 Forming and strengthening co-management institutions

ECOFISH II changed its strategic action point in the third year to focus more on landing center based coastal and marine resource management, while continuing to work with local Fisheries Conservation Groups (FCGs) in the nearby coastal fishing villages. At the moment, both village-based and landing center-based management are considered to be important.

As a part of capacity building of stakeholders for co-management, ECOFISH II trained 76 batches (2,315 beneficiaries, 7.6% women) from Year 3 beneficiaries on biodiversity conservation in Cox's Bazar Sadar (6), Teknaf (23), Ukhiya (17), Moheshkhali (8), Ramu (2), Barguna (3), and MPA (17) in 2022. Total 22 Fisheries Conservation Groups (FCGs) were formed, each of which consisted of 7 to 11 executive committee members (Figure 9). These group formation meetings involved 1,096 participants, of whom 2.7% were women. They are expected to disseminate biodiversity conservation messages throughout communities and these executive members will be followed up next year with training and engagement. Furthermore, the team continues to strengthen co-management institutions formed prior to 2022 through active collaboration with Shushilan at ZOR and MPA sites. Total 97 out of 100 FCG groups were trained for a half-day on biodiversity conservation with 2,468 participants altogether.

Efforts have been made to enhance the knowledge and skills of fishers towards initiating a Ghat/Fish landing center based co-management approach. Within the Ghat based management approach, apart from fishers, particular emphasis was given to awareness raising and in part to capacity building of other Ghat based stakeholders. These include Arotder, boat owners, and others related to fish and fisheries products trading. Total 16 Ghat group consultation meetings were conducted in ZOR area

with 341 participants all of whom were fishers (Figure 9). Furthermore, four awareness events with elite and powerful stakeholders of different fish landing centers were convened. After a series of consultation meetings, a Ghat-based co-management committee (GCC) was formed at Moheshkhalipara Ghat. A 13-member executive committee was formed in the presence of DoF representatives, boat owners, boat skippers, crews, moneylenders, fish traders, ice suppliers, auto-rickshaw drivers, Citizen Scientists, Landing Center Facilitators, and officials from WorldFish.



Figure 9. Village based FCG committee formation meeting (left), Stakeholder consultation meeting for ghat based co-management at Samraz Ghat (Right).

Evidence based conservation

ECOFISH II intended to enhance the management and monitoring of artisanal fishing practices. Total 319 boat skippers were trained this year on biodiversity conservation, safety at sea, and responsible fishing. Following training, they expressed a commitment to the conservation of fish and megafauna (sharks, dolphins, and turtles). Additionally, ECOFISH II provided special training to 40 smart boat skippers who were designated as Citizen Scientists to monitor the digital catch in real time. These environmental stewards help to facilitate community-led conservation initiatives. The goal of this effort is to help reduce IUU fishing and improve management practices. At present, both trained boat skippers and Citizen Scientists are releasing entangled megafauna alive (Figure 10). As of this year, 28 megafaunas, including 24 turtles, one skate, one shark, one dolphin, and one porpoise were released by the trained fishers. The conservation stories were prominently featured in the national print media.



Figure 10. ECOFISH II trained fishers rescued and released tiger shark (*Galeocerdo cuvier*) and the olive ridley sea turtle (*Lepidochelys olivacea*) from the coastal water of the Bay of Bengal.

2.2.1.2.2 Strengthening the Ecosystem Approach to Fisheries Management

ECOFISH II adheres to an EAFM approach and tries to involve government and non-government stakeholders in the decision-making process and implementation of fisheries governance. Specifically, the project collaborated with IUCN and SUST to manage the Nijum Dwip MPA by updating MSP and developing a proposal for establishing a marine protected area (MPA) around the Naf Estuary.

In multi-species, multi-gear fisheries such as those in Bangladesh, effective management is always a challenge. EAFM is a more effective management solution than conventional stock-based management, which has proven effective in many parts of the world. EAFM offers better chances of making realistic, equitable, and sustainable management plans. An MPA such as the one around the Naf Estuary, requires careful consideration of potential livelihoods and compensation options that is ensuring social well-being for local communities. EAFM is therefore an effective means of addressing this issue, particularly in the context of the marine fishery in the Bay of Bengal.

ECOFISH II hired an international consultant to conduct training on EAFM to strengthen the proposed MPA for the Naf Estuary as well as other area-based management approaches within the EAFM framework. Training is expected to take place in February 2023. Participants in the training program will include fisheries experts from the Department of Fisheries, BORI, universities, and NGOs. Following the training, a team of participants, including the DoF, is expected to develop EAFM-based management guidelines for implementation at landing centers throughout the MPA and ZOR.

2.2.1.2.3 Improved fisheries governance

Community engagement and training programs can help to improve fisheries governance by addressing the context-specific needs of the local community. ECOFISH II aimed to improve the

management and monitoring of artisanal fishing practices. A boat skipper training program is one of several initiatives designed to assist fishers in complying with fishing regulations, maintaining their safety at sea, and engaging in responsible fishing practices. [Fishers' training on sustainable biodiversity and responsible fisheries can foster better fisheries governance](#). Total 13 batches of boat skipper trainings were conducted this year in the following areas: Cox's Bazar Sadar (2), Moheshkhali (1), Teknaf (4), Ukhiya (2), MPA (2), Barguna (1), and Patuakhali (1). The majority of boat skippers are unaware of the rules and regulations of the government. SUFO/UFO from DoF facilitated these sessions alongside ECOFISH II staffs. Other resource persons, including the Coast Guard Commander, Navy personnel from Bangladesh, and the president and secretary of the press clubs in different regions, also participated in making fishermen aware and motivated about different aspects of fisheries governance. Skippers were trained to guide fellow fishermen toward compliance with fishing regulations, ensuring safety at sea, and practicing responsible fishing practices.

In different areas of ZOR and MPA, ECOFISH II conducted 31 awareness building programs related to 65-day marine ban (12), brood-hilsa ban (1), Jatka conservation (4), megafauna conservation (4), long-liner (1), and catfish conservation (9). Local teams invited DoF officials to these awareness events. For example, the MPA team jointly organized awareness meetings at four fish landing centers, which involved about 230 seagoing fishers and associated arotders and mahajans.

Artisanal boats in Bangladesh lack modern life saving equipment like life buoys, radios, compasses, life jackets, and First Aid Boxes. ECOFISH II provided 379 life jackets to boat skippers who were trained on marine biodiversity conservation and responsible fishing practices (Figure 11). Team successfully conducted FirstAid training events and distributed FirstAid Kits to 93 selected fishers of Cox's Bazar Sadar (5), Teknaf (31), Ukhiya (17), Bhola (10), Patuakhali (30), including Citizen Scientists and trained and non-trained boat skippers. First Aid Kits can potentially save the life of a fisherman by preventing the spread of an injury. Local Ghat based stakeholders were actively involved throughout this process and distribution events and greatly acknowledge this initiative.

ECOFISH II took the initiative to tag CFGs with DoF patrolling teams during the Jatka ban period to ensure their active participation and log book maintenance. They advised general fishers about Jatka conservation, deterred illegal fishing, and notified the relevant DoF and law enforcement agencies about illegal fishing.



Figure 11. Fishers participate in an interactive session in a boat skipper’s training program (left) and patrolling planning meeting at Bhola Sadar with CFGs prior to Jatka ban period (right).

This year, ECOFISH II distributed 4,000 posters and 20,000 leaflets on Jatka conservation, 5,000 posters and 20,000 leaflets on the 65-day marine fishing ban, and 5,000 posters and 20,000 leaflets on the Hilsa fishing ban. To facilitate conservation initiatives and increase compliance, ECOFISH II also assists non-registered fishers (26) in obtaining Fishers' ID cards in Cox's Bazar Sadar. MPA team celebrated the “[International Day for the Fight Against Illegal, Unreported and Unregulated Fishing](#)” at Samraz fish landing centers with 40 Arotders and sea-going fishers.

Fishers' congress

The United Nations General Assembly declared 2022 as the International Year of Artisanal Fisheries and Aquaculture (IYAFA 2022). On 29 May 2022, ECOFISH II celebrated this global festival at Kuakata, Patuakhali for the first time in Bangladesh. By organizing the Artisanal Fishers Congress, ECOFISH II has echoed the vision statement of IYAFA for 2022, which is: "A world where small-scale artisanal fishers, farmers, and workers are fully recognized and able to contribute to human well-being, healthy food systems, and eradicating poverty."

ECOFISH II recognizes the contribution of artisanal fishers to food security and employment, particularly those involved in reviving the Hilsa fisheries. The congress attempted to promote the establishment of an inclusive national platform for coastal and marine biodiversity conservation. Participants included fishers, leaders of fishers' organizations, leaders of fisheries co-management, fisherwomen, youth, academics, researchers, development partners, and representatives from non-governmental organizations.

Boat and net census in the Nijhum Dwip MPA

ECOFISH II conducted a boat census in the Nijhum Dwip Marine Protected Area (ND-MPA). The survey was conducted by engaging local data enumerators and the collected data was analyzed (Figure 12). Boat and net surveys provide valuable information for effective fisheries operations, ecosystem impacts, and management regulations. ND-MPA is home to 11,386 boats and these vary greatly in size, characteristics, and operational procedures. Out of the five boat types, Kosha and Choto Tempu are the most common. Although Kosha and Choto Tempu operate in large numbers, Chandi boat and Trawlers (large wooden boat) are large in size, have greater engine capacity and higher number of crews, and thus fish deeper region (Table 5). The majority of these boats are motorized with inboard engines (>99%). Gill net is the most prevalent fishing gear (about 98%), catching primarily Hilsa. The majority of these boats have cold storage facilities with a capacity of less than 0.50 tons, followed by 0.50 to 1.0 ton (17%) and 2 to 5 tons (12%). Most of these boats operate in seawater (64%), with 27% fishing in estuaries and 8.4% fishing along the coast. Fishers fish inside, around, and outside the ND-MPA areas. Most fishers likely fish in the southeast (79%), some in the southwest (16%), and the rest in the far south (6%) of the ND-MPA suggesting increasing fishing pressure in the south-eastern side of the MPA. Fishers primarily fish around Gas fields, Dhal Char, Thenggar Char, and a few other locations. Chandi boat and Trawlers have higher engine costs, net making costs, and fuel costs, whereas Dingi boats operates in nearshore waters spend less on fishery operations. Lifesaving equipment such as life jackets and life buoys are insufficient on most fishing boats. A closer look at the characteristics of the artisanal fishing crafts and gears of the ND-MPA area suggests that data-driven future management plans must incorporate specific gear dynamics. Also, immediate efforts must be made to improve the cold storage facilities of the artisanal boats and safety for fishers.

Table 5. Dimensions of different types of boats available in the MPA

Types of boats	Number of boats	Mean width of the boat (feet)	Mean length of the boat (feet)	Fishing crew per boat (median)
Chandi boat	1485	13.05	42.54	12
Dingi boat	16	8.63	31.56	5
Kosha boat	4505	9.31	35.38	7
Choto Tempu	3993	9.81	37.45	10
Trawler (wooden)	1386	13.92	45.90	16



Figure 12. Artisanal fisher interviewed by ECOFISH II data enumerator during boat and net census.

2.2.1.3 Sub-IR1.3: Improved policy support

2.2.1.3.1 Supporting HFMAP implementation

ECOFISH II submitted the revised HFMAP for 2020–2030 and advocated for its approval. For the Hilsa fishery to be sustainable, approximately 24 management measures have been recommended. Through its co-management structure and modalities, ECOFISH II is assisting the DoF in implementing the HFMAP.

2.2.1.3.2 MPA assessment and management

SUST investigated the possibility of creating a new Marine Protected Area (MPA) in the Naf River estuary and proposed 860 km² area to be delineated as a new MPA (details in Section IR1.1). In the proposal, SUST suggested three levels of restrictions in three zones to manage the proposed MPA (entry, no-take; partial reserve, and general reserve zones) for an effective management using technological and socioeconomic data. ECOFISH II then submitted the proposal to the Department of Fisheries (DoF) and requested to take necessary steps for the declaration of the proposed MPA under the Marine Fisheries Act 2020. The proposed fishery focused MPA would be a complementary MPA to the recently declared 1,743 km² megafauna focused MPA around the St. Martin Island's surrounding area by the the Ministry of Environment, Forest, and Climate Change (MoEFCC).

In response to a request from the Director General of DoF, WorldFish arranged a workshop to let him know more details about the proposal. Following that, another stakeholders' consultation workshop was arranged at DoF. After incorporating the recommendations of the workshops, the proposal was revised and resubmitted to DoF for further processing to get approval from MOFL.

After declaration and proper management of the proposed MPA will protect marine biodiversity, such as coral reef fishes, turtles, algae, and seagrass beds, and thus the livelihoods of coastal and island communities will be improved. Furthermore, this will aid the country in meeting its long-term development goals, particularly [SDG 14](#).

2.2.1.3.3 Hilsa Conservation and Development Fund and Payment for Ecosystem Services

The Hilsa Conservation and Development Fund (HCDF) is a revolving fund of BDT 35 million (USD 430,000) that was created under ECOFISH-BD. The fund is in a fixed deposit account, and only the interest would be used following the guidelines that the MOFL approved for the benefit of Hilsa fishers and fisheries management. ECOFISH II is playing a key role in managing the HCDF, with help from the DOF, and has continued advocating for policies to increase seed capital through government support. Meanwhile, DoF has taken the initiative to revising its operational guidelines to ensure smooth implementation, and ECOFISH II is contributing in revising the document.

2.2.1.3.4 Transboundary legal framework formulation

Bangladesh, India and Myanmar together make up more than 98% of global Hilsa production and own a common pool resource in the Bay of Bengal. Following the previous initiatives of ECOFISH-BD, ECOFISH II has taken steps to strengthen efforts for transboundary Hilsa conservation in the form of a joint ecological, biological and socioeconomic assessment, while trying to establish a viable transboundary policy platform. Recently, ECOFISH II raised the issue in the Bay of Bengal Conversation, organized by the Center for Governance Studies (CGS), held at the Pan Pacific Sonargaon Hotel, Dhaka on September 21–23. ECOFISH II took part in a ‘Speed Talk’ session titled, "Are we rightly managing and sharing the fish in the Bay?" The transboundary fishery crisis in the Bay of Bengal.

2.2.2. IR2: Improved equity and resilience of food, nutrition and livelihood benefits

ECOFISH II has been working with small-scale fishers to improve livelihood resilience in order to minimize the fishing pressure in the Bay of Bengal and coastal riverine ecosystems. Therefore, strengthening livelihood resilience is the core emphasis of ECOFISH II, which combines the [EAFM](#) (Ecosystem approach to fisheries management) concept in reaching well-being outcomes. The livelihood component of ECOFISH II is a buy-in approach that can incentivize fishers to conserve aquatic biodiversity through responsible fishing practices.

The ECOFISH II partners' roles in carrying out the activities are crucial. Shushilan (a national NGO) focused on AIGA activities through the distribution of vegetable seeds and livestock, such as goats/sheep, chickens/ducks/pigeons, at the households level. CVASU supported the promotion of green mussel and seaweed farming practices in the coastal marine waters. NSTU assisted for the production of nutritionally sensitive fish and seaweed-based products. The progress of various IR2 activities to ensure equitable livelihood benefits for both men and women are shown in Table 6. The following sections provide a synopsis of these accomplishments from January to December 2022.

Table 6. Summary of progress under IR2. (■ completed ■ in progress ■ yet to start)

Activities	Progress	Status
Sub-IR2.1: Improved livelihood resilience of coastal fishing communities		
Diversify and improve livelihood capacity and options	<ul style="list-style-type: none"> The team selected 19 new and 08 old villages in ZOR (Teknaf, Ukhiya, Ramu, Cox’s Bazar Sadar and Moheshkhali), MPA (Hatiya, Charfasson and Rangabali) and MRE (Barguna) areas. The team conducted 42 FGDs (ZOR-12, MPA-30) with more than 914 participants from fishing communities to select beneficiaries for Year-3. 1,038 household members (50% women) received the capacity building training on AIGA organized at the fishing villages. Livelihood supports were provided to 2,429 households in the ZOR and MPA in various enterprises out of the targeted 2,500 households in 2022. 	

Activities	Progress	Status
	<ul style="list-style-type: none"> Organized "Livestock Treatment and Vaccination Campaigns" in 15 intervened fishing villages in ZOR and MPA. 	
Improve access to finance for fisherwomen	<ul style="list-style-type: none"> Formed 17 new CSGs with 532 fisher's women. Up to December 2022, 2,082 CSG members from 69 CSGs saved BDT 3,725,799 (USD 36,903). Distributed BDT 540,000 as soft loans among 84 CSG members to support alternative income-generating activities. Conducted ToT of 26 BLS Facilitators 19 BLS of Year 2 has completed stipulated 24 sessions and 22 BLS of Year 3 has continued their weekly sessions. 	
Increase access to improved technology and market links	<ul style="list-style-type: none"> Developed habitat suitability maps for seaweed farming in Bangladesh coast. <i>Gracilaria</i> floating long-line culture was found as the most promising seaweed farming culture technology. The average biomass production of <i>Gracilaria</i> sp. in the floating long-line system was 135% higher than the traditionally practiced off-bottom long-line culture systems. Selected new 300 women (240 in Cox's Bazar and 60 in MPA) for production and marketing of safe and hygienic dried fish and 290 women artisans received training on the same. Provided critical input supports to 329 HHs (bamboo made matcha and mosquito net to 319 women, low cost UC Davis chimney and box driers to 10 women) and 2,786 kg raw fish to 247 HHs for production and marketing of safe and hygienic dried fish. Continued providing support to 1,040 fisher's women of previous years who received 22,444 kg raw fishes for safe and hygienic dry fish production, who produced 5,457 kg dry fish. 	
Improve food and nutrition benefits, focusing on women and young children	<ul style="list-style-type: none"> Assessed the nutritional efficacy of fish powder by an experimental trail with children as complementary food. Developed a SoP for seaweed powder preparation, eleven ready-to-eat (RTE) food items were prepared from the seaweed powders at NSTU. Distributed micronutrient rich vegetables seeds to 3,337 and 3,623 HHs of Year 2 and 3 during summer and winter seasons, respectively. 1,338 beneficiaries were supported to improve HH income and nutrition through the production and marketing of safe and hygienic dried fish. Celebrated National Nutrition Week 2022 in 04 Upazilas with different events through which 154 participants acquired knowledge on child and maternal nutrition. 	

2.2.2.1 Sub-IR2.1: Improved livelihood resilience of coastal fishing communities

2.2.2.1.1 Diversify and improve livelihood capacity and options

Fishing village selection

The initial step of this component was the selection of fishing communities in its Theater of Operation (ToO). This is a critical task since fishing communities are at the forefront of behavior change toward

responsible fishing. The following characteristics were taken into account when selecting the fishing villages for the various interventions-

- A fishing village with at least 40% small-scale fishers was chosen.
- The fishing communities were located near the Bay of Bengal in the Zone of Resilience (ZOR) in Cox’s Bazar. In the case of the Nijhum Dwip MPA, the fishing villages were located within the MPA’s Direct Impact Area (DIA)² along the Meghna River estuary area.
- The host fishing communities were selected in ZOR since they are the most affected by the Rohingya influx.
- Fishing villages were chosen in areas where fishing households are more vulnerable in terms of both income and climate.
- Priority was given to fishing villages near a fish landing station, as this is the hub of all fishing activities.
- The fishing village was rather hard-to-reach area, with the availability of illegal gears that appears to be in poor compliance with government rules and regulations pertaining to fisheries management.
- The AIGA (Alternate Income Generating Activities) opportunities such as ponds, homestead gardening, and livestock rearing were available in the fishing villages.
- In case of MRE (Meghna River Ecosystem), the fishing village with hook and line Pangas fishers was chosen.

The team first met with DoF Officials to gather primary village names and a list of fisher’s identity cards (FID), then with the respective UP Chairman to get feedback on the primary village list. The field team, comprising project’s partner organization, visited various villages and collected information from key informants (KIs) in the villages. In each village, a focus group discussion (FGD) was convened with various stakeholders to gather primary information. The team conducted 42 FGDs (ZOR-12, MPA-30) with more than 914 participants from fishing communities. Finally, the village that best fits the village selection criteria was chosen for project intervention. The team selected 19 new and 08 old villages of 09 upazila in ZOR (Teknaf, Ukhiya, Ramu, Cos’s Bazar Sadar and Moheshkhali), MPA (Hatiya, Charfesson and Rangabali) and MRE (Barguna) under the ECOFISH II Theater of operation (Figure 13). Given the anticipated impact of the newly declared St. Martin MPA, one village in St. Martin Island was chosen.



Figure 13. Location of 19 new and 8 old villages in ZOR (Teknaf, Ukhiya, Ramu, Cos’s Bazar Sadar and Moheshkhali), MPA (Hatiya, Charfesson and Rangabali) and MRE (Barguna).

² The direct impact area (DIA) is defined as the affected area that has been impacted as a result of the declaration of the Nijhum Dwip Marine Protected Area (MPA) by the government.

Fisher selection

The selection of fishing households is the most important step after village selection. The ECOFISH II team selected 2,500 fishing households based on the criteria listed in Table 7. The team selected 700 fishing households in Teknaf, 500 in Ukhiya, 50 in Ramu, 200 in Cox's Bazar Sadar, 250 in Moheshkhali, 600 in MPA and 100 in Barguna. Considering the selection criteria, it was difficult to find out a suitable fishing village in Ukhiya and Ramu. So, instead of working in the new fishing villages, ECOFISH II increased fishing household coverage in the existing eight fishing villages in Ukhiya and Ramu.

Table 7. The criteria used to select fishing households in the ZOR, MPA and MRE region

Attributes	Description
Occupation	Active fishers ³ with a Fishers ID Card (FID) were given top priority. Fishers who did not have a FID card had to show proof that they had successfully applied to the Department of Fisheries (DoF) for a FID card. True fishers were chosen despite the fact that they did not have a FID or proof of application; however, the field team authenticated the occupation without bias. Vagi (shared fishers) and bonded labors were selected, but a boat owner might be chosen if he operates a small fishing boat with a 10 hp engine and switches professions between Vagi and boat owners.
Nationality	Bangladeshi citizens with a national ID card
Poverty status	Fishers who are currently living below the poverty line, with priority given to extreme poor fishing households living on less than \$1.9 per day. ⁴ Poverty in the fishing village was assessed using a community-based definition through a participatory well-being analysis.
Willingness	Show high interest to responsible fishing and livelihood activities
Age	18-60 preferably 18-50
Fishing period	More than six months

The team selected 72 percent of the households with FID, while the remaining fishers do not have FID. The team crosschecked the non-FID fishing households with care, verifying their NID and occupation. Before finalizing the list, the team conducted community profiling and gender analysis in each of the newly selected villages (Figure 14). Well-being analysis, social mapping, gender analysis, stakeholder analysis, and institutional mapping methodologies were used to collect information on socio-demographic characteristics, local ecological knowledge, coping strategies to shocks and stresses, and fishing patterns. Using participatory tools, communities were involved in the collection of this information.



Figure 14. A glimpse of community profiling in the fishing villages of MPA; Wellbeing analysis (left) and village validation workshop (right).

³ The term "active fisher" refers to someone whose principal source of income is fishing

⁴ [The World Bank defines the extreme poor as people whose daily income is less than \\$1.90.](#)

The project emphasized well-being analysis, among other participatory tools, to categorize fishing households' poverty status. The participants classified the households into four poverty categories based on community-driven criteria (Extreme Poor, Poor, Lower Middle Class, and Middle Class). Approximately 72% of the selected fishing households are extremely poor, 26% are poor, 1.75 % are lower middle class, and 0.08 % are middle class. The extreme poor were found in the highest concentrations in Ukhiya and Teknaf, while the lowest concentrations were found in Cox's Bazar Sadar and Barguna. This type of analysis is useful for intervention design, particularly for interventions aimed at improving livelihoods. Following the selection of fishing households, the team collected the Basic Household Information (BHII) from each household using a customized template (detailed in 'MEL' section).

ECOFISH II provided livelihood support to 2,429 fishing households out of the targeted 2,500 households in 2022 (Year 3) and yet to provide livelihood support to 100 fishing households in the St. Martin Island. Sixty seven percent of these households received goats, 20% received poultry (duck, pigeon and chicken) rest of the households received agriculture farming (4%), small business supports (2%) and other non-farm business enterprises (Figure 15). These start-up capital assisted the fishing households in generating additional income particularly during the 65-day marine fishing ban period. The ECOFISH II team continues to monitor the targeted fishing households in order to assist them in receiving benefits from the livelihood support. The observation found that the household started their micro-enterprises by rearing their goats, ducks and chickens as well as started non-farm businesses.



Figure 15. Hamida Begum (40) from Uttar Deilpara village under Khurushkul Union is a small-scale fisherwomen requested a sewing machine to start tailoring business. According to her, she earns around BDT 2000-3000 per month by sewing clothes. *“The sewing machine has proven to be a blessing for me because it is enabling me to become financially independent.”*-she said and she expressed gratitude to USAID's ECOFISH II Activity for assisting her in coping with the difficult time she was left to live with her four children after her husband's death.

The team organized 37 batches of AIGA trainings on goat husbandry and other AIGAs. Total 1,038 participants received those training of which 520 were women. In cooperation with the Department of Livestock Service (DLS), ECOFISH II also organized "Livestock Treatment and Vaccination Campaigns" in 15 intervened fishing villages in ZOR, MPA, MRE region. During the campaigns, approximately 1,078 goats, 1,807 ducks and chickens were vaccinated against PPR, Newcastle Disease (ND) and duck plague

disease. Additionally, beneficiaries and locals received treatment for their cattle, goats and chicken.

Box 1. Livelihood support to fisher's family enhanced women empowerment

Rasheda Begum is a Rastarpara resilient model fishing village resident with four daughters, four sons, and a husband. Her husband, Kalim Ullah, is a small-scale fisherman. Rasheda and her family were suffering as a result of her husband's low income. The family's suffering is exacerbated further by the fishing ban and the COVID-19 pandemic. In 2021, Kalim Ullah joined the Fisheries Conservation Group (FCG), and Rasheda joined the project's Community Savings Group (CSG). To improve their livelihood, her husband received AIGA training, eight (08) native chickens, one (01) goat, and five (05) types of winter vegetable seeds. Although Kalim Ullah received assistance, Rasheda is primarily responsible for the chickens and goats because Kalim Ullah goes out to sea to fish. Around 450 eggs were laid by chickens, which were sold at markets, consumed by family members, and incubated for the production of chicks. Rasheda now has 20 chickens and has made BDT 12,000 by selling eggs, chicks, and 18 marketable-sized chickens at the local market. Rasheda used her earnings to purchase two (02) goats, and she now has four (04) goats, one of which is pregnant. In her small yard, she grew climate-smart homestead vegetables like bottle gourd, red amaranth, tomato, chili, and coriander. As a result, she earned BDT 8,000 by selling these vegetables, which she also used for family consumption during the winter. While out at sea for a long time, fishing boats bought bottle gourd directly from Kalim Ullah. *"I am grateful to the project for empowering and supporting fisherwomen and increasing our skills, which will eventually improve our livelihood,"* Rasheda said.



An assessment was conducted to better understand the local level climate change perception, impact, and adaptation strategies of fishers in ZOR and MPA coastal villages. The ECOFISH II team organized eight focus group discussions (FGD) with community members for the Community Risk Assessment (CRA) and Risk Reduction Action Planning (RRAP) to address climate change adaptation. Later, the team organized three validation workshops with local government representatives and community levels in three unions (Teknaf Sadar, Sabrang under Teknaf Upazila, and Jalia Palong union). However, the collected data will be analyzed in the hopes of assisting in the development of community-level adaptation strategies to climate change.

2.2.2.1.2 Access to finance for fisherwomen

Community savings group

To support fisher's women access to finance, 17 new CSGs were formed with 532 fisher's women in ZOR and MPA in Year 3. Team conducted 351 CSG mobilization meetings with 8,109 participants. Up to December 2022, 2,082 members from 69 CSGs saved BDT 3.73 million including their own savings (BDT 2.55 million) and matching fund (BDT 1.18 million). Most of the matured CSGs has started different AIGAs by taking loans from CSGs savings. It was reported that, total BDT 540,000 was distributed among 84 CSG members to support goat rearing, chicken rearing, agriculture, dry fish business, grocery and tailoring business (Figure 16).



Figure 16. CSG activity with fisher’s women.

Business literacy school

Team has continued monitoring of the business literacy of CSG member’s by attending their weekly sessions. This year project trained 26 BLSFs of ZOR and MPA and hired 22 BLSFs to conduct BLS weekly sessions throughout the six months course. Up to December 2022, 585 weekly sessions were conducted with 1,1016 fisher’s women. BLS sessions are helping fisher’s women to improve business literacy, learn basic education, to realize the importance of safe drinking water, sanitation, dietary diversity, nutrition of mother and child, creating awareness about child marriage, gender-based violence, dowry and biodiversity conservation. It was reported that 19 BLS of Year 2 has completed stipulated 24 sessions and 22 BLS of Year 3 are continuing weekly activities (Figure 17).



Figure 17. ToT of BLS facilitators and BLS weekly sessions with CSG members.

2.2.2.1.3 Access to improved technology and market linkages

Seaweed farming

Seaweeds are a form of marine autotrophic macroalgae prevalent in coastal waters and are of both ecological and economic importance. Due to their outstanding nutritional profile, seaweeds are currently considered the food supplement of the twenty-first century. Seaweeds are rich in protein, carbs, beta-carotene, minerals, vitamins, and important amino acids. Seaweeds contribute to carbon sequestration, carbon sinking, ocean deoxygenation and acidification control, and alternative income generation for fishermen; as a result, seaweed is regarded as a promising nature based solutions for alternative income generation as well as blue carbon adaptation and climate change mitigation strategy. Considering these Blue Economic importance, ECOFISH II, with the assistance of CVASU, introduced seaweed farming in the coastal waters of Cox's Bazar, Bangladesh with the engagement of the fishing households. The objective of this initiative was to develop a production and economically efficient seaweed farming technology through a trial and error process.

The team identified four potential seaweed culture species (*Gracilaria* sp., *Ulva* sp., *Hypnea* sp., and *Enteromorpha* sp.) along the Teknaf-Cox coast in the last two years. *Gracilaria* sp. (red seaweed) has a local demand for human consumption in Bangladesh, primarily among tribal people. Traditionally, seaweed extracted from the natural environment to meet the local demand and gradually off-bottom farming systems have been practiced in only Cox's Bazar. Later on, CVASU developed a floating seaweed culture system in 2021 that yielded better growth and product quality. Additionally, the CVASU team provided training/technical support to selected farmer for producing good quality seaweed and packaging supplies, weighing scale, & sealer machine to entrepreneurs in order to expand market channels and boost demand.

Habitat suitability mapping for seaweed along the Bangladesh coast

CVASU developed the habitat suitability maps throughout the entire Bangladesh coast to select the best suitable site for better growth rate and culture method for seaweed with a view to expand the floating culture system by fulfilling the knowledge gaps. Sea surface temperature (SST), salinity, NO₃ concentration, Photosynthetic absorption rate (PAR), water current (both zonal and meridional components), total suspended matter (TSM), and depth are taken into account as the explanatory variables in this context. After measuring the spatial variability in the environmental condition in the marine and coastal water of Bangladesh, the Generalized Additive Model (GAM) was applied in a growth performance approach to define the environmental variables that predicts the distribution and growth rate of seaweeds (*Enteromorpha* sp. *Ulva* sp. *Hypnea* sp. *Gracilaria* sp.) in the maritime territory of Bangladesh. The Generalized Additive Model (GAM) was applied to develop the habitat suitability maps. The results showed, for all the four species, the off-bottom farming system was found less suitable, which may be confined only some areas of Cox's Bazar regions (Figure 17). The model predicted that a large portion of coastal maritime area of Bangladesh can be brought under floating culture system with high suitability in the southeast coastal areas (Figure 18). The output of this study will help to establish the seaweed industries considering the commercial and nutritional requirements.

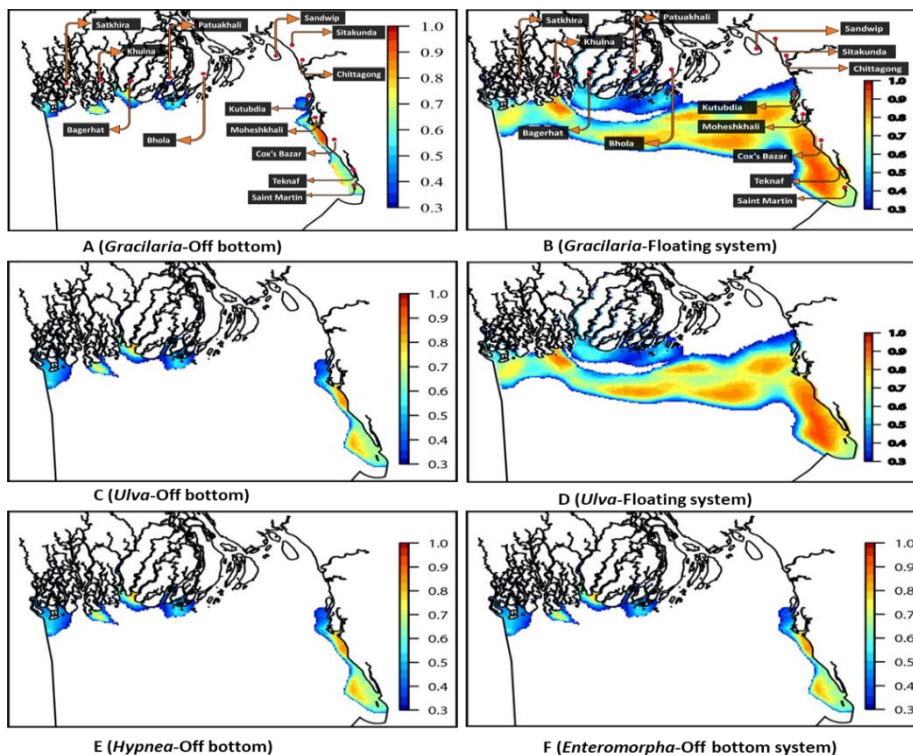


Figure 18. Spatial distribution of seaweed (*Enteromorpha* sp. *Ulva* sp. *Hypnea* sp. *Gracilaria* sp.) farming probability by off-bottom and floating long line method predicted by Generalized Additive Model in the coastal area of Bangladesh. Probability 1 indicates the 100% culture probability.

Development of farming system

Gracilaria was considered for seaweed farming with four farming systems (Floating long-line, off-bottom long-line, floating net and off-bottom net) (Figure 19). Farming systems were designed based on site appropriateness factors like as salinity, transparency, tidal wave, and bottom sediments. The off-bottom net culture method greatly outperformed the off-bottom long line in terms of all growth metrics, including specific growth rate, daily growth rate, and biomass production. In terms of *Hypnea* sp. the off-bottom long line system produced 6.03 kg of raw biomass per square meter for the entire season (October/November-February/March), whereas the off-bottom net culture system produced 12.52 kg of raw biomass per square meter (Figure 20). Three different culture techniques (floating long lines, off-bottom long lines, and off-bottom net cultures) were used to test the production systems (Figure 18) of the *Gracilaria* sp. The floating long line culture method greatly outperformed the off-bottom net culture method and the off-bottom long line approach in all growth metrics. For a whole season (October/November-February/March), the output of off-bottom long lines, off-bottom nets, and floating long line systems were measured as 5.38 kg raw biomass/m², 7.51 kg raw biomass/m², and 12.55 kg raw biomass/m², respectively (Figure 21).

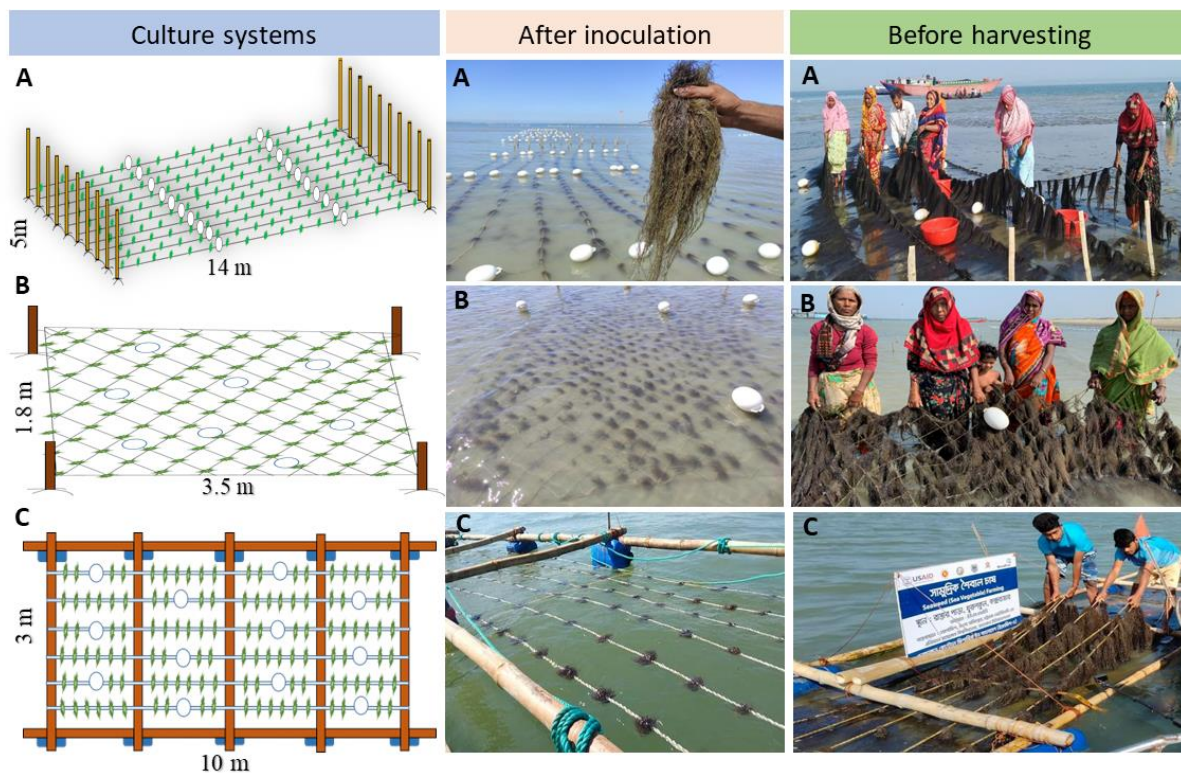


Figure 19. Design and photographic view of different culture systems of *Gracilaria* sp. after the first inoculation and before the harvesting period. Here, A, off-bottom long line system; B, off-bottom net system; C, floating long-line system. A total of 25 off-bottom long-line, 20 off-bottom net, and 10 floating long-line culture plots were established at the south-east coast of the Bay of Bengal (Nuniachora, Cox’s Bazar) with farmers’ participatory approaches.

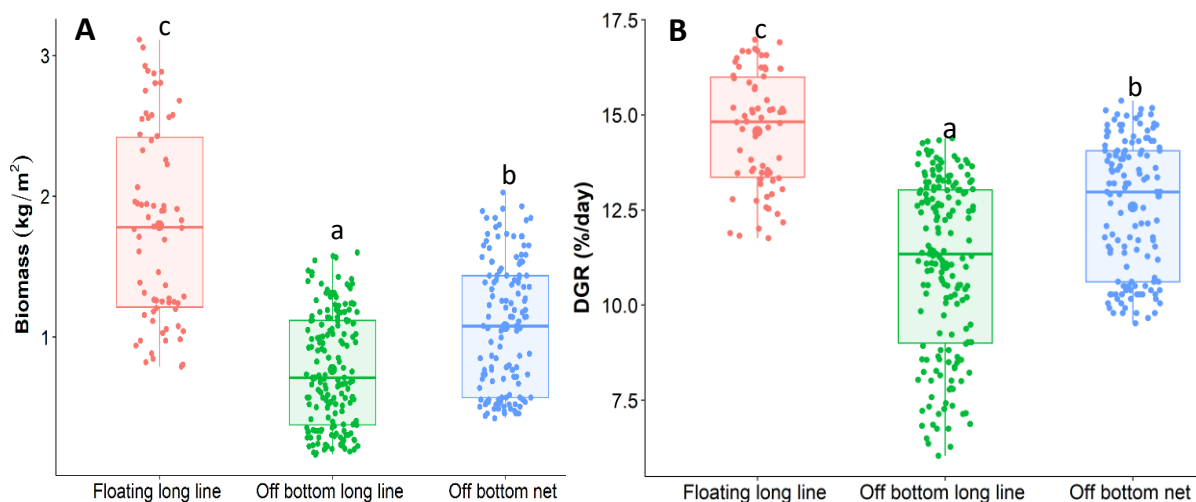


Figure 20. Comparison of production performance in terms of (A) gross wet biomass (kg/m²/month) and (B) daily growth rate (%/day) of *Hypnea musiformes* seaweed cultured at the south-east coast of the Bay of Bengal, Bangladesh. Box and Whiskers plots with the different superscript letters indicate significant differences ($p < 0.05$).

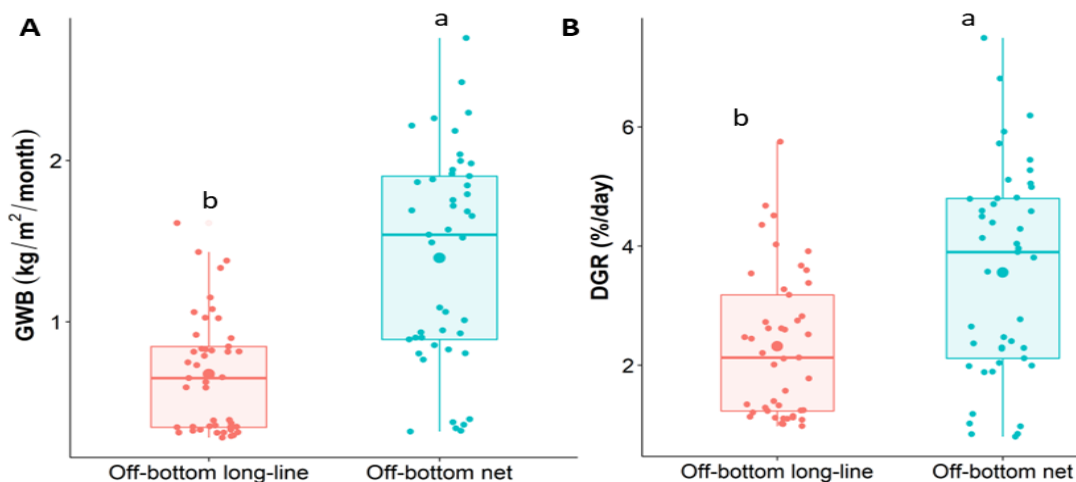


Figure 21. Comparison of production performance in terms of (A) biomass (fresh wet basis/m²/month) and (B) daily growth rate (DGR) of *Gracilaria tenuistipitata* seaweed cultured at the south-east coast of the Bay of Bengal, Bangladesh.

Globally, *Gracillaria* sp. is valued for its high-quality seaweed and is well-known for producing agar. As a result, the agar composition of three different production methods of *Gracillaria* sp. has been examined. Interestingly, *Gracillaria* sp. from the floating long-line system has a substantially greater concentration of agar than *Gracillaria* sp. from the off-bottom net or off-bottom long-line culture (Figure 10). More crucially, it was found that seaweed cultivated on a floating long-line system is safer (in terms of heavy metal content) than seaweed grown in an off-bottom system. In addition, the evaluation of various nutritional and food safety factors has been given a special focus, which is crucial for the marketing and branding of seaweeds in home and abroad. *Gracillaria* sp. cultivated under a floating long-line system had much higher protein, lipid, fatty acid, and mineral content than *Gracillaria* sp. cultured on the bottom (Table 8).

Table 8. Variation of proximate composition (%) of *Gracilaria tenuistipitata* seaweed under different farming systems located at the south-east coast of the Bay of Bengal, Bangladesh

Proximate composition	Culture systems			F-value	Sig.level P-Value
	Off-bottom long line	Off-bottom net	Floating long line		
Protein (%)	21.61±0.6 ^b	22.13±0.8 ^{ab}	23.04±0.9 ^a	3.77	0.050*
Lipid (%)	0.47±0.1 ^b	0.72±0.1 ^a	0.83±0.1 ^a	24.26	0.000***
Crude fiber (%)	8.99±0.5 ^a	8.48±0.4 ^a	8.78±0.4 ^a	1.72	0.220NS
Ash (%)	15.72±0.8 ^b	17.84±1.1 ^a	17.31±1.5 ^{ab}	4.54	0.034*
NFE (%)	53.20±0.3 ^a	50.82±1.4 ^{ab}	50.03±2.2 ^b	6.04	0.015*

All the values are represented as the mean ± SD of the five replicated culture units. Different superscripts in the same row denote significant differences among different months ($P < 0.05$).

Gracilaria floating long-line culture is the most promising seaweed farming culture technology of the three culture systems piloted (off-bottom long-line, floating net and off-bottom net). Compared to the other culture systems, the average biomass production of *Gracilaria* sp. in the floating long-line system was 135% higher than the traditionally practiced off-bottom long-line culture systems. Since it has higher agar and protein content in *Gracilaria*, so it has potential to utilize it both in the agar and animal feed industry for its value addition. However, in order to ensure the financial viability of the floating lone line system, a complete economic analysis of the system is required, and this evaluation will take place during the next year. Subsequently, some social, economic, and environmental challenges must be addressed in order to reap the benefits of Bangladesh's seaweed farming potential.

Green mussel farming

ECOFISH II also piloted green mussel (*Perna viridis*) farming as another natural solution for the coastal men and women in Cox's Bazar. At two culture sites (Moheshkhali and Khurushkul), the CVASU team has trained 50 beneficiaries on green mussel, 35 of whom are trained farmers and 15 of whom are active farmers who have received both training and input support. Four upgraded green mussel culture units (30 ft x 30 ft) were established in the Khurushkul region, and two upgraded green mussel farming systems (30 ft x 30 ft) were established in Moheshkhali's Ahmadiakatha in the Moheshkhali channel. Unfortunately, the stocked green mussels died due to a sudden change in salinity caused by tidal flash and surface run-off in the cultured region, as well as cyclone Sitrang. However, preliminary observations suggested that spat attachments would improve in the breeding season.

An experiment was set to determine the influence of culture depth on green mussel development and productivity. In mussel shocks, 1.5, 3.0, and 4.5 ft of green mussels were placed at three different depths in Khurushkul, and Moheshkhali areas. Green mussel growth was found significantly higher at 1.5 (24.92±13.89 g) and 3 feet of depth (23.63±12.91 g). Similarly, the specific growth rate (SGR) was higher for 1.5 feet (1.170.32 percent per day) than for 3 feet (1.150.31%/day) (Table 9).

Table 9. The growth parameters (Mean ± SD) of *Perna viridis* in different depth at Cox's Bazar coast. Different letters indicate significant variation ($p < 0.05$)

Variable	Culture depth			F value	Sig
	1.5ft	3ft	4.5ft		
Initial weight(g)	2.95±0.51 ^a	2.95±0.51 ^a	2.95±0.51 ^a	0.000	1.000NS
Final weight(g)	27.88±13.8 ^a	26.59±12.9 ^a	22.33±11.9 ^b	12.048	0.000***
Weight gain(g)	24.92±13.8 ^a	23.63±12.9 ^a	19.38±12.0 ^b	12.038	0.000***
SGR(% day ⁻¹)	1.17±0.32 ^a	1.15±0.31 ^a	1.05±0.30 ^b	10.519	0.000***

Seminar on seaweeds and green mussels and Blue Food festival

ECOFISH II hosted a [seminar on “seaweeds & green mussels and food festival”](#) based on the delicious cuisines of seaweed and green mussel in Cox’s Bazar on March 19, 2022 to provide various stakeholders with an opportunity to exchange and share the experience and knowledge on seaweed & green mussel farming. In addition, challenges were identified that should be addressed in order to boost up the blue growth and utilization of this rapidly expanding climate resilient [aquatic food systems](#). In the seminar, 120 people were present, including seaweed and green mussel growers, sellers, seaweed processors, private sectors, restaurants, government officials, academics, and researchers. Emeritus Professor Dr. Md. Abdus Sattar Mandal, Former Vice-Chancellor of Bangladesh Agricultural University (BAU) & Member of Planning Commission (GED), Bangladesh was the chief guest of the seminar. Mr. Ashraful Haque, Project Management Specialist, Environment Office of Economic Growth, USAID/Bangladesh, Captain M Minarul Hoque, (H), BCGM, PSc, BN, Director General, Bangladesh Institute of Maritime Research and Development (BIMRAD) and Dr. Md. Sharif Uddin, Director (Marine), Department of Fisheries (DoF), Chattogram attended the seminar as the special guests. Dr. Asaduzzaman, Assistant Professor, CVASU delivered the keynote speech at the seminar. Professor (Rtd.) Dr. Md. Abdul Wahab, Team Leader, ECOFISH II, WorldFish Bangladesh chaired the seminar and blue food festival. A number of recommendations were made at the end of the seminar, which are (1) development of spatial planning to avoid future conflict between resource users; (2) improvement of the existing culture systems and development of integrated culture technologies; (3) strengthening the value chain and marketing strategies through diversified product developments; and (4) branding of the blue food products for domestic and international markets. Following the immediate conclusion of the seminar, the Blue Food Festival was launched. All attendees entered the food festival location, which was located on the seagull hotel's swimming pool side. The festival features ten stalls decorated with seaweed-based food items (48 items), seaweed-based food ingredients (04 items), cosmetic products (04 items), industrial ingredients (03 items), and various species of raw and dry seaweed. Distinguished guests, academicians, and other participants visited the stalls and sampled various seaweed-based foods. The food festival was broadcast 'live' on [local IP television](#), and communication team prepared a [short documentary](#). The leading print and electronic media covered the seminar on seaweeds and green mussels farming and blue food festival.

Coastal aquaculture

Asian Seabass (*Lates calcarifer*) is a commercially important species that is rich in nutrition and has high demand in coastal regions. The fish is a great attraction for foodies as kebab delicacy as well as curry. It is available for capture from the wild year around but peak season is in winter both in saltwater and brackish-water. From early 90’s till now, there has been several attempts on breeding the fish yet unfortunately, any breeding technology is still yet to be developed in Bangladesh. Thus culture of Asian seabass is still at extensive level while farmers collect fingerlings from nature and rear them in pond. As the fish is a euryhaline species with high demand and market price, an initiation on developing a suitable culture practice in coastal region is important. ECOFISH II provided supports to 30 fishing households in the Char Kukri Mukri Island (average pond size 14.47 dec) under the Nijhum Dwip MPA and Patuakhali (average pond size 15.73 dec) for aquaculture practices. The experiment was designed in 3 treatments namely T1 (Seabass: Tilapia 1: 5), T2 (Seabass: Tilapia 1: 10) & T3 (Seabass: Tilapia 1: 15) with 5 replications and seabass fingerlings were stocked after one month of tilapia fingerlings. Initial observations indicated, seabass growth performance is better in T3. In a general statement, the growth of seabass is dependent on the abundance of natural foods (Tilapia fries) in the culture ponds. In the next quarter, the full economic performance will be analyzed in order to recognize the seabass aquaculture protocol.

Improved dry fish production and market linkages

Safe and hygienic dried fish production with small pelagic fishes by fisher’s women is one of the key interventions in USAID ECOFISH II activities; the intervention is creating alternative income generating

opportunities in the community. The project continued providing support to 1,040 fisher's women of previous years who received 22,444 kg raw fishes for safe and hygienic dry fish production; and produced 5,457 kg dried fish. The team made regular follow up visit and mobilizes the producer group members for dried fish business, and linking them with local traders. However, with the technical and materials support and by getting the raw fish in several installment, the fisher's women are encouraged to continue dried fish business initiatives for their economic empowerment and participation in dried fish value chain. A database on dried fish producer's individual and group information along with their business status has been updated that indicated 522 beneficiaries are continuing the business with average eight times procurement of raw fish by themselves. They continued their dried fish production throughout the seasons, and produced 80,1917 kg safe and hygienic dried fish, of which they consumed 12,576kg and sold the rest amount in market with a value of about BDT 30 million (Figure 22).



Figure 22. Safe and hygienic pelagic small dry fish production and selling by fisher's women.

In collaboration and consultation with Department of Agriculture Marketing (DAM), BSMRAU, NSTU and entrepreneurs, ECOFISH II team facilitated an experiment on the effectiveness of low cost UC Davis chimney and box driers (2 boxes and 2 chimney driers in Ukhiya upazila) for the production of safe and hygienic dried fish. Senior staffs from the project and a team consisting Additional Secretary, Joint Secretary and Deputy Secretaries from Department of Agriculture Marketing (DAM), Ministry of Agriculture visited the newly installed driers (Chimney and box drier) as well as the existing fish drying *Macha* for safe and hygienic dried fish production (Figure 23). The field team monitored the whole process of the driers installment and fish drying including temperature, moisture and other matters. In short, having few limitations (capacity, longevity etc.), the box performance found well and the beneficiaries were satisfied on its performance with the quality and price of the dried fish produced. All these recommends the driers to replicate and scale up in other areas with addressing the identified limitations.



Figure 23. Fish drying in the box and chimney driers and a team from DAM visiting the driers.

New 300 women artisan (240 in Cox’s Bazar and 60 in MPA) for year-3 has been selected and they received a training on safe and hygienic dried fish production and marketing in 11 batches; Senior Upazila Fisheries Officer (SUFO), and ECOFISH team facilitated those training (Figure 24). The beneficiary list has been shared with respective DoF office for their record and information.



Figure 24. Training on Safe and hygienic dried fish production & marketing; training facilitation by Sr. Upazila Fisheries Officer (left) and by ECOFISH team (right).

The project provided critical input supports to 329 HHs (bamboo made matcha and mosquito net to 319 women, and low cost UC Davis chimney and box driers to 10 women). Team facilitated distributing 2,786 kg raw fish to 247 HHs for production and marketing of safe and hygienic dried fish (Figure 25). The beneficiaries are using the materials and initiated business. Their total dried fish production and income status will be analyzed in upcoming months.



Figure 25. Distribution of raw materials (Up L&R) and production of safe and hygienic dried fish (Down L&R).

As part of a piloting initiative, a producer group has been operating with dried fish producer women under Cox’s Bazar Sadar Upazila. The team assisted the beneficiaries to make savings aiming to strengthen the capacity for future economic perspectives for dried fish business, strong communication with the group members, and supplying in the market and way to create sustainable income source by the fisher’s women. Besides, the savings group received matching fund BDT 25000 against their savings. A consultation meeting with 33 PG executives (president, secretary and cashier)

from previously formed eleven groups were conducted to know the status of their existing dry fish business and it is found that many of them are interested to turn into business model. An operational guideline for the dried fish producer group has been developed, which guides the group to continue the dried fish production, following the business model, making savings, and it create an opportunity to disseminate the nutrition awareness messages among the beneficiaries.

2.2.2.1.4 Improving food and nutrition benefits, focusing on women and young children

IR2 has a special focus on improving the dietary diversity/food consumption to improve the nutrition situation of the poor fishing HHs. To support year-round diversified food for fishing family, ECOFISH II provided seasonal vegetables seed during summer and winter. 3,337 and 3,623 HHs received the vegetable during summer and winter respectively. The beneficiaries (>70% women) were oriented on nutrition-sensitive homestead gardening and HH nutrition during seed distribution on winter. In addition, 20 HHs has been supported with farming materials including organic fertilizers, pheromone trap along with the vegetable seeds (Figure 26).

The support to beneficiaries will accelerate the nutrition-sensitive homestead horticulture and it will diversify and enrich their diets with nutrient rich vegetables, and contribute HHs overall income. This will strengthen introducing good practices that enable year-round access to a variety of nutritious foods. Thus, HHs food security and vegetable consumption behavior will be improved in the long run, which ultimately will lead to HHs nutrition improvement particularly for women and children.



Figure 26. Vegetable production by ECOFISH II beneficiaries in CXB Sadar Upazila.

During Year-2, ECOFISH II, in collaboration with Noakhali Science and Technology University (NSTU), developed a composite fish powder from three important pelagic small fishes that could be used as nutrient supplement to the children's diet. NSTU has conducted a Randomized Controlled Trial (RCT) to observe the effectiveness of a composite pelagic small fish powder mixture-based complementary diet on the nutritional outcome of children aged 6 to 24 months. The fish powder was given to 30 children in an ECOFISH II intervention-fishing village as the first “1000 days” of life are critical for optimal physical and mental development. Each children received 25 g fish powder of the intervention group for a week to consume 5g/child/day (anchovy, sardine, and faissa (40:30:30)) for 16 weeks. After that, NSTU carried out an end line survey to assess the efficacy of the previously developed fish powder. Anthropometric and biochemical markers (e.g., vitamin B12, calcium, ferritin, iron, and hemoglobin) were considered to assess the differences between baseline and end line between the intervention and control groups. Except for a change in head circumference (DiD of 0.94 ± 1.47 in the control group versus 1.02 ± 1.05 in the intervention group), there were no significant changes ($P > 0.05$) in anthropometric indicators from baseline to end line. However, there was a significant change in the biomarkers of the intervention group in the end. For example, children with normal retinol status increased in the intervention group from 85.72% to 100%; the increment was 80.95% to 88.24% in the control group. Iron climbed from 92.86% to 95.24% and calcium from 50% to 57.14% in the intervention group. The proportion of respondents with normal iron levels grew from 92.86% to 95.24%, whereas the range for calcium values was between 50% and 57.14%. The intervention group exhibited greater vitamin B12 levels outside the acceptable range (0%–9.53%) than the control group

(2.78%–4.76%). Hemoglobin declined in the control group (-8.05%) but rose ($P < 0.05$) in the intervention group (6.98%). RBS dropped -5% and -7.41% in both groups, from 3.9 to 5.6 mmol/L. A significant difference in responses was observed in the panel test for smell and taste with the percentage of favorable reactions at 84% and 80%, respectively. Findings support that inclusion of pelagic small fish composite powder-based ready-to-eat fish products in the diet may improve children's nutritional status and thus, may be promoted across the coastal communities.

NSTU in collaboration with ECOFISH II carried out a trial to prepare ready-to-use (RTU) fish and seaweed powder. Following standard operating procedures (SOP), the powder was prepared. Eleven ready-to-eat (RTE) food items were prepared from the seaweed powders in NSTU and an organoleptic test of all prepared items was conducted using a simple random sampling method with 23 samples. However, the RTU fish and seaweed powder has been given to six enthusiastic entrepreneurs and other small- and large-scale food producers to conduct experimental preparation of various ready-to-use food products (RUFPs).

During this reporting year, ECOFISH II observed the National Nutrition Week 2022 with different awareness building events including nutrition video show, discussion and quiz competition among mothers and nutrition status measurement of the present 57 under five children. In four Upazilas of ZOR, 154 participants (139 female, 15 male) received knowledge on dietary diversity, maternal and child nutrition practices, hygiene etc. through the discussions. Senior Nutrition Specialist conducted the nutrition awareness sessions with the beneficiaries. Upazila Fisheries Officer (UFO) of Ukhia, and Senior Upazila Fisheries Officer (SUFO) of Teknaf were participated in the discussed on the importance of small pelagic fishes and other aquatic foods for children and women consumption to combat malnutrition. Leaflet on safe and hygienic dry fish production has been distributed among the participants. ECOFISH II facilitated a quiz competition among WorldFish staffs, produced Facebook contents and Blogs on it. Senior Nutrition Specialist represented WorldFish ECOFISH II in a national level seminar organized by Bangladesh National Nutrition Council (BNNC) on the eve of National Nutrition Week 2022 (Figure 27).



Figure 27. Glimpse of National Nutrition Week 2022 celebration (discussion, video show, nutrition status measurement and quiz prize distribution).

4 COVID-19 response

The socio-economic condition of the fishers, boat and net owners, traders, input suppliers, ice suppliers and dry fish producers have been seriously affected due to the COVID pandemic situation from 2020. ECOFISH II is trying to help to overcome the economic crisis through implementation of different Alternative Income Generating Activities (AIGA) supports to improve their livelihood in this pandemic situation. ECOFISH II Activity team followed all precautionary measures advised by the government and WorldFish. Although COVID situation is improved from 2nd quarter of 2022, ECOFISH II team and partners facilitated the communities in each and every event to maintain social distancing, using masks, avoiding mass gathering, washing hands frequently, using hand sanitizer as per national and regional level, during the COVID-19 pandemic.

5 Communications

Media Coverages

ECOFISH II has received media attention for its comprehensive activities to improve fishers' livelihood resilience, conserve biodiversity, and enhance ecosystem resilience. Several lead stories were published in the country's renowned dailies. The links to the published materials are given in Table 10.

Table 10. List of published materials of ECOFISH II in 2022

Sl	Hedaing of the news	Name of media
1	Dead Dolphins found at Kuakata	Prothom Alo Dhaka Post, RtvBd journal SamakalAjker Bangladesh Dhaka Tribune Alokito Bangladesh Bangala News
2	Beach clean-up at Char Kukrimukri	Bangla News 24, Somoy Sangbad
3	The lost season of Hilsa is returning	Prothom Alo
4	Horse crab released in sea	Rising BD, Ajkerpatrika
5	Dead jelly fish found in Kalapara	Janakantha
6	Horse crab released in sea	Khola kagoj, Ekattor.tv Daily Inqilab Desh Rupantor, Daily-Bangladesh. Rtv Jugantor, Bangla Tribune, Barta Bazar
7	Seminar on Sea weeds & green mussel	Channel 24, Bangladesh Protidin, Bangla Tribune, Ajker Patrika, Sangbad, Bhorer kagoj Ittefaq, Amar barta24.com, Amader Shomoy Bhorer kagoj
8	Jelly Fish found in Kuakata	Shomoyer Alo, Daily Inqilab, Rtv
9	Abundance of read crab at Char bijoy	Rising BD
10	Dead Dolphin found in Kuakata	Jugantor, Dhaka Tribune, Amader Shomoy Channel24 Dhaka Post, Daily Janakantha Dhaka Mail
11	Dead Dolphin found at Kuakata	Prothom Alo, Desh TV, Daily Nayadiganta, Manob Kantha, Dhaka Post, Dhaka Mail
12	Dead sea turtle found at Kuakata	Jagonews 24, Jugantor, Kalerkantho, Ekattor TV, Ajker Patrika, Bangladesh Observer, Dhaka Mail, Dhaka Times
13	Native Catfish in fear of getting lost	Prothom Alo
14	Seaweed and green mussel farming a new hope for coastal community	Jamuna TV, Channel 24
15	Earth Day Celebration at Kalapara	Bangladesh Post, Jugantor, Amader Shomoy, Manob Kantha, Daily Jagaran.
16	Operation to protect the native catfish, fined 7 fishermen	Prothom Alo
17	Hygienic dryfish producers celebrates Nutrition Week-22	The Bangladesh Observer
18	Conserving Hilsa: Why voluntary participation of fishers is crucial	The Business Standard
19	65-day ban on fishing in the sea, fishermen in trouble due to Corona	<u>Prothom Alo</u>

SI	Hedaing of the news	Name of media
20	A Green tortoise, weighing 40 kg, was recovered alive in Kuakata	Prothom Alo, Kaler kantho, Jugantor, Channel 24, Rtv, Ajkerbangladesh.com, Jagonews 24.com, Barta24.com, Bhorer Dak, Bangla News Express, Rising bd.com, DBC News, Prothom Alo, Tribune News bd, Jugantor
21	Artisanal fisher's congress held at Kuakata	Bangladesh Pratidin, Daily Janakantha, The Bangladesh Observer, The Bangladesh Post, The Daily Star, The Financial Express, Daily Desh Janapad, Sokaler khobor24.com
22	Training on responsible fishing held in Cox's Bazar	Bangladesh Observer
23	Dolphin released safely by boat skipper	Prothom Alo, Kaler Kantho, The Daily Naya Diganta, The Daily Observer, Daily Jugantor, Daily Protidiner Sangbad, Daily Bhorer Kagoj, Daily Bhorer Kagoj, Daily Desh khabar, Channel24bd.tv, Charfashionnews24.com, Amar News.com, Bangladesh Journal, Dhaka Post.com, Bangladesher khabor, Dhaka Mail, Banglar Alo News, Odhikar News, Songbadprokash.com
24	World Ocean day celebrated	Sangbad , Mktinews24.com , Sagorkonnya.com
25	Fishers training held at Teknaf	Observer
26	Government restrictions on 65 day fishing ban are not accepted	Naya Diganta, Agamir News
27	Yellow-Bellied Sea Snake' was spotted at Kuakata beach	Prothom Alo , Daily Inqilab, Bangla Tribune, Bonikbarta, shodeshbidesh.com, Abnews.24.com, News24.com, DBlivenews.com, Bhorer-dak.com, Somoynews.tv, Dhakareport24.com, Bd24live.com
28	Despite the government ban, Brood Hilsa goes hunting in the sea!	Dhaka Times, Janakantha
29	Bangladesh is one of the top four countries in increasing fish production.	Prothom Alo
30	International recognition of the nutritional quality of Mola fish	Prothom Alo
31	Fish week celebrated	Bangladesh Observer
32	Fishermen's Assistance Scheme: The allocation is less, but the misery continues.	Prothom Alo
33	Nutrition for Women and Sustainable Development	Sangbad
34	With an increase in fuel prices, the marine fishing sector is in a crisis.	Prothom Alo
35	A 30-foot-long dead whale washed up on Kuakata	Daily Star, Desh Rupantar, Jago News, Bangla Tribune
36	Sail Fish caught at Kuakata	Bangladesh Pratidin

SI	Hedaing of the news	Name of media
37	Ensure lifejackets for fishers	The Shamokal
38	World River Day celebration	Jagonews24.com, Kalerkantho, and Bangladesh Pratidin
39	Large Hilsa has decreased in this season	Prothom Alo
40	Indifference to protecting whales and dolphins	Prothom Alo
41	Fishermen join campaign to help enforce fishing ban	Daily-Sun
42	World Fisheries Day is celebrated at Mohipur	Barta Bazar
43	World Fisheries Day is celebrated at Mohipur	PBA agency
44	World Fisheries Day is celebrated at Mohipur	Ittefaq
45	First Aid Boxes distributed	Sokaler Khobor
46	First Aid Boxes distributed	Bangladesh Pratidin
47	First Aid Boxes distributed	Banglar Chokh

OP-ED and Article

An OP-ED titled "Access to finance is key to empowering fishing community women" was published in the Business Post. Another OP-ED titled "Super fish" Mola to eradicate malnutrition was published in the Jugantor. An OP-ED titled "Ensure sustainable and alternative livelihoods for fishers" was published in the Jugantor. An OP_ED titled "How lifejackets could save fishers' lives" was published in the Business Post. OP_ED titled "Nutrition for women: Why it matters" published in the Business Post.

TV talk show

Dr. Md. Mr. Jalilur Rahman, Scientist, ECOFISH II along with Additional Director General, DoF, Mr. Atiar Rahman, and Additional Secretary, MOFL, Mr. Abdul Kaium, took part in a TV talk show on Rtv during Fish Week (23-29 July) titled "Socio-economic improvement of fishers".

Outreach: Artisanal Fishers Congress and Blue Food Festival

ECOFISH II Activity organized a day-long congress as part of the celebration of the International Year of Artisanal Fisheries and Aquaculture 2022, announced by the UN General Assembly (Figure 28). Team Leader of the ECOFISH II Activity Professor (Retd.) Dr. Md. Abdul Wahab presided over the event while emeritus Professor and former Vice-Chancellor of Bangladesh Agricultural University. Md. Abdus Sattar Mandal attended the event as the Chief Guest. Dr. Md. Jalilur Rahman, Scientist, ECOFIH II presented a short presentation highlighting artisanal fishers' contribution to food security and employment in Bangladesh. Dr. Md. Nahiduzzaman, Scientist, ECOFIH II, presented and discussed on long-term initiatives to improve the lives and livelihoods of artisanal fishers.



Figure 28. Artisanal Fishers Congress held on Sunday, 29 May 2022 at Sikder resort, Kuakata.

The Director General of WorldFish, Dr. Essam Yasin Mohammad, participated in the event through online from Malaysia. The Vice-Chancellor of Patuakhali University of Science and Technology, Professor Swadesh Chandra Samanta, Director (Marine) of the Department of Fisheries, Dr. Md. Sharif Uddin, Mahbuba Panna, Additional Secretary, Department of Economic Relations, Mohammad Kamal Hossain, Deputy Commissioner, Patuakhali, Abdullah Al Mamun, Divisional Forest Officer, Patuakhali, Ashraf Haque, Activity Manager of ECOFISH II, Economic Growth Office, USAID Bangladesh also addressed in the event. The event was also participated by fishermen, leaders of fishermen's organizations, fisheries co-management leaders, fisherwomen, youth, government officials, academics, researchers, development partners, and NGO representatives. Participants in the panel discussion made recommendations to recognize the contribution of artisanal fishers to food security and employment, raise awareness of biodiversity conservation, ensuring sustainable and alternative livelihoods for them. In the congress, 15 people were honored in nine categories for their outstanding contributions to empowering fisher women, conserving Hilsa and biodiversity, and protecting the native Pangas (Figure 29).

Seminar on seaweed and green mussel farming and Blue Food Fest

ECOFISH II organized a seminar on seaweed and green mussel farming and Blue Food Fest held at Sea Gull hotel in Cox's Bazar on March 19, 2022.

The event was attended by seaweed farmers, traders, consumers, processors, chefs, academicians, practitioners, researchers, and private sector, government officials, and development practitioners. Speakers at the event stressed the need to harness seaweed's potential.

The event's chief guest was Emeritus Prof Dr Md Abdus Sattar Mandal, former vice-chancellor of Bangladesh Agricultural University, and member of the Planning Commission of Bangladesh (Figure 29).



Figure 29. Guests visit the Blue Food Festival stall

Prof Dr Md Abdul Wahab, team leader, ECOFISH II, WorldFish Bangladesh, presided over the programme. Captain M Minarul Hoque, Director General of the Bangladesh Institute of Maritime Research and Development, Ashraf Haque, Project Management Specialist of USAID Bangladesh; Dr Md Sharif Uddin, Director (Marine), Department of Fisheries attended in the event as the special guests.

Dr Md Asaduzzaman, assistant professor of Chattogram Veterinary and Animal Sciences University, Dr Abdullah Al Mamun, professor and chairman, Noakhali Science and Technology University, Dr Mostafa Ali Reza Hossain, professor of Bangladesh Agricultural University, Zahanara Islam, Chairman, Zahanara Green Agro, addressed in the event.

Documentary production

Produced a video documentary on conserving biodiversity and building fishers' livelihood.

Publications (printed materials)

During this reporting period the project produced 60,000 leaflets and 14,000 posters on Jatka conservation, a 65-day marine fishing ban, and a 22-day brood Hilsa fishing ban and distributed them in ECOFISH II working areas (Figure 30-32).



Figure 30. Brood Hilsa Conservation leaflet and poster.



Figure 31. Jatka Conservation leaflet and poster.

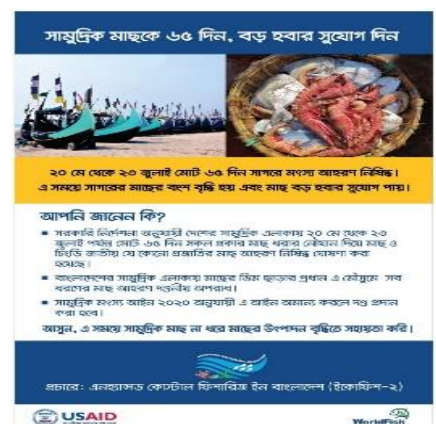


Figure 32. Posters and leaflets on 65-days marine fishing ban.

Socila medai outreach: During this reporting period, the project posted 24 Facebook contents on various aspects of fish and biodiversity conservation, women economic empowerment and wellbeing of fishing community and posted on the Hilsa Facebook page 'Conserve Hilsa'. Screen shots of some of the posts are shown in Figure 33.

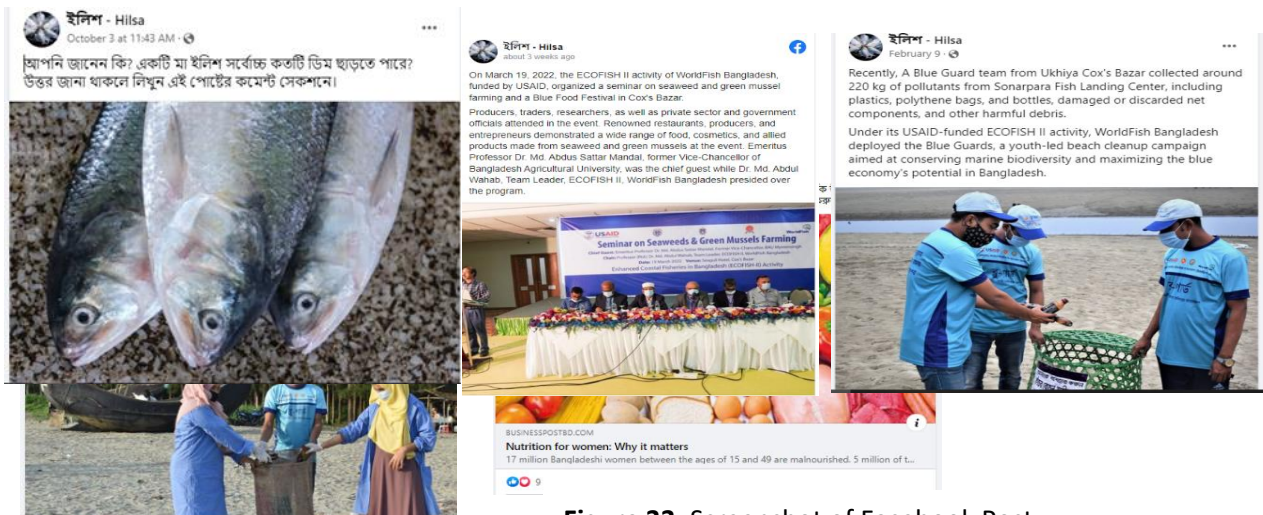


Figure 33. Screenshot of Facebook Post.

The ECOFISH II Activity showed its wide range of initiatives through a photo exhibition and the screening of a video documentary at the Bay of Bengal Conversation, held at the Pan Pacific Sonargaon on September 21–23 in Dhaka and organized by the Center for Governance Studies (CGS). Dr. Md. Jalilur Rahman and Dr. Nahiduzzaman, scientists with ECOFISH II, took part in the SPEED TALKS session titled, "Are we rightly managing and sharing the fish in the Bay?" about the transboundary fishery crisis in the Bay of Bengal. The photo exhibition of WorldFish Bangladesh's ECOFISH II activity was visited by distinguished guests, including US Ambassador to Bangladesh Peter Haas (Figure 34).



Figure 34. US Ambassador visited ECOFISH photo exhibition in the BoB Conversation.

6 Environment

The Environmental Monitoring and Mitigation Plan (EMMP) provides a basis for systematic implementation of Initial Environmental Examination (IEE) and Environmental Assessment (EA) conditions. Its purpose is to determine whether the proposed project interventions have any potential adverse impacts on the environment as well as to suggest a mitigation plan to reduce environmental consequences. The ECOFISH II Activity strengthens the ability of fishing communities to extract maximum benefit from coastal environments using sustainable practices and to mitigate the adverse effects of climate change. Like throughout the project implementation period, in the year of 2022 (January to December), the project carefully followed the EMMP guidelines.

- ECOFISH II ensured to meet EMMP requirement or exceed the requirements complying with the approved EMMP guideline.
- Activities that are Categorically Excluded like training, community mobilization, other capacity building activities, studies, academic or research workshops or meetings, and document and information transfers are those for which no environmental impacts are expected.
- The EMMP establishes a Negative Determination with Conditions for activities that have the potential for negative impact on the environment but where the inclusion of mitigation measures can prevent significant impacts.
- The EMMP does not identify any proposed activities that have the potential for a significant effect on the environment (Positive Determination), requiring an Environmental Assessment.

7 Monitoring, evaluation and learning (MEL)

7.1 Summary of results: USAID and ECOFISH indicators

ECOFISH II helped in achieving the predefined USAID standard and ECOFISH II custom indicators (Table 11 and Figure 35) as a result of assistance from the USG.

Table 11. Summary of ECOFISH II results to date with performance monitoring standard indicators.

Indicators	Target	Achievement	Achievement (%)
Standard indicators			
EG.10.2-1 Number of hectares of biologically significant areas showing improved biophysical conditions as a result of USG assistance	78,200	74,966	96
EG.10.2-2: Number of hectares of biological significance and/or natural resources under improved NRM as a result of USG assistance	173,840	162,334	93
EG.10.2-3: Number of people with improved economic benefits derived from sustainable natural resource management and/or biodiversity conservation as a result of USG assistance	1500	14,480	97
EG.10.2-4: Number of people trained in sustainable natural resource management and/or biodiversity conservation as a result of USG assistance	3000	3214	107
EG.10.2-5: Number of laws, policies or regulations that address biodiversity conservation and/or other environmental themes officially proposed, adopted or implemented as a result of USG assistance	1	1	100
CBLD-9: Percentage of USG-assisted organizations with improved performance	85%	80%	94%
Custom indicators			
Number of species newly appeared or reappeared or improved in fishers' catch along the coast of Cox's Bazar as a result of USG assistance	5	5	100
Percentage increase in hilsa and other important marine species (CPUE) along the coast of Cox's Bazar as a result of USG assistance	5%	6%	120
Number of fishing households practicing better fisheries management	3000	2843	95
Number of households with increased food and nutrition security (Household Dietary Diversity Score and Food Consumption Score) as a result of USG assistance	3000	2750	92
Number of households with improved well-being and diversified sources of income as a result of USG assistance	3000	2780	93
Number of people gaining employment from sustainable fisheries management	500	490	98
Number of youths with access to improved technologies and market links in ZOR sites as a result of USG assistance	200	91	46

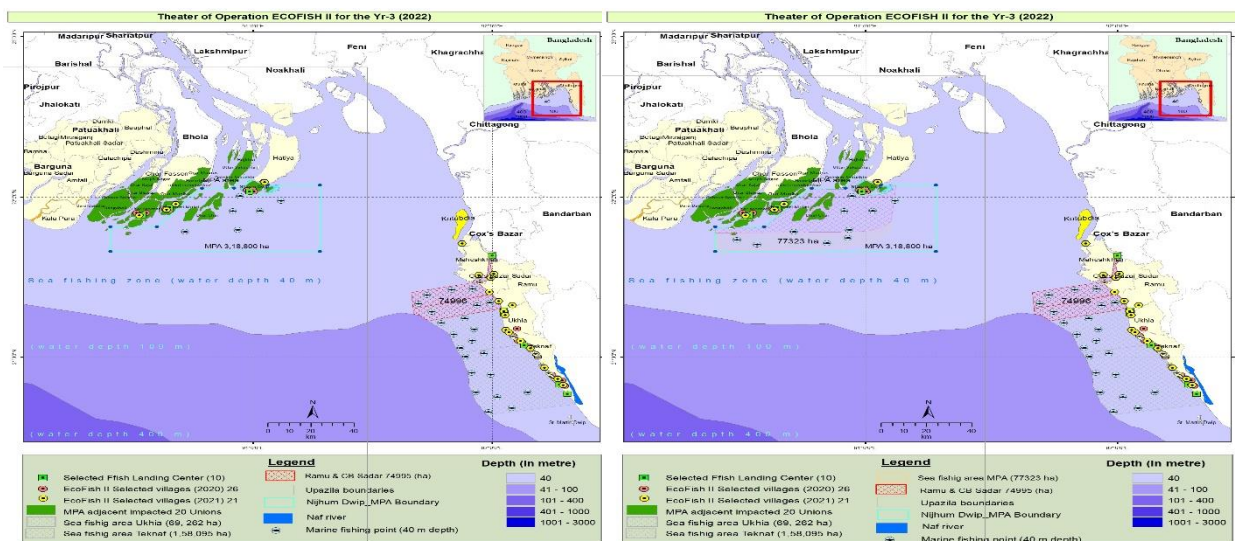


Figure 35. Biophysically and NRM improved areas as result of USG assistance.

In 2022, the overall target biophysical improvement area was of 78,200 hectares, but ECOFISH II achieved 74,996, so the deviation was less than 10 percent. The area was measured using Arc GIS and validated with the existing 40 m depth zone of EEZ designated for the artisanal fisheries. The major threats of coastal biodiversity include an indiscriminate catch of juvenile and brood of commercial fish species, alarming bycatch of megafaunas, and ecosystem health deterioration due to pollution. ECOFISH II activity generated scientific information to support ecosystem health and fisheries biodiversity improvement applying the ecosystem approach to fisheries management (EAFM) using co-management as a tool engaging all stakeholders in fisheries management initiatives in the Bay of Bengal.

The target for improved NRM was 173,840 hectares, but achieved 162,334, so, the deviation remains less than 10 percent. These co-management building blocks are contributing to ecosystem improvement by adopting responsible fishing practices. The fishers and other stakeholders learnt how to involve in biodiversity conservation in the targeted ecosystems. Trained boat skippers are also contributing to the ecosystem improvement by defusing the conservation knowledge to the fellow crew members and ensure the responsible fishing practices following the FAO's code of conduct on the responsible fishing (CCRF) for sustainable fisheries.

To monitor the fish abundances in fisher's catch, ECOFISH II engaged 40 Citizen Scientists (trained boat skippers, equipped with Smartphone and Bangla Aps), who provided all the information, especially species-wise catch composition of their harvest directly to the ECOFISH, WorldFish database. The data are very reliable and important to monitor the fish abundance through estimating catch per unit effort (CPUE), which is very important for fisheries management decision-making.

ECOFISH II engaged 3,000 fishing households in biodiversity conservation initiatives through training and motivation. Fisher's (boat skipper) training program on biodiversity conservation and responsible fishing practice was a big step towards improved fisheries governance. Skippers can later guide their crew members to comply with fishing regulations, operate safely, and maintain responsible fishing practices. So far, ECOFISH II provided training to 319 boat skippers in 11 batches in Barguna, Patuakhali, Charfasson, Cox's Bazar Sadar, Ukhiya, Teknaf and Moheshkhali. Besides, awareness-raising meetings, rallies, documentary shows, banners and posters with conservation messages, stakeholders' acquaintance, and regular patrolling of the river were successfully implemented.

As a special effort on Hilsa conservation, awareness building activities were conducted focusing on brood Hilsa protection and Jatka (juvenile) conservation. ECOFISH Scientists participated in the

discussion on TV Talk Show highlighting Hilsa conservation, wrote newspaper article on megafauna conservation, distributed more than 20,000 leaflets and posters to highlight the necessity of the brood Hilsa protection. Similar efforts were provided for the major riverine catfishes conservation focusing on the juvenile protection in the lower Meghna River ecosystem.

To strengthen the efforts, the local youths are motivated and engaged to be associated with ECOFISH II as “Blue Guard” to reduce plastic and net materials (Ghost gears) for the ecosystem improvement. So far, 129 Blue Guards (25% women) have been engaged in Cox’s Bazar and Kuakata. In this reporting period, they have removed about 16 metric tons of wastes, including 03 metric tons of discarded net materials from the coastal region, which contributed to improve the coastal ecosystem health.

ECOFISH consider the marine protected area (MPA) as a good tool for effective biodiversity conservation. So, after supporting the declaration of the Nijhum Dwip MPA in the previous year, ECOFISH along with other stakeholders, developed sustainable management plan for the MPA and Govt. approved the plan for implementation. Moreover, in partnership with the Shahjalal University of Science and Technology, ECOFISH studied biophysical and socio-economic characteristics to assess the possibility of delineating a new MPA around the Naf River estuary. After the assessment, proposed a new MPA around the Naf River estuary.

Holistic efforts of ECOFISH II, together with other ongoing efforts of other stakeholders, the present marine catch is expected to increase from the present 0.681 million tons to 0.700 million tons in the next year. Hilsa production may reach to 0.600 million tons milestone from its present 0.565 million tons/year. Annual riverine catfish (Pangas) production may reach to 1,000 tons from the present 926 tons. Additionally, the Megafauna bycatch evidently reduced and released alive entangled turtles. Whatever the numeric figure, it is obvious that the biodiversity conservation efforts need to be continued for the sustainable coastal biodiversity and healthy ecosystem.

The catch per unit effort (CPUE) measured from the real-time digital catch monitoring data generated by the ECOFISH II Citizen Scientists. Considering the indicator reporting period (Sep 2021-Oct 2022), estimated CPUE showed an increasing trend in Year 3 compared to that of in Year 2. The CPUE for Hilsa was 22.4 kg/boat/day in Year 2 and the catch has been increased to 31.9 kg/boat/day in the ZOR, in Year 3. The CPUE for all artisanal marine species together was 671 kg/boat/day in Year 2, which has been increased to 806 kg/boat/day in Year 3, showing an increasing trend in the artisanal marine catch in this year. The trend estimated in the ZOR, may or may not be exactly the same for other coastal areas, but undoubtedly this reflect a positive growth in the marine fish production. This high positive trend of the marine catch, might be due to the direct impact of the implementation of the 65-day marine ban for the artisanal fisheries and the efforts to improve its compliances. ECOFISH II significantly contributed in improving the compliances, especially in ZOR due to the awareness building activities focusing on the ban periods for fishers and general peoples, including training of boat skippers, Citizen Scientists and Blue Guards.

The training indicator in the current year captured persons trained in natural resources management and/or biodiversity conservations through day-long training on fisheries conservation and different AIGA training. The activities set a target of 3,000 in 2022 and trained 3,214 people altogether, comprising 2,665 (82%) males and 549 (18%) females, which 104% achievement over the target. The number of people was calculated from the number of participants who attended the training on fisheries conservation, boat skippers and other AIGA.

ECOFISH II, in collaboration with Shahjalal University of Science and Technology (SUST), conducted a study from January 2020 to June 2022 to evaluate the potential of declaring the Naf River estuary as a MPA. During this study, data was collected on the environment, biodiversity, ecological habitats, fishing and socioeconomic conditions of fishers and found the area as very suitable for delineating the MPA. It may be mentioned that the new proposed MPA will be a complementary management initiative to the recently declared MPA around St. Martin’s Island, resulting in a holistic approach to

managing fisheries resources and megafaunas sustainably in the Teknaf-St.Martin peninsula. ECOFISH II prepared and submitted a stakeholder-driven MPA management plan to DoF with the collaboration of SUST to get approval from MOFL for the gazette. This management plan helps to provide a sustainable, practical and accountable framework for protecting marine biodiversity, sustaining productive fisheries and improving local livelihoods through an ecosystem-based and adaptive co-management approach.

In 2022, the project initiated fisheries management planning for FCG and strengthened capacity building in six boarder areas on governance, leadership, dynamism, organizational management, development activities and environmental adaptation. To measure the improved organizational capacity, an initial baseline assessment conducted in July 2021 and post-intervention assessment conducted in end of September 2022 for counting two types of disaggregation- number of organizations with improved performance as numerator, and number of USG - assisted organizations receiving organizational capacity development support as denominator. This indicator set a target of 100 organizations of USG - assisted organizations receiving organizational capacity development support (denominator) and 85 organizations with improved capacity (numerator), but the project achieved 100 as denominator and 80 as numerator, respectively. The percentage of USG - assisted organizations with improved performance achieved 80 percent as target was 85 percent, so no deviation was found. The project measured the organizational capacity index for co-management building blocks (CBOs) using scale of 100 points. Relative weights have been allocated to the six broader areas and that for specific indicators within each area based on prior experience regarding their relative importance in FCG capacity development process. Using the scale points, relative weights have been allocated to the seven broad areas and that for specific indicators within each area based on prior experience regarding their relative importance in CBOs capacity development process.

7.2. Basic household information

ECOFISH II selected 20 fishing villages in the ZOR and 7 in the Nijhum Dwip MPA. This was done based on aggregating the fishing households and the willingness of fisher communities to participate in conservation practices, as well as the geophysical suitability of the villages. ECOFISH II followed a coherent [GIS-based approach](#), using Google Earth, to finalize 23 villages for Year 3 interventions. For an initial assessment, both the census data and needs and preferences for AIGAs were completed in the ZOR and MPA. The project achieved the 3000 household profiles by collecting basic information from every household and storing them in the database under five districts (Cox's Bazar, Noakhali, Bhola, Barguna and Patuakhali) in coastal area of Bangladesh where 73% beneficiaries in Cox's Bazar Districts of Year-3. A higher percentage of the population lives below absolute poverty line in the coastal area according to the selection criteria. The average size family size in the fishers' households is about 6. About 96% house in the fishers' community have been made of Mud floor and 77% house made of bamboo and tin wall. The roof of these house built by Tin and Polythin/tarpaulin. Remarkable portions (43%) of household have not any own household land, living mostly in government Khas land (17%). They have little (13%) homestead pond in their households where 8% own household pond. Fishing found as the primary occupation (97%) in the study under five Districts. Among the 3000, fishers' household 1806 have at least one fisher identity card. The Fisherman members in the families average 16 years fishing experience and average age of Fishermen are 42. The fishers assemble in boats as a shared or hired fisher and fishing in sea for marine fish. Around 89% were working in other boat, only 10% have own boats for fishing. But, during the fishing ban period most of the fishermen worked as a day labor (59%) for the few time. At this situation majority of the Fisherman took loan from relative (42%), Partake lower quality food (37%), reduce food intake (36%), and take consumer goods on loan (27%) and other related coping strategy. Fishing is the major income sources at selected fishers' households.

7.3. Annual performance survey of fishing HHs

To measure different standard and custom indicators, an annual performance survey has been conducted for 550 sample fishers' households involving 3842 HHs since Year-2. This assessment covers the level of applying or adopting diversified livelihood opportunities, AIGA activities, better management practice as a result of participation in ECOFISH II training, and other project-supported activities. Survey results revealed that the average income from fishing (fish income), other income, and total income of fisher households increased significantly compared to the baseline. After the project intervention, fish income for fisher households increased to BDT 12,287 per household, which was 14% higher than the baseline (the threshold income BDT 92,828/household). The total income of fisher households was increased at BDT 34,549 per household, which was 37% higher than baseline. It is also reported that after involvement in the ECOFISH II project, the average number of income sources increased from 2.62 to 4.30, which was 64% more than compared to baseline status at 1% level.

In FY 2022, the ECOFISH II Activity targeted 15,000 household members (3,842 households) to ensure improved economic benefits and ensured the benefits of 14,531 household members, of which 7,304 (50%) were men and 7,227 (50%) were women. ECOFISH II provided supports to increase the income of these targeted households for improving the household wellbeing. ECOFISH II trained men and women from fishing households on the selected enterprises and ensure access to the technologies available and finance. ECOFISH II supported the fishing households to make the enterprises profitable and linked with the markets for getting fair prices. ECOFISH II provided livelihood supports (productive assets) to the 3,842 households as the start-up capital to run their respective business. The project also built the adaptive capacities that helped them to cope with climate-induced shocks and stressors. However, these households also received benefits from the sustainable fisheries production of the Bay of Bay Bengal.

The project increased nutritional knowledge and adopted better nutritional practices. The dietary diversity of the household was 5.35 in baseline, and it has increased to 6.90, which was 29% more than the baseline. Households that adopt better fisheries management practices start or improve and follow compliance with government rules and regulations for fish conservation. The Activity builds targeted householders' capacity on improved natural resources management (NRM) and AIGAs through training sessions and group learning sessions, group meetings, and exchange. Sample survey results also revealed that after involvement in the project, 95% of households (2843) followed better management and learned how to combat IUU fishing.

8 Implementation challenges

- Market and business model development for dried fish, seaweed and green mussel takes time and need to identify business stakeholders.
- Fishermen are not enough skilled for other works that limit the options for AIGAs i.e. limited choice for alternative income
- Engagement of public and private stakeholders in Blue Economy initiatives is a big challenge, which will take longer time for mainstreaming.
- To develop diversified aqua food-based products (fish powder, fish/seaweed/green mussel-based product), their acceptability, efficiency/efficacy, and development of the market niche.
- Capacity building of boat skippers on biodiversity conservations is a challenge during the normal fishing hours.
- Formation and strengthening of co-management committee/groups at village or landing center (Ghat-based) is crucial which will take longer time.
- CSG formation within fishers' communities in the Nijhum Dwip MPA site due to lack of formal financial institutions (e.g. bank) in the remote islands.

- Multi organizational involvement in host communities in ZOR, Cox's Bazar with less coordination is a challenge.
- The conservation and protection of riverine catfish juveniles' habitat necessitate the development of a strategic management plan by the relevant stakeholders.
- Ensuring safety and security measures of boat skippers and fishermen at the sea.
- Women in ZOR find difficulty in joining in CSGs due to social and local cultural norms. Sustainability of CSGs is a big challenge.
- WASH system is poor and need for safe drinking water and sanitary facilities.
- Cyclone Sitrang damaged beneficiaries HHs and crops, beneficiaries yards drowned under salt water resulting salt water intrusion, increased soil salinity which hampered vegetable cultivation by the HHs.
- This year, less landing of fish causes late procurement of raw fish for safe dried fish production.
- Activities in the Nijhum Dwip MPA are difficult to follow up due to its remote location and poor accessibility.
- Pollution from effluents and the garbage in Dhaka could threaten biodiversity, including hilsa.

9 Integrating crosscutting issues and USAID forward priorities

9.1 Gender equality and women's empowerment

Gender is a crosscutting issue in ECOFISH-II, the project highlights gender equality and women empowerment in its yearly plans and has observed women's contribution in livelihood improvement. During the community profiling project identified existing gender gaps (women's lack of access to finance, conservativeness of women, lack of women's participation in IGAs, lack of opportunity for training etc.) in the fisher communities and to minimize those gender gaps, ECOFISH II provided women-friendly livelihood input supports (small livestock & poultry rearing, tailoring, vegetable gardening, dry fish business etc.), formed community savings groups, involved young boys & girls in biodiversity improvement of the Bay of Bengal. ECOFISH-II supports fisher's women of the intervened fishing communities to bring them together under one umbrella, encourage savings habit & invest money to start income-generating activities, improve literacy level as well as develop their capacity in different alternative income-generating activities. In Year-3, 17 new CSGs were formed with 532 fisher's women of ZOR and MPA. Up to December 2022, 69 CSGs saved BDT 3725799 including their own savings and matching fund. To support AIGAs team distributed BDT 540,000 among 84 CSG members. These small grants are helping fisher's women to contribute to their family income and nutrition.

In addition to regular CSG activities, ECOFISH II continued monitoring of BLS weekly sessions to improve the business literacy of CSG members. The aim of this training was to provide an overview of the 24 sessions of BLS. Fisher's women find this activity very useful to improve business literacy, learn basic education, to understand the importance of safe drinking water, sanitation, dietary diversity, nutrition of mother and child, family planning, become aware of child marriage, gender-based violence, dowry, biodiversity conservation etc. throughout 24 weekly sessions.

Fisher's women are actively participating in different trainings and awareness building meetings. Team ensured 11%, 28%, 50%, 26%, 100%, women's participation in training on biodiversity conservation, FCG training meeting, AIGA training, beach cleaning and producer group meeting respectively. To support fisher's women contribution in fisheries sector, 300 fisher's women were selected to produce safe and hygienic dried fish. On trial basis, a savings group was formed with 30 fisher's

women in ZOR. The aim of this savings group is to initiate loan activities, so that they could invest that money in their business.

This year ECOFISH II organized different events to observe International Women’s Day along with fisher’s women of CSGs, dried fish PGs, seaweed farmers, CFG & Blue Guards, govt. officials, representatives of local government and local elites etc. at upazila and community level with the theme “Gender equality today for a sustainable tomorrow”. Seven events were organized in CXB Sadar, Ukhiya, Teknaf, Moheshkhali, Charfassion, Patuakhali and Barguna with 306 participants (95% female). Fisher’s women and children spontaneously participated in different games and art competition. In addition, Research Associate of ECOFISH II, gave a presentation on **women-led climate resilient technologies intervention** at the [Fish4Thought](#) event "[Gender-inclusive innovations for aquatic food system transformation](#)," which was hosted by WorldFish HQ on the occasion of IWD 2022. On the eve of International Women's Day, WorldFish published an online blog titled [Empowering women as agents of change in hilsa conservation](#). ECOFISH-II senior team participated in a Gender CLA Workshop with different implementing partners of USAID and shared a presentation on gender-focused activities of the project.

On the eve of the International Year of Artisanal Fisheries and Aquaculture (IYafa 2022), ECOFISH II organized Artisanal Fishers Congress, where CSG champions and leaders from different coastal districts participated to share their experiences and discussed on how to ensure sustainable use of artisanal fisheries as well as to improve the resilience of poor fisher’s livelihoods. In that program, best CSGs and champions were highly recognized for their contribution in livelihood improvement and biodiversity conservation. A write-up was published in the business standard as “access to finance key to empowering fishing community women”

<https://businesspostbd.com/opinion-todays-paper/access-to-finance-key-to-empowering-fishing-community-women-2022-07-23?fbclid=IwAR03CY1Ae0qaegf6sasv0ifzuLYhkf-gxeuPcsbP7k1Mb96GihziQViiHJM>

ECOFISH II team organized an awareness meeting to celebrate the “International Day for the elimination of violence against women” (Figure 36) with fishermen (40%) and fisher’s women (60%). Discussion was held on the commonly occurring violence in Bangladesh and men’s role to reduce violence against women, conflict resolution in the family, women’s rights and child marriage.



Figure 36. Celebration of the “International Day for the Elimination of Violence against Women.”

9.2. Sustainability mechanisms

The following steps have been taken to ensure the sustainability of the project:

- Mainstreaming the co-management committees with other activities of the Department of Fisheries. ECOFISH II is trying to formulate a LoA or any form of cooperation agreement with DoF to implement the project activities in collaboration with DoF that will ultimately improve the sustainability of ECOFISH II outputs.
- Formation of Fisheries Management Committee (FMC)/Fisheries Conservation Groups (FCGs) in all intervened fishing villages.
- Strengthening the capacity of formal and informal institutions (i.e. CSGs & CFGs) and linking with DoF or Govt. Cooperative activities.

- AIGAs, community savings and small soft loans for women in fishing villages will be continued.
- Revised version of the Hilsa Fisheries Management Action Plan (HFMAP) will serve as guidelines for Hilsa fishery and biodiversity conservation until 2030.
- Management of the MPA in the Nijhum Dwip and facilitating to delineate another MPA in the Naf River estuary that would sustain the benefits of the biodiversity conservation approach.
- Policy support in selecting the most effective Brood Hilsa Ban period and continued support in implementing the allowable mesh size regulation (6.5 cm) for Hilsa gillnetters will ensure sustainable Hilsa management.

9.3 Global climate change

As continued supports, ECOFISH II strengthens the resilience and adaptive capacity to climate change by supporting sustainable and climate resilient fisheries, AIGAs, gender equality and increasing social capital of the fishing communities. ECOFISH II in partnership with CVASU monitored water quality parameters, the impact of salinity intrusion, water level rise, temperature rise and increased frequency and magnitudes of cyclonic storms would be considered with greater importance to cope with the obvious climate change related issues. ECOFISH II started intervention in the most climate vulnerable area, the St. Martin Island to generate scientific information and management to combat climate change. The project continued efforts on developing the adaptive capacities of the targeted fishing households to cope with climate-induced events like cyclones, heavy rainfall, and other calamities.

9.4 Policy and governance support

ECOFISH II project has been implementing in close collaboration with different departments of the Government of Bangladesh, DoF, universities, national and international NGOs, private organizations to carry out the program sustainable manner. Policy support in selecting the most effective Brood Hilsa Ban period and continued support in implementing the allowable mesh size regulation (6.5 cm) for Hilsa gillnetters will ensure sustainable Hilsa management. These policy supports will remain to be enormously useful in biodiversity conservation year after year. ECOFISH II prepared the Nijhum Dwip Management plan and submitted it to the Ministry of Fisheries & Livestock (MoFL) through the Department of Fisheries. The government has approved the management plan and ECOFISH II started implementation in the Nijhum Dwip MPA. In addition, ECOFISH II in partnership with SUST assessed the Naf River estuarine area and proposed a new MPA covering 860 km² area, arranged stakeholder discussion, updated the proposal and DoF has taken the responsibility to move it forward to get approval from the MoFL.

9.5 Local capacity development

Capacity building of project staffs, paid volunteers, target beneficiaries/groups and different awareness building initiatives/events were a continuous effort in ECOFISH II project to achieve the project objectives. Different trainings, meeting, awareness events and learning sessions organized for the project beneficiaries/groups. During the reporting year 2023, so many capacity building/awareness events organized, some of are: capacity building initiatives of Boat Skippers (13); First Aid training (4) & kits distribution; FGD for FCRA and RRAP (12); Fishers training on biodiversity conservation (76); FCG Training Meeting for Y2 beneficiaries (97); Savings Group Meeting (218); AIGA Training (37); Producer Group meeting (14); awareness program on Jatka, Pangas and Hilsa ban; beach cleaning events; day celebrations, Vaccination Campaign; basic ToT on Business Literacy School (BLS) facilitator, Refreshers training with BG, CS and LCF.

9.6 Public private partnership and Global Development Alliance impacts

From the beginning of the ECOFISH II implementation, several consultations meeting were convened with private entrepreneurs, DoF, Universities, fishers' associations to explore the potential of private public partnerships (PPP) that create favorable business opportunities along the fish value chain and for high-potential AIGAs. In partnership with CVASU and DoF, the project is continued contributing in seaweed farming in ZOR and supporting the fishing communities in ZOR for seaweed and green mussel farming as AIGA. These types of partnership initiatives have been continuing in seaweed and green mussel farming with CVASU, quality dried fish production with NSTU and fish catch monitoring at the BFDC Ghat, Cox's Bazar.

9.7 Science, technology and innovations

To generate high quality management oriented scientific information to support decision making for sustainable fisheries management, the project integrated 'improved science outputs for decision-making' component through assessing and improving ecosystem health, assessing and conserving biodiversity, and fisheries dynamics monitoring activities. These activities are implemented in partnership with CVASU and SUST. In addition, the project developed some farming and production technologies for alternative income generating activities (AIGAs) through 'research in development'. Key achievements in science and innovation as the continued effort of the project are summarized below:

- The qualitative and quantitative information generated on coastal fish diversity targeting vulnerable fish and megafauna' species will get management priority.
- Juveniles' information will guide in determining the breeding season of the important commercial fish species to help government in fine-tuning the marine fishing ban.
- The innovation in seaweed farming technology disseminated to coastal communities that might be generating employment and income, and supporting the families to build resilience. This would help reducing the fishing pressure on coastal marine fisheries.
- Identification of spawning and nursery grounds of river catfish, Pangas, along the Meghna river systems carried out under this activity, would help the DoF to introduce appropriate management measures.
- Through biophysical and socio-economic information around the Naf-St. Martin's Island areas, sustainable management plan would be formulated to help manage the biodiversity hotspots covering both the Naf estuary and St. Martin's corals reefs.
- Finally, the continued efforts on the innovative digital approach "Citizen Science" in catch monitoring would generate new tools for sustainable resource management involving the fishers.

10 Stakeholder participation and involvement

The Activity continued partnership with the Department of Fisheries, four Universities and with NGO, Shushilan. In all cases, relevant officials, fishers and other local stakeholders played important roles in planning, implementing and assist to implementing the activities. Many of following important stakeholders' consultation meetings, visits (DoF, USAID's and WorldFish's team) and other discussions held during the reporting year of 2023:

- ECOFISH II hosted a [learning visit organized by USAID Bangladesh](#) for journalists, students, and teachers from the Department of Mass Communication and Journalism at the University of Dhaka and the Independent University of Bangladesh.

- The Deputy Secretary from the Ministry of Agriculture, representing the Department of Agriculture Marketing, paid a visit to the ECOFISH-II dried fish intervention in Matherbuniya village, Ukhiya, and met with dry fish producers.
- Organized a daylong seminar on Seaweeds & Green Mussels Farming and Blue Food Festival on 19 March at Seagull Hotel, Cox's Bazar. Scientists, researchers, academicians, entrepreneurs, policymakers, seaweed farmers, traders, consumers, processors, chefs, and other stakeholders participated.
- On 18 January 2022, Mr. Jillur Rahman, DD-DoF, Dhaka, DFO-Shariatpur, and SUFO Naria paid a visit to the Resilient Model Fishing Village, Haloishar, Naria, Shariatpur. The ECOFISH II team briefed the team about the supports provided by ECOFISH and discussed the outputs/results. The team also attended the river catfish conservation awareness programs and launched a combing operation in the Pangas breeding grounds to combat the use of illegal gear.
- Dr. Satoshi Chikami, Senior Advisor, Fisheries Development Advisor JICA-FDA team visited ZoR-CXB and observed the ECOFISH II activities including seaweeds and green mussels farming and livelihoods support program.
- With the request of BFDC, ECOFISH II CXB Sadar team trained 60 dry fish producers of Nazirartek on "Safe dry fish production and marketing" under the project on "Dry fish processing industry establishment in Cox's Bazar".
- ECOFISH II CXB Sadar team participated and shared opinion in a "Citizens' Dialogue" to reduce post-harvest loss and proper marketing of marine fish, which was organized by the DoF under "Sustainable Coastal and Marine Fisheries Project" at Upazila Parishad Conference Room, Cox's Bazar.
- ECOFISH II team participated in a meeting on 'to explore possibility of declaration of Hilsa spawning ground in Baleshwar River' in the presence of the honorable Minister (MoFL), Secretary, high officials of DoF, BFRI and other stakeholders at Hotel Pan Pacific Sonargaon, Dhaka dated on 7 February 2022.
- A meeting on 'dried fish business model' organized (virtually, dated on 13 April) with Department of Agriculture Marketing (DAM), BSMRAU, NSTU, private entrepreneurs, and identified potential opportunity for collaboration.
- Extended full support to FAO photography team visited in Cox's Bazar from 04-05 April 2022 to capture photos for the International Year of Artisanal Fisheries and Aquaculture. The team observed the production system and conducted photography by visiting ECOFISH II seaweed site at Nuniarchora and Seaweed-green mussel site at Rastarpara, Khurushkul. The team also visited BFDC fish landing center, Nazirartek Ghat, and the Fish drying yard at Nazirartek.
- The team assisted another FAO team visit led by Dr. Abul Hasanat (National Program Coordinator) and Mr. Mutisungilire Kachulu (Senior Technical Advisor) in the seaweeds and green mussels farming sites at Nuniarchora, Cox's Bazar. The team visited the site and discussed with ECOFISH II beneficiaries on various aspects of seaweed farming, drying, marketing and processing.
- Team Leader of ECOFISH II participated in a roundtable consultation policy dialogue on "Blue Economy: Prospect of Institutionalization the National Progress" held on 14 May 2022 at Carnival Hall, Banghabandhu International Conference Center, Sher-e-Bangla Nagar, Dhaka organized by Bangladesh Planning Commission (General Economic Division), International Economic Wing.
- Team Leader of ECOFISH II also participated in a policy workshop on Seabass farming and export potentials in Bangladesh.

- CXB Sadar team participated in a Workshop organized by DoF under Hilsa Resource Development and Management project at DC office Cox's Bazar. Also participated in an awareness program of "Citizens Meeting" organized by DoF at BFDC.
- ECOFISH II team participated in a meeting at ADC (General) office Cox's Bazar on celebrating World Environment Day on 05 June 2022. The ECOFISH II team has assured to extend full support to celebrate the day with District Administration, Department of Environment, Department of Forest, and other government and non-government organizations.
- ECOFISH II scientists participated in a discussion of the Hilsa Conservation and Development Fund (HCDF) Central Committee regarding the efficient operation of the funds. The meeting was chaired by the Director General, Department of Fisheries.
- Teknaf team conducted a meeting with respective UNO, SUFO, also meet with concern UP-member, Chairman & elites of the Saint Martin Island. Discussed on starting the ECOFISH II interventions in the Saint Martin Island MPA and sought their advice for smooth operation of the Activity.
- ECOFISH II organized a meeting with the team and partners on 22 June 2022 in Cox's Bazar for a potential "Marine Fisheries Blue Economy Initiative" (MaFBEI), with the goal of incorporating suggested interventions into the ECOFISH II work plan of 2023.
- Dr. Edward (Eddie) Allison, acting director of [Resilient Aquatic Foods Systems](#) of the WorldFish, visited the ECOFISH II fishing community in Rastarpara, Khurushkul Cox's Bazar. During his visit, Allison witnessed CSG-BLS work, observed the livelihood supports and household food systems. He also visited dried fish yard, as well as seaweed and green mussels farming sites. Prof. Allison also met with the Blue Guards, Citizen Scientist, Landing Center Facilitator, and trained boat skippers to observe their contribution to the biodiversity conservation.
- Representatives of USAID team, visited to the Cox's Bazar fishing communities of Teknaf and Ukhiya with the support of ECOFISH II team dated on 18 July 2022. The USAID team observed fishers women led Community Savings Group (CSG), Business Literacy School (BLS) training session, livelihood support to the poor fishers households, backyard homestead vegetable gardening, meet with Citizen Scientist, Boat Skipper, and Blue Guards.
- Team facilitated the field visit of Saimon Carter, Global Financial Controller of WorldFish HQ, Mallari Sally, Accounts Manager (Finance & Grants), and Tahamina Yesmin, Head of Finance on July 17, 2022 at Sonarpara Fish Landing Center and Nidania village in Ukhiya. The team observed CSG, BLS, Livelihood support, and Blue Guards' activities.
- Half-yearly progress review meeting held with university partners (CVASU, NSTU, SUST and SAU) dated on 28 July 2022 and presented their progress and shared next course of action.
- ECOFISH II team (Dhaka and CXB Sadar) participated in a workshop on "Revision of National Fisheries Policy 1998" at Hotel Sea Gull organized by WorldFish in association with DoF on 18 September 2022
- On September 9, 2022, a USAID team along with two high level guests from the Congress, Washington DC visited the BFDC Fish Landing Center and ECOFISH II given a brief presentation on the project activities, focusing on marine farming, Blue Guards and other landing center-based interventions. They also met Blue Guards, Citizen Scientists, Landing Center Facilitators and trained boat skippers to learn about the various aspects of biodiversity conservation, responsible fishing, and fishers' safety at sea, and collecting essential information about their fish catch through smartphones.
- Martin Van der Knaap, Chief of Party (CoP), Project Management Consultant (PMC) for World Bank funded Sustainable Coastal and Marine Fisheries Project of DoF and his team visited one of

the Resilient Model Fishing Villages at Uttar Bogula, Haimchar, Chandpur on September 14, 2022. The team explored how community-level fisheries management initiatives enhanced ecosystem wellbeing. The team also looked at how community-level co-management institutions functioned and the results of the first phase of ECOFISH's livelihood assistance.

- A Research Associate of ECOFISH II attended in an international training-workshop on “Climate Action Champions Network” held in Kathmandu, Nepal during 6-7 September. The event was supported by the US Department of State, which brought together 100 champions from five (05) South Asian countries, aiming at leading climate action initiatives and policy formulation in the South Asia and the Indo-Pacific regions.
- WorldFish HQ colleagues (Kek, Cherry & Wong, Irene) visited BFDC fish landing center on 20 September ECOFISH II team facilitated them. Besides fish landing, the HQ team observed ECOFISH II science and awareness activities at BFDC landing center.
- ECOFISH II attended in the sub-national consultation program on “Voice of the Local Citizens: Investment for Sustainable Blue Economy in Bangladesh” held in Chattogram during 24-26 September organized by the General Economics Division (GED) of Bangladesh Planning Commission. In the event, how the private sector can be involved in marine ecosystem and biodiversity conservation and invest in the country’s blue economy development were discussed.
- ECOFISH II team member of Cox’s Bazar Sadar attended in the quarterly Ecologically Critical Area (ECA) meeting at Nirbahi Officer’s Office of Cox’s Bazar Sadar Upazila on 20 September and 27 September.
- Assisted SUST to organize a workshop on “The proposed fishery focused MPA around the Naf River Estuary, Teknaf, Cox’s Bazar” that was held on 24 October 2024 at the conference Room, Department of Fisheries (DoF), Bangladesh with the presence of Mr. Md. Atiar Rahman, Additional Director General, DoF, Bangladesh and other senior officials of DoF. The goal of the meeting was to share and exchange the findings of the research conducted by the Shahjalal University of Science and Technology (SUST) under USAID/ ECOFISH II of WorldFish with the objective of declaration of the fisheries based MPA in and around the around the Naf River Estuary, Teknaf, Cox’s Bazar.
- ECOFISH II in collaboration with SUST facilitated a high-level meeting involving the Department of Fisheries (DoF), USAID Bangladesh and WorldFish on November 8, 2022 at the Conference Room, Matshya Bhaban, Dhaka. The Director General, DoF, the Director of the Economic Growth Office, USAID, and the Regional Director, WorldFish Bangladesh and South Asia led their respective team. ECOFISH II team briefed the progress of major activities; DG-DoF highlighted the Bangladeshi government's current priorities regarding marine and inland fisheries management, biodiversity conservation, and Blue Economy initiatives. Both Director General, DoF and Director, Economic Growth Office, USAID appreciated the contribution of ECOFISH Activities for Hilsa and other coastal fisheries improvement and enhancing food security of coastal fishers.
- An annual work-planning meeting of ECOFISH II held on 16 November 2022 for the year of 2023 at Six Season Hotel, Dhaka. Director General of Department of Fisheries (DoF) with two senior colleagues attended as Chief Guest and provided valuable feedback and suggestions for ECOFISH II Activity. Four member from the USAID includes Environment Team Lead, ECOFISH II Activity Manager, Alternate Activity Manager and later Director of Economic Growth office, Dhaka, Bangladesh provided important feedback and comments. Regional Director of WorldFish Bangladesh and South Asia office, WorldFish Head of Finance, COP WorldFish USAID Bangladesh Aquaculture Activity and ECOFISH II field and Dhaka based staffs were attended the meeting and provided valuable feedback.

- ECOFISH II Activity showed its wide range of initiatives through a photo exhibition and the screening of a video documentary at the Bay of Bengal Conversation, held at the Pan Pacific Sonargaon on September 21–23 in Dhaka and organized by the Center for Governance Studies (CGS). US Ambassador to Bangladesh his Excellency Peter D Haas and distinguished guests visited the photo exhibition of WorldFish Bangladesh ECOFISH II activity. Dr. Md. Jalilur Rahman and Dr. Nahiduzzaman, scientists with ECOFISH II, took part in the ‘Speed Talk’ session titled, "Are we rightly managing and sharing the fish in the Bay?" The transboundary fishery crisis in the Bay of Bengal.
- Expert consultation workshop on “The proposed Marine Protected Area (MPA) around the Naf River Estuary, Bangladesh” held on 24 November 2022 at Conference Room of Department of Fisheries (DoF), Matshya Bhaban, Dhaka organized by DoF and USAID funded ECOFISH II Activity. The goal of the meeting was to feedback from the experts on declaration of a MPA at the Naf River Estuary of the Bay of Bengal, Teknaf, Cox’s Bazar. The Director General of DoF chaired the meeting. Other expert consultants from DoF, Universities (BAU, SUST, SAU, CU, JU), WCS, USAID Bangladesh and WorldFish were participated. Many recommendations were noted, most appropriate would be considered for the improvement of the proposal.
- Climate Action Champions Network (CACN) team visit in ZOR. ECOFISH II Cox’s Bazar Sadar team organized the field visit of CACN team consisting of 40 members along with US Embassy delegates and Journalists at Rastarpara Model Fishing Village, Khurushkul on December 10, 2022.

Key implementing partners (Universities and NGO) and their sub-projects, activities and their progress made so far are shown in Table 12.

Table 12. Major partners, their objectives/activities and progress to implement ECOFISH II Activity

Sl #	Name of Partners	Name of Sub-project	Progress in brief
1	Chattogram Veterinary and Animal Sciences University (CVASU)	Community-based Blue Food Production through seaweeds and green mussels farming	CVASU has designed their study on seaweed and green mussel farming to achieving 06 milestones on (i) Maintenance of new and old culture systems in a participatory approach (ii) quantification of existing market volume of seaweed/green mussels and expansion of existing marketing demands (iii) Development of site suitability maps and site capability rating system (iv) Establishment of the new culture systems of seaweed and green mussels (v) Development of seaweed/green mussel farming and business entrepreneurship (vi) Harvesting, data analysis, marketing and report writing. Most of targeted activities has finished except few and extended (no-cost extension) their agreement up to February 2023 to ensure rest of deliverables like (1) Scientific Manuscript (2) 2.Seaweed farming and supply chain guideline and (3) Data set.
2	Chattogram Veterinary and Animal Sciences University (CVASU)	Fish biodiversity assessment in the climate-focused areas of Bangladesh	CVASU has designed their study to achieving 5 Milestone on (i) Development of the detailed methodology & Collection of larval samples and preservation in the laboratory (ii) Collection of larval samples and preservation in the laboratory up to June, 2022 & Identification of the larvae family or genus or species level up to June, 2022 (iii) Assessment of the water quality parameters & link with seasonal abundance of fish up to September 2022 (iv) Confirmation of identified samples up to genus (DNA Bar-coding) and (v) eDNA assessment. Most of targeted activities has finished except few made no-cost extension up to April 2023 to finish the tasks / deliverables on (i)

SI #	Name of Partners	Name of Sub-project	Progress in brief
			one scientific manuscript (draft) (ii) nursery ground Map and (iii) data set.
3	Noakhali Science and Technology University (NSTU)	Diversification of ready-to-use fish and seaweed products and potential role in women empowerment and nutritional security	<p>NSTU has designed their study to achieving 04 milestones on (i) Development of the Standard operating procedure (SOP) for seaweed and fish powder production (ii) Species selection based on the nutrition, price and availability (iii) Ready to use food items and seaweed based products (brownies, smoothie, jelly) are produced (iv) Nutrition sensitive items are widely accepted by the end users and private sector. Most of milestones are achieved by NSTU. Rest of activities/deliverables will be achieved by March 2023.</p> <p>NSTU made no-cost extension up to March 2023 to ensure Task/Milestone-4, Final Technical Report and other deliverables like: (i) Scientific report on nutrient content of seaweed powder and acceptability of RTE products; ii) 4th quarterly report; iv) One scientific manuscript (draft), v) Extension leaflets, and vi) Final data set.</p>
4	Shahjalal University of Science and Technology (SUST)	Zoning of MPA for Saint Martin – Teknaf Peninsula through integration of stakeholders perceptions and scientific information vis-à-vis climate change	<p>As per agreement with SUST, it was designed the study to achieving 06 milestone on (i) Develop a detailed methodology of the tasks to be accomplished & to develop overview of social and economic status of registered fishermen (ii) Assessment of temporal dynamics of fish assemblage (iii) Exploration of resource use conflict resolution strategies (iv) Investigation of impacts on climate change on proposed MPA zones (v) Identification of sustainable adaptation options for local fishermen and (vi) An integrated management plan for MPA. Maximum commitments has done except few.</p> <p>SUST made no-cost extension up to June 2023 to accomplish the rest of the activities/deliverables on (i) submission of final Technical Report (ii) one scientific manuscript (draft) (iii) two workshop proceedings (iv) data set. As per no-cost extension agreement (addendum), additional/new deliverables has to submit on (1) 3 meeting minutes/proceedings, (2) updated 01 MPA proposal and (3) PowerPoint presentation on stakeholder consultation meeting/MPA proposal.</p>
5	Shushilan	Building resilience of the fishing communities through improving fisheries governance in the Bay of Bengal and the Nijhum Dwip MPA.	<p>As per agreement, Shushilan was committed to perform 12-15 host community selection, profiling and gender analysis in Ukha-Teknaf peninsula & Nijhum Dwip MR/MPA; conduct Survey and Survey data input; provide livelihood support to 1800 fishing households; Provide vegetable seed support to the 1200 fishing households; formation and operation of 15 fishers' women Community Saving Groups (CSGs); CSG monitoring for initial loan management for the CSGs of 2020-2022. Introduce business literacy schools (BLS) for the fishers' women CSGs; Conduct Training – Meeting of Year -2 Formation of Fishers' Conservation Groups (FCGs); Any other activities. Most of activities has completed successfully within time (January to December 2022).</p>

11 Management and administrative issues

Based in the WorldFish offices in Dhaka, the lead implementation team consists of the ECOFISH II Team Leader, three IR Scientists, a Gender Specialist, a Sr. Nutrition Specialist, a MEL Manager, a Project Manager, a Sr. Communication Specialist, and a Sr. Project Accountant. In the field level, seven Research Associates and eight Research Assistants have been implementing the project at nine coastal sites. The Field Offices are located in Cox's Bazar Sadar, Ramu, Ukhiya, Teknaf, and Moheskhali in the ZOR, Cox's Bazar; and in Patuakhali, Charfasson, Chandpur and Barishal in the MRE. At each of the offices, a 3-member team with a Research Associate, one Research Assistant, and an Office Assistant are deployed depending on the necessity.

12 Lessons learned

- Boat skippers training on biodiversity conservation was an important and effective step to build awareness on marine biodiversity conservation and responsible fishing.
- Artisanal fishers can play big role for co-management of fish landing centers and marine/coastal biodiversity conservations.
- Fish drying by poor fishers' women becoming a great scope of AIGA that would improve nutrition status of poor fishing communities.
- Enterprise development is the key to economic resilience of community by taking the advantages of blue economy.
- WASH system is poor and there are needs of drinking water and sanitary facilities.
- COVID-19 made the socioeconomic condition of the fishing households worse.
- Business literacy school (BLS) helped rural women in developing reading skills and simple calculation for managing their small businesses.
- Different types of ban periods (22 days' brood Hilsa ban, 65-days marine ban, and 61 days Jatka ban) severely affect the resilience of fishers' livelihoods.
- Host communities livelihoods and marine resources affected due to the Rohingya refugees' influx.
- Using supports of local community representatives are effective communication approach
- Existing challenges within the communities need to be addressed before setting or further implementation
- Market linkages for marine products are crucial for sustainability.
- Official ties of ECOFISH II with DoF through Letter of Agreement (LoA) may help in building more collaborative implementations of the activities, which will support more policy level contribution of the Govt.



The US Ambassador to Bangladesh, Peter Haas, visited the ECOFISH II photo exhibition at the Bay of Bengal Conversation in Sonargaon hotel, Dhaka on September 21, 2022

