THE WORLD BANK

Bay of Bengal Programme Inter-Governmental Organisation
91, St. Mary's Road, Abhirampuram, Chennai - 600 018. INDIA

Issues, Practices & Opportunities in the Application of Insurance as a tool for Marine Fisheries Management and to Build Resilience in the Sector in South Asia

THE WORLD BANK

Final Report submitted to the World Bank

Issues, Practices & Opportunities in Application of Insurance as a tool for Marine Fisheries Management and to Build Resilience in the Sector in South Asia

Bay of Bengal Programme Inter-Governmental Organisation
91, St. Mary's Road, Abhirampuram, Chennai - 600 018. INDIA
www.bobpigo.org

Project Lead / Coordinator

Dr. P. Krishnan
Director, BOBP-IGO, Chennai

Mr. Rajdeep Mukherjee
Policy Analyst, BOBP-IGO, Chennai

Advisers / Consultants

Dr. V. Rajagopalan IAS (Retd.)
Former Secretary, MoEFCC, GoI, New Delhi

Prof. Dr. Ramachandra Bhatta
Former Emeritus Scientist, ICAR; Ex-Division Chair, MoEFCC-NCSCM, Chennai

Dr. E. Vivekanandan
Senior Scientific Consultant, ICAR-CMFRI, Chennai

Expert Team Members

Dr. Kishore K. Dhavala
Associate Professor (Environmental and Resource Economics) , *International Students School of Ecology and Environment Studies*
Nalanda University, Bihar

Dr. Suchitra Upare
Coordinator, FAO- CAFI SSF

Dr. Shinoj Parappurathu, ARS
Senior Scientist (Agricultural Economics)
ICAR-Central Marine Fisheries Research Institute (CMFRI), Kochi, Kerala

Dr. A. Suresh, ARS
Principal Scientist (Agril. Economics),
ICAR-Central Institute of Fisheries Technology (ICAR- CIFT), Cochin, Kerala

Dr. Subhash Chand, PGMDE, ARS
Principal Scientist (Agril. Economics)
ICAR-National Inst. of Agri. Economics and Policy Research (NIAP), New Delhi

Dr. Prasanna Surathkal
Azim Premji University, Bengaluru

Dr. Sri Hari
Centurion University of Technology & Management, Odisha

Required Citation:

Krishnan. P., Mukherjee, R., Dhavala, K.K., Vivekanandan, E., Bhatta, R.C., Shinoj, P., Suresh, A., Chand, S., Surathkal, P., Sri-Hari, M., Suchitra, U., Rajagopalan, V. (2022). Issues, Practices & Opportunities in Application of Insurance as a tool for Marine Fisheries Management and to Build Resilience in the Sector in South Asia. BOBP-IGO, Chennai. October 2022.pp96

Funding

World Bank Trust Fund
(Contract No 7204358); May-Sep, 2022

Officials from National Governments

BANGLADESH

Dr. Md Sharif Uddin
Director, Marine Fisheries Office, Department of Fisheries

INDIA

Dr. C. Suvarna, IFS.
Chief Executive, National Fisheries Development Board (NFDB), Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying (MoFAHD)

Mrs. N. Chandra
Executive Director, NFDB

THE MALDVES

Mr. Adam Ziyad
Director General, Ministry of Fisheries, Marine Resources and Agriculture (MFMRA)

Mr. Ahmed Shifaz
Director, MFMRA

SRI LANKA

Mr. Dhammika Ranathunga
Director General (Technical), Ministry of Fisheries and Aquatic Resources (MFAR)

Mr. Sushantha Kahawatte
Director General, Department of Fisheries and Aquatic Resources, MFAR.

Preparation of the document

This report, "Issues, Practices & Opportunities in Application of Insurance as a tool for Marine Fisheries Management and to Build Resilience in the Sector in South Asia" is prepared by the Bay of Bengal Programme Inter-Governmental Organisation (BOBP-IGO) in response to the evolving climate risks and other risks in the marine fisheries sector and the need for building resilience in the South Asia region with a special focus on the Bay of Bengal region and the artisanal and the small-scale fisheries sector.

The project work is funded under a Grant received from the World Bank Trust Fund.

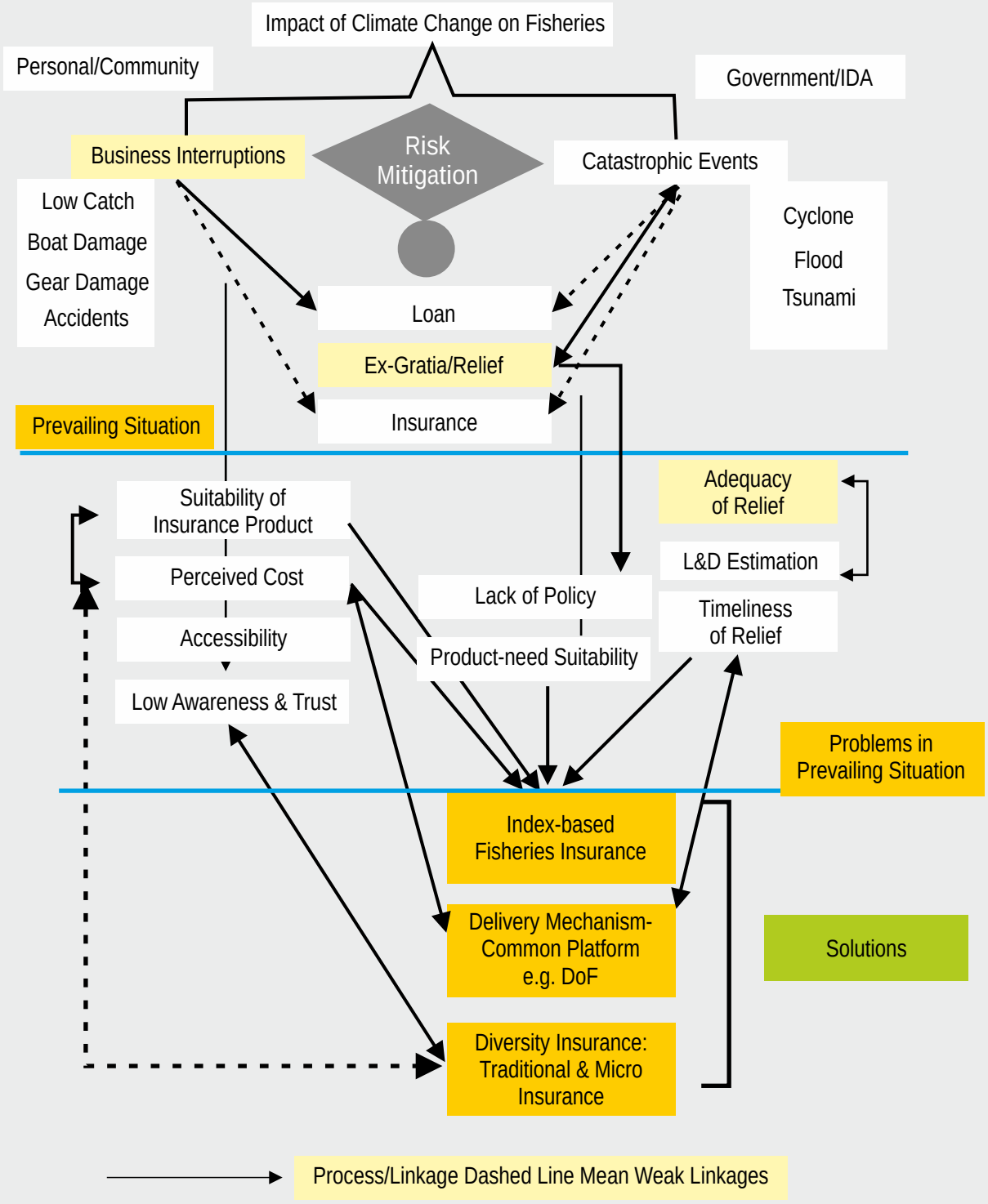
Layout & Design
BOBP Design Factory
E-Mail: bobpdesignfactory@gmail.com

Acknowledgement

The Study Team thankfully acknowledges the support received from the Ministries/ Departments of Fisheries of the Governments of Bangladesh, India, the Maldives and Sri Lanka in review of policies and coordinating with the stakeholders. We especially like to thank Dr. Md. Sharif Uddin, Director, Marine Fisheries Office, Department of Fisheries, Government of Bangladesh, and his staff; Dr (Smt.) C. Suvarna, IFS, Chief Executive, National Fisheries Development Board, Ministry of Fisheries, Animal Husbandry and Dairying, Government of India and her staff; Mr. Adam Ziyad, Director General (Fisheries), Ministry of Fisheries and Agriculture, Government of the Maldives, and his staff; Mr. Dhammika Ranatunga, Director General (Technical); Ministry of Fisheries and Aquatic Resources, and Mr. S.J. Kahawatte, Director General, Department of Fisheries and Aquatic Resources, Government of Sri Lanka, and their staff for their support to the study. We also thankfully acknowledge the support provided by the fishers and their associations from Bangladesh, India, Maldives and Sri Lanka without which, this study would not have been possible.

We are thankful to our reviewers for their time and extensive suggestions, especially: Mr. Tapas Paul, World Bank; Mr. Dhruba Purkaystha, Consultant, World Bank; Dr. R. Soundararajan, Principal Scientist (Rtd.), ICAR; Dr. P.S. Ananthan, ICAR-Central Institute of Fisheries Education (CIFE), Mumbai; and Dr. Amit Biswas, Indian Statistical Institute –Regional Centre, Chennai, Mr. Sudharshan, Institute of Ocean Management (IOM), Anna University, Chennai.

Logic Model for Matching Insurance with Current Problems



Contents

Abbreviations

Executive summary 1

Introduction 7

1.0 Context 7

2.0 Study methodology 9

3.0 Organization of the report 10

Section 2.0 Evolving climate risks in the region 11

2.1 Climate change risk projection 11

2.2 Intensifying cyclonic activities in the Bay of Bengal region 13

2.2.1 The intensity of the cyclones: 14

2.3 Increasing number of cyclones in the Arabian Sea 16

2.4 Conclusion 17

Section 3.0 Quantifying operational and disaster risks in the marine fisheries sector – Current status 19

3.1 The nature of marine fisheries in the region 20

3.2 Types of risks in fisheries 21

3.3 Value at risk – financial implication of various risk factors 21

3.4 Production risks 22

3.5 Life risks 23

3.6 Measuring the value of the physical assets 23

3.7 Prevailing governmental support to the sector and the scope of reallocation 25

3.8 Estimating loss & damage for emergency relief 26

3.9 Examples of DaLA estimation processes: 29

3.10 FAO's methodology for DaLA in fisheries 32

3.11 Estimated damage during weather events: India 33

3.12 Emergency relief: India 34

Section 4.0 Insurance as a risk mitigation measure: Status and scope 37

4.1 Role of insurance & policy implications 37

4.2 Types of insurance programmes 38

4.3 State of insurance in the region 40

4.4 National climate change and disaster mitigation policies and role of insurance 41

4.4.1 Bangladesh 41

4.4.2 India 41

4.4.3 The Maldives 44

4.4.4 Sri Lanka 45

4.5 Efficacy of national measures: Experience from catastrophic cyclones 46
4.6 Global and cross-sectoral experience with insurance 47
4.6.1 Agricultural insurance in Bangladesh 47
4.6.2 Agricultural Insurance in India 48
4.6.3 Fisheries insurance in Indonesia 50
4.6.4 Fisheries insurance in Malaysia 50
4.6.5 Thailand 51
4.2.6 Fishery mutual insurance scheme of Japan 51
4.6.7 Index-based insurance in the Caribbean project 52
4.7 Developing a better mechanism for risk management 53
Section 5.0 Strategies for enhancing coverage and penetration of climate risk insurance solutions 57
5.1 Methodology 57
5.1.1. Results from field Survey in India 58
5.1.2. Result from the focus group discussions 58
Bangladesh 58
India 59
The Maldives 63
Sri Lanka 65
5.2 Salient findings from the stakeholder consultations 67
5.3 Views of the insurance agencies 69
5.4 Lessons learned from the weather-based crop insurance schemes in India 70
5.5. Recommendations 73
References 79
Annexure 1: Measuring willingness to pay (WTP) for insurance premium **83**

List of Tables

Table 1:	Climate risk profile of South & South East Asia	8
Table 2:	Frequency and Probability of the depression, cyclonic storm and severe cyclonic storms in the Bay of Bengal region for the period 1990-2021	15
Table 3.	Cyclonic activities in the Arabian Sea	16
Table 4:	Average contribution of fisheries sub-sectors to the total catch in South Asia	19
Table 5:	Type of risk from climate change facing the fisheries sector	21
Table 6:	Value of marine fisheries production in the region in 2020	21
Table 7:	Marine capture production in South and South –East Asian countries from 2010 to 2020 (in '000 tonnes)	22
Table 8:	Value of fisher's life- simple calculation based on catch share	23
Table 9:	Total number of powered and non-powered fishing vessels	24
Table 10:	Annual profit/loss in marine fisheries	24
Table 11:	Value of fishing vessels operating from Chennai fishing harbour (Replacement Cost)	25
Table 12.	Financial support to the fisheries sector	26
Table 13:	Steps followed to assess the damage and loss of disasters	28
Table 14:	Damage assessment of the agro-industry in the cyclone Sidr affected areas of Bangladesh	30
Table 15:	Post disaster damage assessment of the two extremely severe cyclones Phalin and Fani affected areas in state of Odisha, India	31
Table 16:	State of Insurance market in the region	40
Table 17:	Total damages (in Billion USD 2021 prices) due to tropical cyclones in India and Bangladesh	46
Table 18:	List of stakeholder consultations and surveys	57

List of Figures

Figure 1.	Decadal fish production in South Asia	7
Figure 2.	Climate scenarios for South Asia	11
Figure 3:	Cyclonic disturbance in BOB during 1990-2021	13
Figure 4:	Monthly cyclonic disturbances for the period 1990-2021	14
Figure 5.	Cyclonic disturbance in the Arabian Sea during 1990-2021	16
Figure 6:	The study region	19
Figure 7:	Share of fishers in the rural population of the coastal districts of Tamil Nadu, India	20
Figure 8.	Oil sardine production in India during 1990 to 2020	22
Figure 9.	Regional cyclone warning bulletin from IMD	43
Figure 10:	Number of claims per 100000 beneficiaries in different states and UTs of India in 2021	56

Abbreviations

ABD	Asian Development Bank
BBS	Bangladesh Bureau of Statistics
BDT	Bangladeshi Taka
BHP	Break Horse Power
BOA	Boat Owner Association
BOB	Bay of Bengal
BOBP	Bay of Bengal Programme
CCRIF	Caribbean Catastrophe Risk Insurance Facility
CFH	Chennai Fishing Harbour
CM	Choice modelling
CMFRI	ICAR-Central Marine Fisheries Research Institute
COP	Conference of Parties
CPUE	Catch Per Unit Effort
CS	Cyclonic Storm
CVM	Contingent Valuation Method
D	Depression
DaLA	Damage, Loss and Needs Assessment
DaLA	Damage and Loss Assessment
DBDC	Double-Bounded Dichotomous Choice
DECO	Decompression
DIISP	Developing Inclusive Insurance Sector Project
DLNA	Damage, Loss, and Needs Assessment
DoF	Department of Fisheries
DRFI	Disaster Risk Finance and Insurance
EM-DAT	Emergency Events Database
ENSO	El Niño–Southern Oscillation
ESCS	Extremely Severe Cyclonic Storm
FAO	Food and Agricultural Organisation
FBY	Fasal Bima Yojana
FCA	Fisheries Co-operative Associations
FDWCS	Fishers Development Welfare Cooperative Society
FGD	Focus Group Discussions
FRP	Fibre-reinforced plastic
FWA	Fishers Welfare Association
GAIS	Group Accident Insurance Scheme
GDP	Gross Domestic Product
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Group Insurance Scheme
GoO	Government of Odisha
GoP	Government of Philippines
GSIS	Government Service Insurance System
GST	Good and Services Tax
GT	Gross Tonnage
HLV	Human Life Value
HP	Horse Power
ICSF	International Collective in Support of Fishworkers
IFC	International Finance Corporation
ILO	International Labour Organization
IMD	Indian Meteorological Department
INR	Indian Rupees
IOS	Indian Oil Sardine
IRDA	Insurance Regulatory and Development Authority
IRDAI	Insurance Regulatory and Development Authority of India
IUCN	International Union for Conservation of Nature
IUU	Illegal, Unreported and Unregulated Fishing
JBC	Jiban Bima Corporation
KFWFB	Kerala Fishers' Welfare Fund Board
L&D	Loss & Damage
LKIM	Malaysia Fisheries Development Authority
LOA	Length Overall
MCCPF	Maldives Climate Change Policy Framework
MCS	Monitoring, Control and Surveillance
MFAR	Ministry of Fisheries & Aquatic Resources
MFO	Marine Fisheries Office
MIAN	Micro Insurance Association, Netherlands
MMA	Maldives Monetary Authority
MPCI	Multiple-Peril Crop Insurance
MSW	Maximum Sustained surface Wind speed
MSY	Maximum Sustainable Yield
MT	Million Tonnes
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NDRF	National Disaster Response Fund
NDRF	National Disaster Response Fund
NGO	Non-Governmental Organization
NTC	Negative Temperature Coefficient
OECD	Organisation for Economic Co-operation and Development
OECD	Organisation for Economic Co-operation and Development
OIC	Office of Insurance Commission
PADI	Professional Association of Diving Instructors
PCRFI	Pacific Island Country members of the Foundation
PKSF	Palli Karma-Sahayak Foundation
PMFBY	Pradhan Mantri Fasal Bima Yojana
PMFBY	Pradhan Mantri Fazal Bima Yojana
PMMSY	Pradhan Mantri Matsya Sampada Yojana
R&D	Research and Development
RWBCIS	Restructured Weather Based Crop Insurance Scheme
SBC	Sadharan Bima Corporation
SBDC	Single-Bounded Dichotomous Choice
SCC	Sectoral Climate Cells
SCS	Severe Cyclonic Storm
SDG	Sustainable Development Goals
SDMF	State Disaster Mitigation Fund
SDRF	State Disaster Response Fund
SDRF	State Disaster Response Fund
SEAFDEC	Southeast Asian Fisheries Development Center
SLIC	Sri Lanka Insurance Company
SLR	Sri Lankan Rupee
SPV	Special Purpose Vehicles
SST	Sea Surface Temperature
SupSCS	Super Cyclonic Storm
UNECLAC	United Nations Economic Commission for Latin America and the Caribbean
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
UT	Union Territories
VaR	Value-at-Risk
VWS	Virtual Weather Stations
WIM	Warsaw International Mechanism
WMO	World Meteorological Organization
WTP	Willingness To Pay

Executive Summary

Objective & Scope

The overall objective of the present study is to evaluate the existing mechanisms of risk transfer and risk mitigation concerning climate change in the fisheries sector. Insurance is now being considered as a viable source of risk transfer and risk mitigation. However, in fisheries sector, penetration of insurance is persistently low. The present report aims to contribute with its inputs to understand the underlying issues and facilitate relevant policy framing and appropriate implementation strategies.

Nature of fisheries in the region & impact of climate change

South Asia region comprises Bangladesh, India, the Maldives, and Sri Lanka. One of the unique features of these countries is the presence of a significant small-scale fisheries sector. In South Asia, approximately 1 to 8 percent of the GDP comes from fisheries. However, the region is highly vulnerable to climate change. Data shows that while intensity of cyclones is increasing in the Bay of Bengal, number and intensity both are increasing in the Arabian Sea. Apart from extreme weather events, there are chronic risks such a sea level rise, ocean acidification, increasing sea surface temperature, etc. There were also hidden dangers like lightning, which is the largest cause of death due to the forces of nature in India.

The risks are already visible. Significant production losses are reported from India due to climate change. However, there were no insurance coverage for such losses. The marine fisheries in the region is a USD 33 billion sector. As the sector is being modernized, the volume of the built-up capital has apparently increased. However, estimates on the capital are not available. Fish catches seem to be stable, but large variations in production were observed at the species level due to weather events. In the case of Indian Oil sardine, which is amongst the largest fisheries in India, weather events led to a 20 times decline in production below average during 2021, wiping out 3/4th of the income of the fishery stakeholders. In the case of the value of the life of a fisher, the estimate should be based on the expected lifetime income. Given the current prices and trend, a fisher in India will earn about INR 5.4 million in 20 years of his active fishing. In contrast, the insurance coverage is only about INR 0.5 million in case of death or permanent disability, which is equivalent to about two years of his income. Therefore, there is a need to improve coverage.

This called for improving loss and damage assessment and linking it with insurance. There is a scope of reallocation of the government's support to the fisheries sector post-WTO. Disaster Management is one such area where the Government can support fishers without contributing to the over-fishing. This would also contribute to the SDG 14.b.1 – Securing sustainable small-scale fisheries.

State of the insurance market

The insurance market in South and Southeast Asia is still in the growth stage. Sri Lanka has the lowest penetration (life insurance premium as a percentage of GDP) and Thailand has the highest penetration, followed by Malaysia, India, and Indonesia. Globally, there are mainly two types of insurance available: (1) Loss & Damage (L&D) Insurance or traditional insurance, and (2) Parametric or Index-based insurance. L&D Insurance can be delivered through multiple channels, namely, by insurance companies, local NGOs, and micro-insurance. The mutual insurance option is tailor-made to the individual need and capability. Micro-insurance is a possible way to deal with high transaction costs and information requirements by grounding it within the community or through mutual insurance. On the other hand, parametric (or index-based) solutions are a sort of insurance that cover the likelihood that a pre-set event will occur, rather than compensating for actual

damage experienced; thus, the parametric insurance is considered as a quick compensation, and it does not cover entire damage. The key differences between traditional indemnity and parametric insurance are related to the payment trigger, recovery, basis risk, claims process, term, and structure. Although weather or natural disasters are the most common triggers, there can also be other triggers. Therefore, the way forward is a judicious mix of both channels of insurance.

Value at risk

The marine fisheries in the region is a USD 33 billion sector. As the sector is being modernized, the volume of the built-up capital has apparently increased. However, estimates on the capital are not available. Fish catches seem to be stable, but large variations in production were observed at the species level due to weather events. In the case of Indian Oil sardine, which is amongst the largest fisheries in India, weather events led to a 20 times decline in production below average during 2021, wiping out 3/4th of the income of the fishery stakeholders. In the case of the value of the life of a fisher, the estimate should be based on the expected lifetime income. Given the current prices and trend, a fisher in India will earn about INR 5.4 million in 20 years of his active fishing. In contrast, the insurance coverage is only about INR 0.5 million in case of death or permanent disability, which is equivalent to about two years of his income.

Loss & Damage Estimation Methodology

Fishermen community often leave their boats and other fishing equipment close to the coast, and also their hamlets are located around 1 km vicinity from the coast. Any disturbance in the sea, fishermen are the one who get affected first. The community has become more vulnerable due to frequent damages to their assets. In order to minimize the losses, a robust loss and damage assessment methodology is needed to support the fishers' risk mitigation and help them in adaptation to resilience as current measures are falling short. The loss and damage assessment due to climate change has gained much attention in the last two decades. The damage assessment also plays an essential role in establishing the cost of the specific disaster, recovery management, and preparedness for any future disaster events. In 1972, the United Nations Economic Commission for Latin America and the Caribbean developed a comprehensive methodology for assessment of the losses and damages of natural disasters, known as the Damage, Loss and Needs Assessment (DaLA) methodology, which was further refined and adopted by many other international organizations.

The DaLA methodology practiced by the World Bank has six steps. Step 1: Develop a Baseline Assessment: For the Baseline assessment, two types of information are required a) information related to demographic and socioeconomic characteristics of the country, and b) sectoral-wise detailed economic activity. Step 2: Develop Post-Disaster Scenario: a field survey (physical inspection) preferably with an aerial survey (GIS and Remote Sensing techniques) is conducted to identify the assets' damage. In assessing the damage, the assets are divided according to the size and capacity of the infrastructure that allows the authorities to allocate the resources appropriately. It also provides estimates of the expected reconstruction costs of the assets (housing, infrastructure, etc.) and the expected magnitude of recovery of the production (industry, agriculture, etc.). Step 3: Post-Disaster Performance of the Sectors: the funding/insurance agencies examine the damage to each economic sector based on the estimation of average productions, with and without cyclonic disturbances. Step 4: Estimating Total Value of Damages and Losses: losses and damages from all economic activities are aggregated while taking care of double counting. Step 5: Estimation of Macroeconomic Impact of Damage and Losses: The difference between pre-disaster GDP and value-added losses is estimated to get the post-disaster GDP. The impact on GDP growth is also considered. Step 6: Estimate Impact on Personal/Family Income: Loss in potential

employment is estimated, by knowing the production loss of each sector.

Findings from Stakeholder Consultations

Following the desk research, several stakeholders were consulted through sample surveys and focused group discussions. The salient findings from the Stakeholder consultations are as follows.

Boat Owners and Crew Members

- Insurance is not provided for the hull of wooden boats. There is also no insurance for the crew. In case of an accident or disaster event, the crew are at the mercy of the boat owners to get adequate compensation (E.g., Bangladesh). The same is noticed among all the countries; even when crew is covered, claim settlement is difficult if the body of the person is not found, as it is treated only as a case of missing person.
- Boat owners are reluctant to purchase an insurance policy as they consider it an additional investment burden without return/profit. User dissatisfaction citing high premium, partial coverage of insurance policy, and lengthy and disputed settlement of claim are the key factors for not availing of insurance (almost in all countries).
- Accident insurance for crew covering partial disability is inadequate to meet the cost of prolonged medical treatment. Further, in the case of accident insurance, issues of income loss due to disability are not covered. It is also difficult to prove that the death is definitely accidental and not natural.
- Overall, there is a lack of clarity about the significance of the purpose and process of insurance, which has led to apathy and distrust among the fishers. Therefore, a statement by the Government endorsing the benefits of livelihood and income risk covering insurance and also assuring the government's responsibility and involvement in the process, is important and would go a long way in ensuring greater acceptance of the insurance among the marine fishers. There is also a dire need for awareness raising.

Insurance Companies

Very few companies are offering insurance to the fishermen, because of low penetration and high risk. Currently, Insurance companies in India are offering traditional insurance (indemnity) and parametric (index-based) insurance to agriculture crops and livestock. Livestock insurance are offered in two forms viz., indemnity insurance - claims are paid on the death of the cattle; under parametric insurance - claims are paid based on the temperature and humidity thresholds.

In case of crops, claims are paid, based on the weather parameters. Yield loss: usually officials of insurance companies visit a few places to assess the damage to the crop (size, green/dry etc.), based on the preliminary assessment, they disburse the pay-out in that region.

- In the case of fish-catch, it is difficult to monitor the reduction in yield. Hence, satellite-based GIS data can be helpful to assess loss due to fish movement and other climatic variables.
- Mandatory fishing vessel insurance with coverage of more than 80% of the vessel value, and mandatory insurance for all the crew members would increase the insurance penetration and enhance the interest among the insurance companies to provide insurance.
- Restricting parametric insurance to Extreme/Severe Cyclones or Wind Speed above certain threshold level will lower the premium.
- Currently, GST on insurance schemes is about 18%. Lowering the GST for fishermen's insurance will lower the total premium cost and aid in greater penetration.
- The probability of having one extreme cyclone in a year in the Bay of Bengal region is 0.15 (1 cyclonic disturbance out of 6.4 possible cyclonic disturbances will turn into severe/very severe). Because of the high frequency, the premium would be

higher. The premium would be lower if entire Bay of Bengal coastline is considered.

- In the views of the insurance companies, given the complexities of the fisheries sector, parametric insurance could be the best option. Such insurance does not need personal verification and can be operated based on third-party information alone.
- However, a relatively large risk pool will make parametric insurance viable both for the insurer and the insured. This is a challenge for the insurance companies and they see a definite role of the Government in facilitating the process. To overcome the ongoing market failure in insurance, the Governments need to play a proactive role and all stakeholders agreed on this, albeit from different perspectives.

Key Recommendations from Stakeholders' Interactions

- ***Provide*** insurance education for all, especially the marginal section of fishers.
- ***Issue*** a policy statement delineating appropriate financial risk mitigation measures including the role of different actors like the Government and the Insurance companies.
- ***Develop*** a Strategic Plan for the Bay of Bengal region, on the lines of the Caribbean Multi-Country Strategic Plan (2022-26). The Plan, inter alia, shall focus on the quantification of disaster risk, improved climate reporting, and the creation of a pooled fund for disaster finance.
- ***Develop*** a pooled risk insurance scheme for the Bay of Bengal region to ensure the speedy disposal of the adequate fund during a calamity.
- ***Link*** all-peril insurance for "unnamed crew" and all-peril marine hull insurance to licensing for all fishing vessels.
- The data collected by the Government about the fishing vessels (including price during registration) may be used to buy an all-peril insurance cover for the fishing vessels. The Government may use tax revenue to buy re-insurance products from the market for risk coverage and/or impose Cess on the Licensing Fee to generate funds, which can be used for the purchase of "an all-peril" insurance policy.
- ***Notify*** guidelines seeking insurance companies to reserve a fund for catastrophic risks.
- ***Increase*** the limits of the Group Insurance Scheme (GIS), given the increased occupational risks. Countries that do not have a GIS, may consider implementing such schemes for fishers.
- ***Exercise*** special care to ensure that migrant workers are covered in insurance programs.
- ***Develop*** a Model Parametric Insurance Scheme to guide the insurance sector and implementation at a pilot scale.
- *Parametric* or Index-based insurance can meet the business loss due to climate change. One example of parametric insurance could be Cyclone Insurance, where the fishing units (e.g., a boat owner) would be compensated at a fixed rate, once the event is triggered (i.e., the event of a cyclone). The fixed rate will depend on the fund size. A specially designed parametric insurance (based on cyclonic disturbance) will be helpful for the fishers.
- Under the parametric insurance claims are paid for the loss of working hours/days, for any unavoidable situation, if workers did not get enough working hours/days. Similarly, parametric insurance for protecting the fisher's working days needs to be implemented. As calculated from historical data, with a high probability, 295 days are safe days for fishing (Excluding fishing ban and holidays). Insurance can be paid if the fishing days' decrease below 295 days (Excluding fishing ban and holidays as applicable under national laws).
- ***Mainstream*** catch documentation by instituting a mechanism to collect data on the type and quantity of fish caught by the fishers. This will aid the industry in developing an insurance product that will effectively cover the days lost due to adverse weather conditions and aid in determining the extent of compensation to be paid.
- ***Consider*** various forms of insurance including micro-insurance, community-based insurance, and market-based insurance apart from the Governmental support schemes.
- ***Design*** insurance products that adhere to the principles of SUAVE (Simple, Understandable, Easily accessible, Valuable to risk coverage, and Efficient in application and processing).
- ***Design*** insurance products to cover also partial damages to fisheries assets.


नीतिमान
YAMAHA
9.9

Section 1.0 Introduction

1.0 Context

The marine fisheries sector in South Asia has undergone a transformation post-independence. Consequently, the estimated current marine fisheries production from the region has touched 5 million tonnes, showing a 7-fold increase since the 1950s **(Figure 1).** Marine fisheries in South Asia is now a 10 billion US Dollar (USD) sector that generates about 2 million rural employments. Fisheries also makes a significant contribution to the food security and export earnings of this region. However, as current marine fisheries production is approaching the natural limit and the growth rate is slowing down, the focus is now on consolidating the fisheries businesses, capturing the value and sustaining the livelihoods.

A similar pattern of development was also observed in South East Asia (Indonesia, Malaysia, Myanmar and Thailand, which share the same ecosystem – the Bay of Bengal) and elsewhere in the world as global marine fisheries production seems to hit a plateau. Therefore, from the expansionary objectives of fisheries management, as in vogue until 2000s, the focus has shifted to consolidation and continuity of fisheries activities over time.

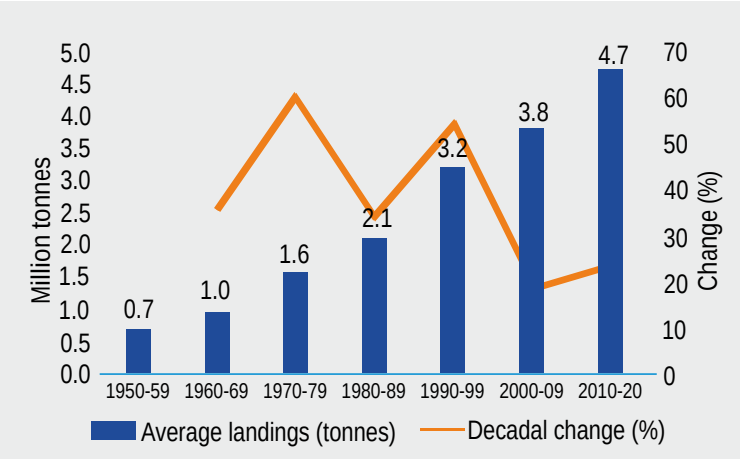


Figure 1. Decadal fish production in South Asia

However, climate change is posing a substantial threat to the sustainability of the sector. Fisheries, is a socio-ecological system. Socio-ecological systems reflect a highly interconnected relationship between society and ecosystems. Resilience of such a system of systems depends on a wide range of factors stemming from the linkages between human societies and ecosystems. The climate, by its all-encompassing nature, affects both the social and ecological system creating an additive effect that is augmenting the inherent risks in the fisheries sector. Both South and South East Asia are vulnerable to climate change and are prone to natural disasters **(Table 1).** Therefore, the fisheries sector in the region is facing significant increase in risks and uncertainty, which is likely to spiralling out over the coming years. Considering the dominance of the small-scale fisheries sector in the region, this would also affect progress towards Sustainable Development Goal (SDG) 14.b.1 – Securing sustainable small-scale fisheries.

There are two approaches to climate risk management viz., ex-ante and ex-post measures. Under, ex-ante measures, which include insurance, the risks are identified and insured against to compensate for loss. The ex-post measures, include measures such as ex-gratia payment from the Government - especially, in case of a disaster, personal and business loans, support from NGOs, etc. Both the measures have their pros and cons. In the case of insurance, the monetary compensation is certain but the event is uncertain. For ex-post measures, the event has already

[1] *South Asia comprises of six maritime countries, Bangladesh, India, Iran, Maldives, Pakistan, and Sri Lanka. For the purpose of this report, four South Asian countries, Bangladesh, India, Maldives and Sri Lanka are considered. Together these countries contribute 82% of the marine fish production from the region.*

Table 1: Climate risk profile of South & South East Asia

Risk factor/ Country	Coastal flood	Cyclone	Extreme heat	Tsunami	Overall
Bangladesh	High	High	High	Medium	High
India	High	High	High	Medium	High
Indonesia	High	High	Medium	High	High
Malaysia	High	High	Medium	High	High
Maldives	Very low	No data	No data	Medium	Low
Myanmar	High	High	High	Medium	High
Thailand	High	High	High	Medium	High
Sri Lanka	Medium	High	Medium	Medium	Medium

Compiled from thinkhazard. https://thinkhazard.org/

materialized; however, the amount of compensation and its timeliness remains uncertain.

Insurance is a standard instrument for mitigating the financial implications of a risky event. It is a risk-transfer and risk-pooling mechanism to compensate for loss and damages (L&D) from an adverse event. Conventional insurance products cover a wide range of L&D situation such as loss of life, disability, home, accident, employment injuries, assets, theft, health, and business liabilities. Conventional insurance products often do not provide cover for various climate-related risks , such as extreme weather events, either due to the scale of the event (beyond the capacity of the insurance provider) or by design (problems in modelling natural disasters). In view of the climate change, there is a rethinking on the scope of insurance and novel products have emerged with L&D insurance to cover for disasters (e.g. Add on coverage against damage from flood in a householder policy). Another set of insurance products, called parametric or index-based insurance have also emerged with flexibility to deal with various types of climate risks (e.g. damage to crop from excess or low rainfall) complementing the L&D insurance.

Globally, insurance is gaining traction as a preferred tool for managing disaster risks. However, ex-post measures are still in vogue. In developing countries, insurance penetration remains poor. People largely depend on personal and business loans and government assistance to recover from a disaster. The climate risk insurance in various forms is offered as a solution for transfer and pooling of risks from climate change indicators. Especially for the developing countries, this is an area that needs holistic and urgent intervention to ensure the continuity of lives and livelihoods.

In the above context, the objective of the study is to evaluate the existing mechanisms for risk transfer and risk mitigation concerning climate change impacts on the fisheries sector, so that to develop a guideline for improved and efficient insurance coverage.

2.0 Study Methodology

The study adopted an exploratory research method to address the objective. A step-by-step (work packages) approach was employed to address the key questions. At the first step, secondary sources of information (scientific papers, reports, Governmental policies) were collated and analysed to understand the nature of the problem. It was noted that inadequate penetration of fisheries insurance is a persistent problem. The primary cause seems to be the insurance need and the insurance product mismatch. There were also other issues, such as lack of awareness, perceiving the premium high, etc. Further, during this stage global and cross-sectoral experience in conventional and parametric insurance were evaluated and lessons were drawn. In step two, climate risks and exposure of the fisheries sector was evaluated. Exposure to risk was assessed in various dimensions such as production shocks, loss of life and loss of fishing assets. A thorough analysis was undertaken to evaluate the current ex-post or emergency relief measures with the globally accepted measures for L&D assessment. The exploratory findings were shared with the stakeholders through a series of international and national workshops and focus group discussions. The findings from the group discussion were supplemented by the information collected through sample surveys. The survey assessed current insurance coverage, common loss and damage and fishers' perception of insurance. Based on the findings from the exploratory and quantities analysis, a set of recommendations were developed and validated by the stakeholders. One of the major recommendation of the study is to provide insurance awareness to the fishers. For future purposes, awareness building in insurance should be supplemented by a study on their willingness to pay to design suitable policy. The methodology for measuring WTP is provided in the **Annexure 1**.

One of the important contributions of the study is to assess the role of parametric or index-based insurance. Parametric Insurance provides some flexibility in terms of reducing the burden of proving the claim on the insured, costly loss and damage assessment, etc. such attributes make it suitable for the fisheries sector. Information asymmetry and lack of trust between the insurer and the insured remain a crux in case of the traditional insurance in the fisheries sector. The parametric insurance can bypass it by using third-party data (e.g. data from the weather office on the nature of a storm). At this stage, fishers are largely uninformed about parametric insurance and their views can be influenced by presenting a selective picture. Therefore, the Government has a catalytic role to play here. This report provides global experiences on the uses of parametric insurance, its possibility, and the government's role in regulating it to build community resilience.

3.0 Organization of the Report

The report is organized in the following manner. **This section** provides the objectives of the study. The **next section** provides an overview of the evolving climate risks in the region and explores the question: what is at stake? **Section 3.0** provides an estimate of the stake and an **evaluation of ex-post measures.** The current methods of post-disaster compensation/ ex-gratia payment in the region is benchmarked against the globally accepted Damage and Loss Assessment Methodology. In summary, the section provides the need for improvement in the current mechanism of assessing damages and loss from disaster in the region as it may contribute to the undervaluation of loss and insufficient compensation to the affected parties. **Section 4.0** introduces insurance as a risk management measure and reports on national and regional policies. **Section 5.0** presents the findings from the stakeholder consultations on the role of insurance. It answers very persistent questions, such as: why do fishers not insure? What role can insurance companies play? Can Government promote insurance? etc. It then provides a set of recommendations and policy options at the national and regional levels and presents a set of recommendations.

Section 2.0 Evolving climate risks in the region

2.1 Climate change risk projection

The International Panel on Climate Change has developed Representative Concentration Pathways (RCPs) to model how the climate may change in the future due to anthropogenic activities. The RCPs make predictions of how concentrations of greenhouse gases (GHGs) in the atmosphere will change in the future as a result of human activities and the consequential changes in the climate. The RCPs describe four different 21st-century pathways of GHG emissions and atmospheric concentrations: a stringent mitigation scenario (RCP 2.6), two intermediate scenarios (RCP 4.5 and RCP 6.0), and one scenario with very high GHG emissions (RCP 8.5).

Coordinated by the Centre for Climate Change Research (CCCR) at the Indian Institute of Tropical Meteorology (IITM), the Ministry of Earth Sciences, the Government of India published the first assessment report to describe the physical science basis of regional climate change over the Indian subcontinent and adjoining areas (Krishnan *et al.*, 2021). Projections by climate models of the Coupled Model Inter-comparison Project Phase 5 (CMIP5) based on multiple standardized forcing scenarios (RCPs) showed that the surface air temperature would increase by 2.0 and 2.4oC under RCP 4.5; and by 2.7 and 4.4oC under RCP 8.5 during 2040-2069 and 2070-2099, respectively (**Figure 2**)..

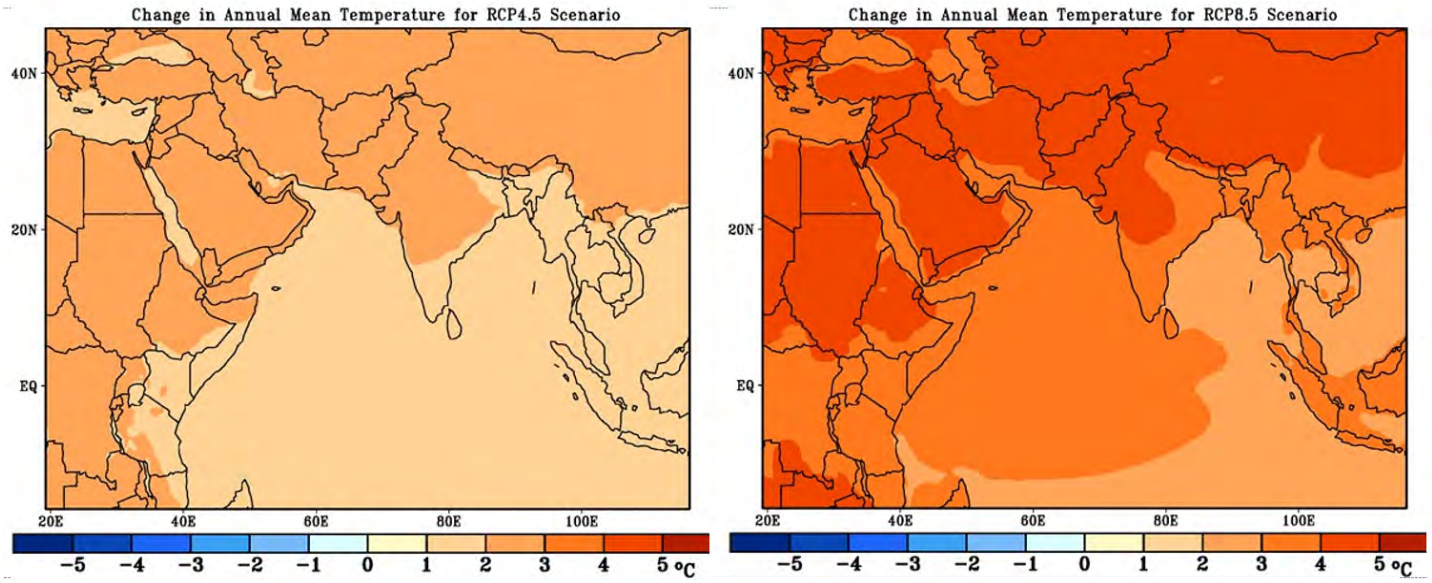


Figure 2. Climate Scenarios for South Asia

Source: Centre for Climate Change Research (CCCR), Indian Institute of Tropical Meteorology

Other projections that will have direct impact on marine fisheries in the region are as follows:

- **Sea surface temperature (SST)** of the tropical Indian Ocean has risen by 1°C on average during 1951–2015, markedly higher than the global average SST warming of 0.7°C, over the same period. Ocean heat content in the upper 700 m of the tropical Indian Ocean has also exhibited an increasing trend over the past six decades, with the past two decades (1998–2015) having witnessed a notably abrupt rise. SST is projected to increase by 1.2 and 1.6oC under RCP 4.5; and by 1.6 and 2.7oC under RCP 8.5 during 2040-2069 and 2070-2099, respectively. The projected increase in SST is likely to change fish distribution further in the Indian seas, with the possibility of negatively changing population abundance.

- **Changes in precipitation** is likely to influence fish breeding. With continued global warming and anticipated reductions in anthropogenic aerosol emissions in the future, CMIP5 models project an increase in the mean and variability of monsoon precipitation by the end of the twenty-first century, together with substantial increases in daily precipitation extremes. Resulting from the increased variability of monsoon precipitation and increased water vapour demand in a warmer atmosphere, climate model projections indicate a high likelihood of increase in the frequency of drought intensity (>2 events per decade) in arid and semi-arid zones, and the area under drought conditions will increase in India by the end of the twenty-first century under RCP8.5 scenarios.

- **Sea level** has risen globally because of the continental ice melt and thermal expansion of ocean water in response to global warming. Sea-level rise in the North Indian Ocean (NIO) occurred at a rate of 1.06–1.75 mm per year during 1874–2004 and has accelerated to 3.3 mm per year in the last two and a half decades (1993–2017), which is comparable to the current rate of global mean sea-level rise. At the end of the twenty-first century, steric sea level (Steric sea-level change refers to changes arising from ocean thermal expansion and salinity variations) in the NIO is projected to rise by approximately 300 mm relative to the average over 1986–2005 under the RCP4.5 scenarios, with the corresponding projection for the global mean rise being approximately 180 mm. Thus, sea level rise is projected to be much higher relative to global mean rise.

- **Ocean acidification** projections are still in nascent level for the India seas. Projection in the Annual Report 6 of IPCC suggests that the global average ocean surface pH will reduce from 8.02 in 2020 to 7.96 in 2050s and to 7.89 in 2080s under RCP4.5; and to 7.92 in 2050s and to 7.67 in 2080. Decrease in survival, calcification, growth, development and abundance has been recognised as response to acidification by various categories of marine organisms.

- **Tropical cyclones** and thunderstorm intensity increase, and associated heavy precipitation, are generally correlated with temperature increase associated with global climate change events. While there has been a significant reduction in the annual frequency of tropical cyclones over the NIO basin since the middle of the twentieth century (1951–2018), the frequency of very severe cyclonic storms (VSCSs) during the post-monsoon season has increased significantly (+1 event per decade) during the last two decades (2000–2018). Climate models project a rise in the intensity of tropical cyclones in the NIO basin during the twenty-first century. Increase in the intensity of cyclones will have devastating effect directly on the life and properties of the coastal communities.

2.2 Intensifying cyclonic activities in the Bay of Bengal Region

To examine the frequency and severity of the cyclonic storms in the BoB region, we used the data provided by the web-based IMD-Cyclone eAtlas with information on all the cyclonic disturbances formed in the Northern Indian Ocean for the period 1891-2021. For the current study, we have examined the cyclonic data of the Bay of Bengal region from 1990-2021. During this period, the region has experienced 190 cyclonic disturbances, of which

approximately 60% are Depressions or Deep-Depressions (MSW <62 kmph), 15% are Cyclonic Storms (61<MSW<89 kmph) and 25% are Severe Cyclonic and above (MSW>88 kmph).

The wind distribution around a cyclonic disturbance is described as the radial extent of a particular maximum sustained wind speed (MSW). Indian Meteorological Department (IMD) calculates the maximum sustained wind speed (MSW) of all the cyclonic disturbances in the Northern Indian Ocean.

The Bay of Bengal, the largest bay in the world with an area of 1 million square miles, accounts for 0.6% of the global ocean area. Due to natural disasters, nearly 1 million lives (half of the total natural disaster deaths in the world) have been lost in the last fifty years. In the last 30 years, the Bay of Bengal experiences 6-7 cyclonic disturbances per year (**Figure 3**).

The Indian coast receives around 61% of tropical cyclones, followed by Bangladesh (23%) and Myanmar (16%). In India, the tropical storms largely landfall in Indian coastal states Odisha-West Bengal Coast in October, Andhra Pradesh in November, and Tamil Nadu coast in December.

From the historical data, it is evident that 48% of the annual cyclones occur in the northeast monsoon season (October, November, and December), and 23% of the annual cyclones occur in the pre-southwest monsoon (April-June). The number of northeast monsoon cyclones is 66% more than pre-southwest monsoon. The region also witnessed a few unexpected cyclonic disturbances in non-monsoon months (**Figure 4**). As per the Indian Meteorological Department (IMD, 2021), the average size of outer core winds of Cyclonic Storms in the BOB is higher in post-monsoon than in pre-monsoon season, because of this reason, the region gets more intensified cyclonic storms in the post-monsoon months.

The most destructive post-monsoon cyclones are Cyclone 1996 (4-7 Nov 1996, MSW>200 kmph), Super Cyclone (25th Oct- 3rd 1999, MSW>250 kmph), Cyclone Sidr (11 - 16th Nov. 2007, MSW>250 kmph), Cyclone Phalin (4-14th Oct 2013, MSW>250 kmph), Cyclone Hudhud (8-14 Oct 2014, MSW>250 kmph), Cyclone Titli (8-12 Oct 2018, MSW>150 kmph), Cyclone Bulbul (28 Oct to 5 Nov 2019, MSW>200 km/h), and Cyclone Gulab (24-30 Sept 2021, MSW>150). Pre-

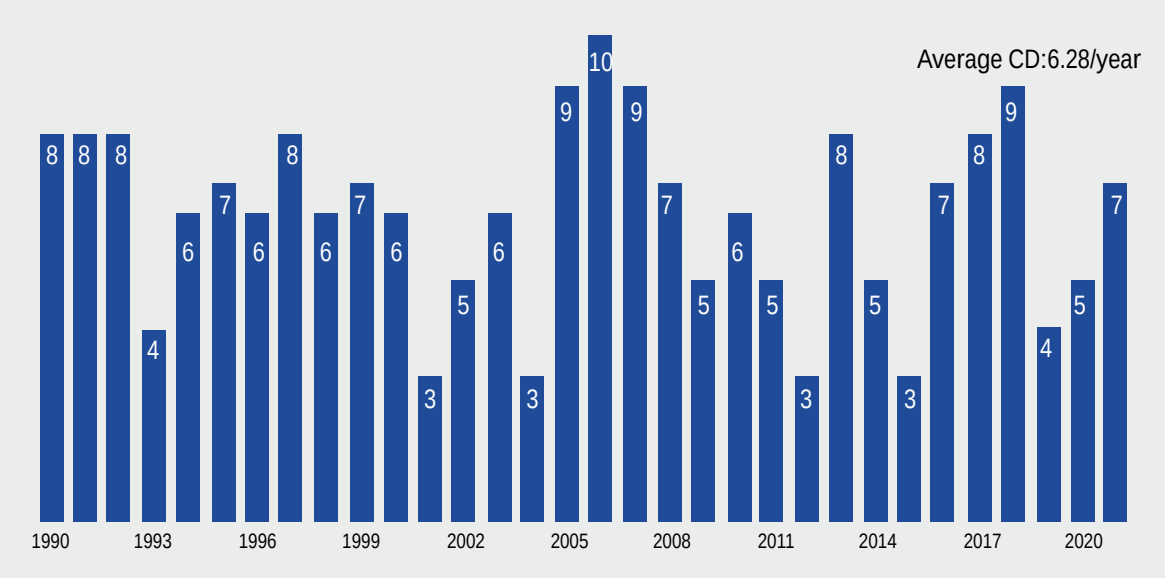


Figure 3: Cyclonic disturbance in BOB during 1990-2021

Source: Authors, calculations based on IMD-Web Cyclone eAtlas database (2022)

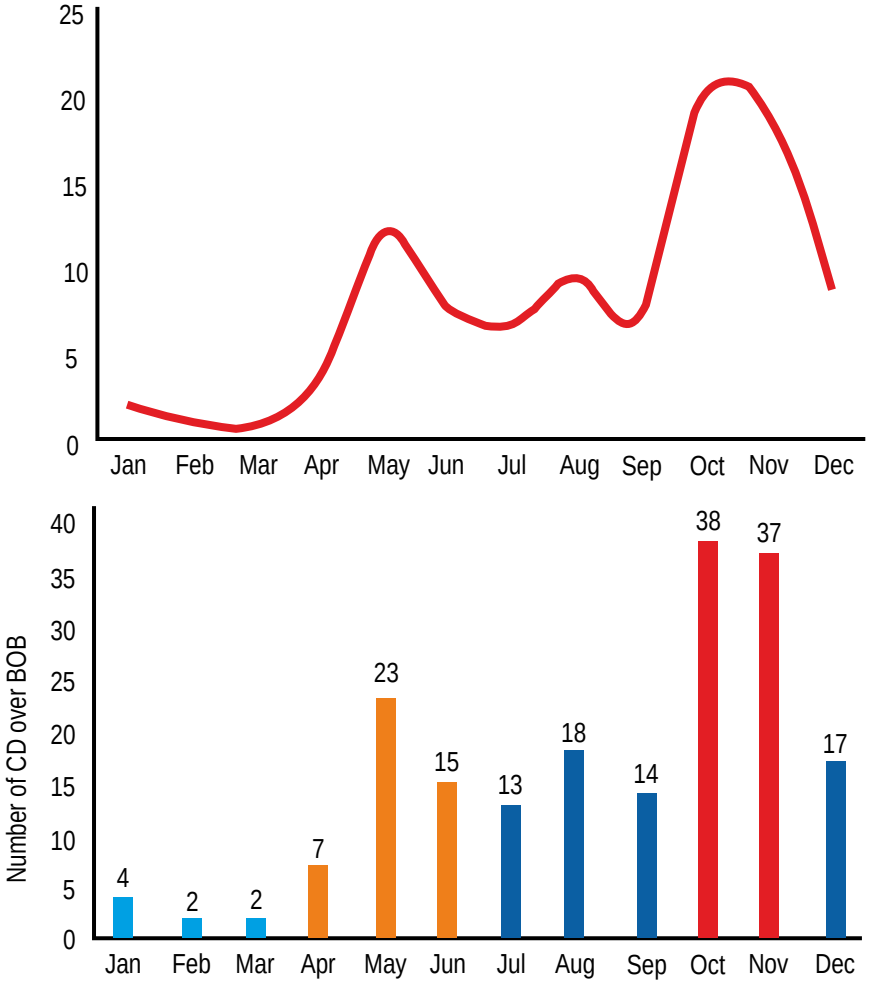


Figure 4: Monthly cyclonic disturbances for the period 1990-2021:
Panel (a) Percentage of Cyclonic Depression b) Number of Cyclonic Disturbances

Source: Authors, calculations based on IMD-Web Cyclone eAtlas database (2022)

monsoon Cyclones: 1990 Super Cyclonic Storm (8-14 May 1990, MSW>220), 1994 Bangladesh Cyclone (2-6 May 1994, MSW>200 kmph), 1997 Bangladesh Cyclone (14-20 May 1997, MSW>150) Cyclone Nargis (27 Apr - 3 May 2008, MSW>2008), Cyclone Fani (26 Apr to 5th May 2019, MSW>215 kmph), Cyclone Amphan (16-21 May 2020, MSW>250 kmph), Cyclone Yaas (23-28 May 2021, MSW>150 kmph) and Cyclone Tauktae (14-19 May 2021, MSW>200).

2.2.1 The intensity of the Cyclones:

As per the Indian Meteorological Department (IMD, 2021), the frequency of the tropical cyclone has decreased significantly over the period 1961-2020. However, it is observed that more depressions convert into tropical storms and above category.

During 1990-2021, a total of 190 disturbances were recorded in the BOB region (Web Cyclone eAtlas, 2022), and 110 tropical disturbances remained as depression/deep-depression (58% of the total), 25% of tropical disturbances converted into severe cyclonic storms and 17% turned into cyclonic storms. The probability of intensification of depression into cyclonic/severe cyclonic is maximum in April (100%) followed by November (70%), May (61%), and March (50%). Approximately 60% of cyclonic storms convert into very destructive cyclonic storms (Severe or Very Severe cyclonic storms: MSW>200 kmph). More than 73% of cyclonic storms form in December and convert into Severe/Very Severe cyclonic storms, followed by April (71%), November (69%), May (64%), and October (54%). Table 2 provides the probabilities of the tropical cyclone by month. Given the probabilities, the BOB region has a 25% chance of witnessing a severe cyclone of

Table 2: Frequency and Probability of the Depression, Cyclonic Storm and Severe Cyclonic Storms in the Bay of Bengal Region for the period 1990-2021

Month	D+CS+SCS/ ESCS	CS+SCS/ ESCS	SCS/ESCS	Probability D to CS	Probability D to SCS/ ESCS	Probability CS to SCS/ ESCS
January	4	2	0	50%	0%	0%
February	2	1	0	50%	0%	0%
March	2	1	0	50%	0%	71%
April	7	7	5	100%	71%	64%
May	23	14	9	61%	39%	0%
June	15	1	0	7%	0%	0%
July	13	1	0	8%	0%	0%
August	18	0	0	0%	0%	33%
September	14	3	1	21%	7%	54%
October	38	13	7	34%	18%	69%
November	37	26	18	70%	49%	73%
December	17	11	8	65%	47%	60%
Total	190	80	48	42%	25%	60%

Source: Authors, calculations based on IMD-Web Cyclone eAtlas database (2022)

all the cyclonic disturbances forming in the BOB, moreover, when we consider the entire severe cyclone formed in the last 31 years, for every two years there is a chance to receive three severe/very severe cyclones. The probabilities of the intensity of the cyclones are important for the insurance industry to prepare the premiums for the assets.

2.4 Conclusion

- The world is in a climate emergency – "a code red for humanity" according to the UN Secretary-General. The world is far from securing a global temperature rise to below 2°C as promised in the Paris Agreement.

2.3 Increasing number of cyclones in the Arabian Sea

In the Arabian Sea also there is an increase in the number and intensity of the cyclonic events. Comparison of last two decades (2000-10; 2011-21) shows that the number of cyclonic disturbances has increased by 47% in the region (**Table 3**). There is also an increase in average number of cyclonic events per year in the Arabian Sea (**Figure 5**).

There is also an increase in intensity as can be seen from the increasing number of the SCS in region. In addition, there is a higher chance now that a depression or CS will convert to SCS in the Arabian Sea as compared to 2000-10 implying worsening of the situation.

As compared to 1990-99, total number of cyclonic events has increased by 70%. That is there is an indication of long terms changes in the number of cyclonic disturbances in the Arabian Sea, although it is usually considered as relatively calmer than the Bay of Bengal.

Table 3. Cyclonic activities in the Arabian Sea

Events	1990-99	2000-10	2011-21	Change (2011-21/2000-10)
Frequency of D+CS+SCS	19	23	34	48
Frequency of CS+SCS	12	14	19	36
Frequency of SCS	8	8	13	63
Total	39	45	66	47
Percentage Frequency of D+CS+SCS	49	51	52	1
Percentage Frequency of CS+SCS	31	31	29	-7
Percentage Frequency of SCS	21	18	20	11
Probability(D to CS)	63.2	60.9	55.9	-8
Probability(D to SCS)	42.1	34.8	38.2	10
Probability(CS to SCS)	66.7	57.1	68.4	20

Source: IMD Cyclone eAtlas

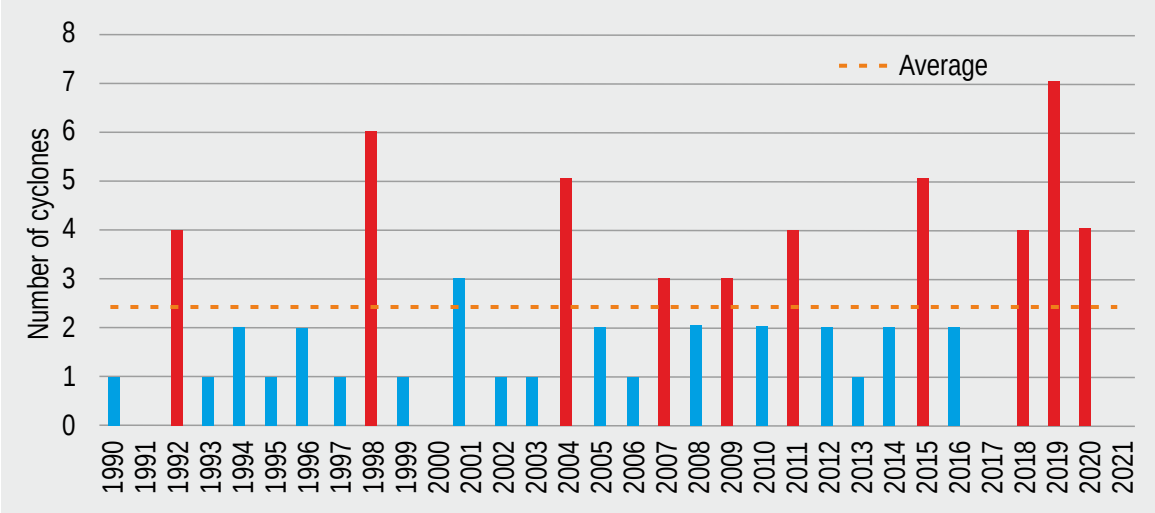
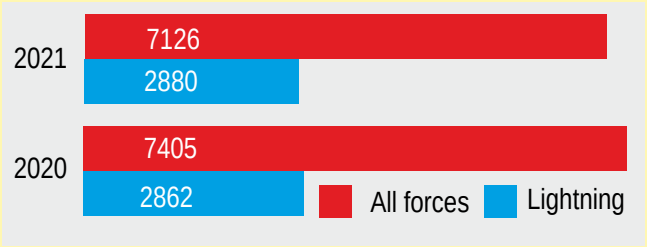


Figure 5. Cyclonic disturbance in the Arabian Sea during 1990-2021

The Hidden Disaster: Death due to lightning



"Climate change may be sparking more lightning across the world, and there is an increasing scientific evidence pointing to the trend. The frequency and intensity of lightning strikes in India are expected to increase by 10-25% and 15-50% by the end of this century. Coastal areas may be at the highest risk. An increase of one degree Celsius would increase the frequency of lightning strikes by 12 per cent, warned California University in a study published in 2015" – reported Down To Earth in July 2021.

As per the data available from the National Crime Record Bureau, lightning was responsible for 40% of death from forces of nature in 2021. In general, number of deaths, due to forces of nature, is higher in the coastal states than that of inland states in India, the NRCB data shows.

- Despite the global alarm, GHG emissions are choking our world, mitigation opportunities exist but GHG emissions continue to rise. The world is rather close to disastrous RCP 8.5 scenario than the RCP 4.5, which now seems optimistic.
- At the moment the world is heading for a rise in excess of 3°C this century. According to the IPCC there will be more severe and frequent extreme weather events in the near future like floods, droughts, wildfires and hurricanes. A fraction of a degree in average global warming can have massive consequences.
- That is, not only cyclonic disturbances, other impacts of the climate change, such as sea level rise and coastal flood, ocean acidification would intensify.
- The fisher community, owing to their high dependence on natural resources and the open sea would like to become increasingly vulnerable.
- The number of disasters, as a result is also likely to increase.
- Therefore, there is an urgent need for political and fiscal action, on one hand, to mitigate climate change and on the other hand, o build resilience of the people including the fishers.

Section 3.0 Quantifying operational and disaster risks in the marine fisheries sector – Current Status

3.1 The nature of marine fisheries in the region

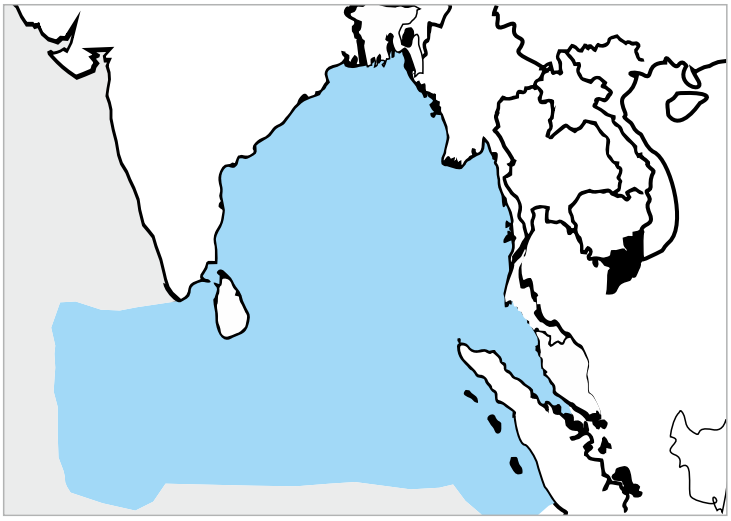


Figure 6: The Study region

South Asia region comprising Bangladesh, India, the Maldives, and Sri Lanka together contributed about six percent to the global marine capture fisheries production (excluding aquatic plants) (**Figure 6**) during the last decade.

One of the unique features of each country is the presence of a significant small-scale fisheries sector (**Table 4**). A large number of fishing vessels are manually operated and are below 20-metres length overall (LOA). Owing to the tropical nature of the ecosystem, varieties of fish are harvested in great number in the region with deployment of multiple types and dimensions of gears. Fisheries is also one of important sources of livelihood in the coastal areas. In Tamil Nadu, India the fisher community (active fishers, fish workers, and their family members) makes up four percent of the coastal rural population. Close to the urban centres, such as Chennai, fishers are about 1 – 2 percent of the coastal rural population; in south Tamil Nadu, Ramanathapuram, and Kanyakumari districts fishers constitute about 21 and 47 percentages of the coastal rural populations, respectively (**Figure 7**).

Fisheries also play an important role in the national economy. In South Asia, 1 to 8 percent of the GDP comes from fisheries (Including inland capture and culture). In addition, fish is a prized tradable commodity. The **OECD-FAO**

Table 4: Average contribution of fisheries sub-sectors to the total catch in south Asia

Fisheries sub-sector[3]	Catch (2010-18, million t)	Share in total catch
Artisanal & subsistence (Small-scale)	20.50	41%
Industrial	30.08	59%
Total	50.58	100%

Estimated from SeaAroundUs Project

[3] *Following typology is used in the SeaAroundUs project for different sub-sectors.* ***Industrial sector****: consisting of relatively large motorized vessels, requiring large sums for their construction, maintenance and operation, either domestically, in the waters of other countries and/or the high seas, and landing a catch that is overwhelmingly sold commercially (as opposed to being consumed and/or given away by the crew). Thus, the industrial sector can also be considered* ***large-scale and commercial*** *in nature;* ***Artisanal sector****: consisting of small-scale (hand lines, gillnets etc.) and fixed gears (weirs, traps, setnets, etc.) whose catch is predominantly sold commercially (notwithstanding a small fraction of this catch being consumed or given away by the crew). The artisanal sector is thus defined as* ***small-scale and commercial. Subsistence sector****: consisting of fisheries that often are conducted by women and/or non-commercial fishers for consumption by self/family. The subsistence sector is thus defined as* ***small-scale and non-commercial****.*

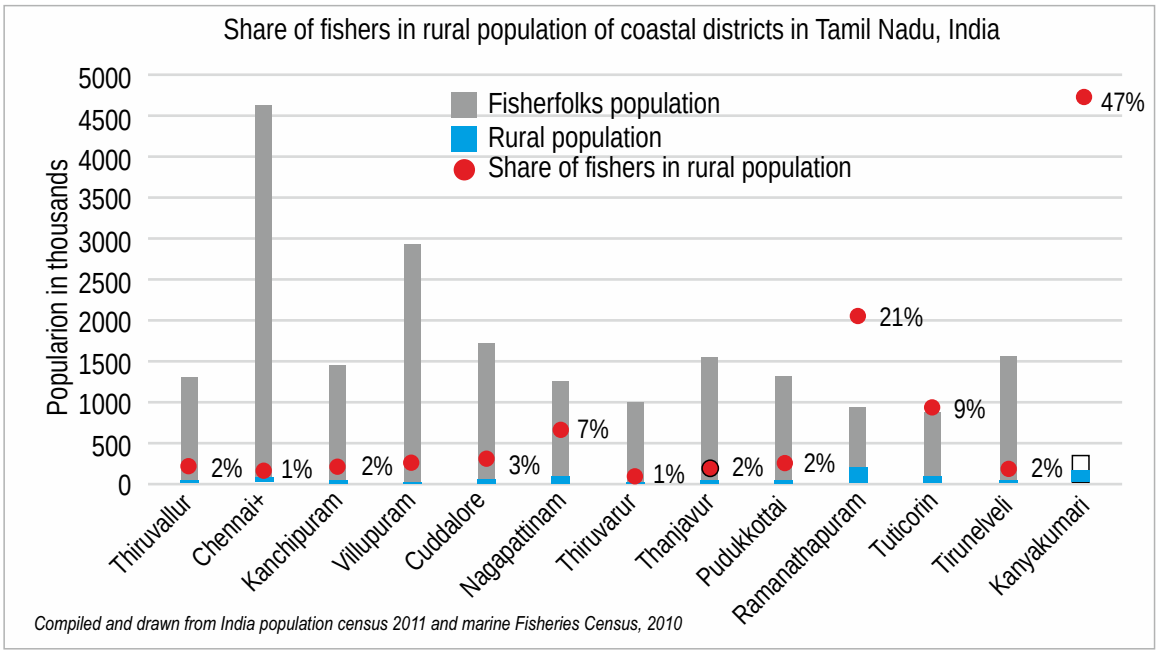


Figure 7: Share of fishers in the rural population of the coastal districts of Tamil Nadu, India

Agricultural Outlook for 2020-2029 projected that high demand, increasing fish production, improved logistics, and globalization of food systems would further expand the international fish trade and Asia would be the biggest beneficiary.

3.2 Types of risks in fisheries

Given the importance of the marine fisheries sector in the national economies in the context of the climate change, the question emerges, what types of risks the sector is facing and what are the prevailing measures to address them. Marine fisheries is inherently risky activity. Apart from the production risks, fisheries (fisheries implies marine capture fisheries unless otherwise mentioned) is also subjected to a high degree of natural oscillations, occupational risks, supply chain disruptions, and policy risks.

Therefore, risk management is an integral part of modern fisheries management. This is usually done through accumulated knowledge of the fisheries manager and complemented with scientific input. For example, fishers use *their accumulated* knowledge along with scientific inputs, wherever available, to improve the chances of a good catch; Policymakers use their knowledge and scientific input to prepare developmental roadmaps.

As detailed in the previous section of the report, climate change is likely to make obsolete the accumulated knowledge by altering, for example, seasonal patterns and associated weather events, and in the process altering the conventional risk profile of the fisheries sector (Transition risks). There are growing evidences that climate change will lead to changes in biological (such as primary production, biodiversity, species distribution,

[4] *At the casualty rate of 80 per 100000 fishers, fisheries is amongst the riskiest occupations in the world.*

[5] *According to FAO, Fisheries management is the integrated process of information gathering, analysis, planning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and the accomplishment of other fisheries objectives.*

FAO.2022. Fishery manager's guidebook: Management measures and their application. FAO Fisheries Technical Paper, (424), 231p.

Table 5: Type of risk from climate change facing the fisheries sector

Risks/ Actors		Fishers	Government
Operational risks	Damage to boat and gear	Taking loan to restart operation Insurance	No provision
	Loss of life/limbs	Ex-gratia payment from boat owner to affected fisher	Group insurance schemes
	Production shock (Business loss)	Taking loan to manage current expenses	No provision (Maldives: Income support)
	Bad weather (Loss of fishing days)	Meeting basic needs of crew	No provisions (Maldives: Income support)
Catastrophic risks	Loss of life/limb		Emergency relief
	Damage to boat and gear	Taking loan to restart operation	Emergency relief
	Loss of fishing days		Emergency relief/ alternative livelihoods
Chronic events	Sea level rise	Migration	Mitigation measures/ alternative livelihoods
	Fish migration	Investment in new technology and market	No current measures

and habitat suitability), physical (such as wind speed, ocean current, and temperature), and chemical (such as salinity, oxygen saturation, and ocean acidity) parameters that will affect marine fisheries.

Consequently, the risk profile facing the fisheries sector can be clubbed into [1] Operational risk, that is the risk profile faced by the fishers during day-to-day operation such as bad weather, stock fluctuation, damage to fishing vessel, man overboard, etc. in absence of an extreme weather event; and [2] catastrophic risks due to extreme weather events, such as loss of operational days, damage to fishing vessels and gear, loss of life, etc. There is also a third level of risk which occurs from slow inset of event or chronic events such as seal level rise; migration of fish; etc. The following table shows various coping mechanism to deal with these risks.

3.3 Value at risk – financial implication of various risk factors

The marine fisheries in the South Asia region generates a revenue of USD 10 billion dollar while the marine fisheries sector of the South East Asia region generate revenue of USD 23 billion a year (**Table 6**). As the sector is getting

Table 6: Value of marine fisheries production in the region in 2020

Country	Production (Million Tonnes)	Estimated UNIT Value	Total value (USD/Tonne)	Daily Production value in million, 200 days per year)
Bangladesh	0.67	2,128	1,428.11	7.14
India	3.71	2,128	7,892.75	39.46
Indonesia	6.43	2,558	16,447.92	82.24
Malaysia	1.38	1,903	2,632.68	13.16
Maldives	.15	2,128	316.15	1.58
Myanmar	1.01	1,650	1,667.3	8.34
Sri Lanka	.33	2,128	695.24	3.48
Thailand	1.52	1,510	2,300.5	11.5
Total	15.2	2,189	33,380.64	166.9

Sources: Production data from FAO Fishstat J database; Unit Price for India from CMFRI, the same is used for Bangladesh, Maldives, and Sri Lanka. For Indonesia. Malaysia, Myanmar, and Thailand, value is estimated from SEAFDEC SEASOFIA 2022.

modernized, the volume of the built-up capital has also increased. However, an estimate of built-up capital is not available readily. Value-at-risk (VaR) is a statistical measure of the riskiness of financial entities or portfolios of assets. In the present context, we have used VaR to analyze the production and asset risks in the fisheries sector due to weather events and normal operations.

3.4 Production risks

Multi-species and Multi-fleet fishery is one of the specific characteristics for tropical countries. However, while information is available on their catch, there is limited information on stock status, Maximum Sustainable Yield (MSY), the price at the first sale, etc. as this information is not regularly studied or reported. Climate change is likely to have different impacts on various species, impact different fishes in different ways, and the impact may not be negative always.

Fish stocks are at risk more from anthropogenic activities and climate change is only likely to aggravate it. Finally, fish stocks are shared and property rights, (at individual or national levels) which are not well defined. Therefore, the production risks are estimated based on catch data and information available on the possible impact of climate change on the catch.

At the national or regional level, there is no significant fluctuation in the catch (**Table 7**). It is because the decline in one fishery might have been compensated by the other in terms of quantity, but not in terms of value.

Table 7: Marine capture production in South and South –East Asian countries from 2010 to 2020 (in '000 tonnes)

Year	Bangladesh	India	Indonesia	Malaysia	Maldives	Myanmar	Sri Lanka	Thailand
2010	607	3,272	5,046	1433	123	1,176	338	1,601
2011	546	3,275	5,391	1377	121	1,178	369	1,610
2012	579	3,432	5,471	1476	120	1,132	407	1,500
2013	589	3,439	5,729	1487	130	1,081	425	1,614
2014	595	3,744	6,080	1462	129	1,118	452	1,488
2015	600	3,516	6,263	1490	127	1,107	433	1,317
2016	627	3,735	6,149	1579	129	1,186	445	1,343
2017	637	3,958	6,612	1469	142	1,268	423	1,300
2018	655	3,638	6,755	1457	151	1,148	423	1,393
2019	660	3,692	6,630	1460	135	1,064	415	1,411
2020	671	3,727	6,494	1387	149	1,010	327	1,524

Case study: Decline in oil sardine production in India

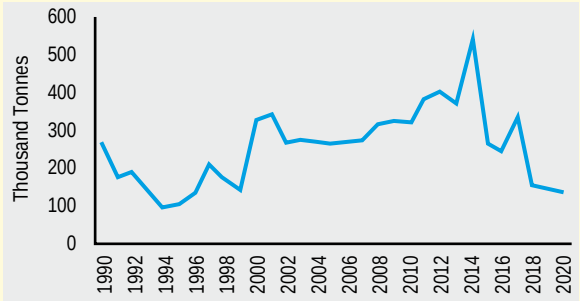


Figure 8. Oil sardine Production in India during 1990 to 2020

Sardinella longiceps, Indian Oil Sardine (IOS) is traditionally amongst the topmost contributors to total production in India. However, the fishery is sensitive to temperature fluctuation which can lead to fluctuation in yield (**Figure 8**). The ICAR-CMFRI attributed the decline in the catch in 2016 to El Nino which led to reduced recruitment and when coupled with the normal fishing pressure, it led to the decline of the fishery. According to a recent CMFRI report (2022), the landings of IOS further declined in 2021.Consequently, the annual value of the sardine in the landing centres dropped to INR 300 million in 2021 from that of INR 6,080 million in 2014, incurring a loss of INR 5780 million to the sector, and resultantly, the annual income of fishers was reduced to INR 90,262 in 2021 from that of INR 0.34 million, on an average.

3.5 Life risks

Human Life Value (HLV) is estimated as the present value of all future income that one could expect to earn for their family. It is defined as the total income an individual is expected to earn until retirement. It indicates the economic loss a family would suffer in case of the early demise of the earning member. However, no published information is available on the income stream of fishers. Given this, the following assumptions are made to measure the value of HLV:

- On average, fishers receive 40% of the gross revenue, which is shared equally amongst the crew.
- The price and catch remain constant throughout the year.
- The median age of a fisher is 40 years and he remains active still 60 years of age:

Based on these assumptions, the value of human resources is estimated as follows (**Table 8**):

Therefore, potential loss for the fishers and his family due to bad weather or any other operational risks could be at least USD 10, 376 in case of Myanmar and 0.3 million in case of a fisher from Maldives. However, actual loss will vary significantly based on the type of operation they are engaged in. In the case of India, converting back to the local currency, the HLV of a fisher is about INR 5.4 million whereas the insurance coverage is about INR 0.5 million under the Group Insurance Scheme, roughly equivalent to his two-years income.

That is in case of the death of the bread winner, the family get about two years to prepare themselves for the future including finding a job with comparable pay if they have to maintain their standard of living. This is quite a steep challenge. In many cases, especially, where there the single bread winner dies, the family often drove to destitution following such an event.

3.6 Measuring the value of the physical assets

In the case of physical assets, the first decision point is whether the book value or the replacement value of the assets will be considered. Book value denotes the depreciated value of the asset and needs information on its cost of acquisition, years in use and lifespan, depreciation rate, etc. Alternatively, book value can be considered equal to the sale value of the asset at the current market. On the other hand, replacement value denotes the price of the

Table 8: Value of fisher's life- Simple Calculation based on catch share

Country	Total value (USD)	Labour share (USD)	Number of active fishers	Annual per capita income	Total income in 20 years
Bangladesh	1,428.11M	571.24M	0.51M	1,115.71	22,314.21
India	7,892.75M	3157.1M	0.93M	3,405.42	68,108.40
Indonesia	16,447.92M	6579.17M	2.3M	2,864.56	57,291.19
Malaysia	2,632.68M	1053.07M	0.13M	8,318.44	1,66,368.84
Maldives	392.36M	156.94M	0.01M	16,427.04	3,28,540.75
Myanmar	1,667.3M	666.92M	1.29M	518.80	10,376.05
Sri Lanka	695.24M	278.09M	0.23M	1,235.87	24,717.33
Thailand	2,300.5M	920.2M	0.2M	4,703.80	94,076.07

Table 9: Total number of powered and non-powered fishing vessels

Country	Powered vessels	Non-powered vessels	Total
Bangladesh	33,093	34,810	67,903
India	143,020	50,567	193,587
Indonesia	460,658	165,050	625,708
Malaysia	47,790	37,155	84,945
Maldives	-	-	-
Myanmar	17,288	5,122	22,410
Sri Lanka	31,376	27,469	58,845
Thailand	11,237	-	11,237

*FAO. 2021. FAO Yearbook. Fishery and Aquaculture Statistics 2019; *Data not available*

asset, if it is procured in the current market. For normal goods, replacement value exceeds book value. (**Table 9**) shows the country-wise number of fishing vessels.

Given that the objective of the asset insurance is to ensure resuming the business following an unfavourable event at the earliest, replacement value would be a better measure than book value.

The availability of information from secondary sources is inadequate both for estimation of replacement cost or book value. Data on book value may be collected from a sample survey of fishing units. A recent FAO and BOBP study reported that the book value of a shrimp trawler in Bangladesh is about USD 900,000 while that of a gillnetter is USD 32,785. The same for India is about USD 75 000 and USD 95 118 respectively (Van Anrooy *et. al.* 2020*)*.

In the case of replacement cost, data may be collected from market surveys. Hull accounts for the largest share of vessel cost followed by gear and electronic equipment. Since gear and electronic equipment are very diversified and their use varies from boat to boat, only the price of the hull for the different fishing vessels will be collected for the purpose of the study. Countries, such as Bangladesh import trawlers often with all paraphernalia. Therefore, in such cases import cost of a similar trawler may be collected.

It may be noted that there are limited cases of total damage to fishing vessels and a probability distribution can be drawn to estimate the damage curve if data is available. However, such an exercise is beyond the scope of this project.

In terms of fleet-level economics, a recent FAO study, which covered 13 major fishing fleets of Bangladesh, India, and Indonesia, reported that 12/13 fishing fleets are earning a profit, exhibiting a rather optimistic future for fisheries (**Table 10**). Only tuna long line fishery of Indonesia reported a net loss during the study.

Table 10: Annual profit/Loss in marine fisheries (US$)

Country	Revenue/Cost	Shrimp trawlers	Fish trawlers	Wooden Trawlers	Gill netters
Bangladesh	Total Operating costs	1,058,831	1,119,347	345,817	123,919
	Total revenue/ earnings	1,717,430	1,572,293	364,694	151,791
Country	Revenue/Cost	Trawler	Gillnetter	Purse seiner	Ring seiner
India	Total Operating costs	138,315	40,935	321,045	192,785
	Total revenue/earnings	205,577	95,433	445,333	257,420

Country	Revenue/Cost	Purse seiners	Cast netters	Tuna longlines	Pole and liners	Squid jiggers
Indonesia	Total Operating costs	197,989	89,865	140,418	8,927	222,370
	Total revenue/ earnings	261,721	141,000	72,767	10,651	272,979

Source: Van Anrooy, R., Carvalho, N., Kitts, A., Mukherjee, R., Van Eijs, S., Japp, D. and Ndao, S. 2021. Review of the techno-economic performance of the main global fishing fleets. FAO Fisheries and Aquaculture Technical Paper No. 654. Rome, FAO.

To sum up, the marine fisheries sector is playing an important role in the regional economy as a source of food and livelihood. Therefore, ensuring that risks are mitigated and L&D or compensated to the best possible extent is of paramount importance.

Table 11: Value of Fishing Vessels operating from Chennai Fishing Harbour (Replacement Cost)

Sl. No	Association	Type of Fishing	Number of Members	Number of Boats	Estimated cumulative value of the asset (Million US$)
1	Chennai Mechanized BOA	Trawlers	300	300	33.75
2	Chennai Gillnet & Longline Tuna Fishing BOA	Gillnet-cum-Longline	300	250	31.25
3	Chennai-Thiruvallur-Kanchipuram District Mechanized BOA	Trawlers	350	350	30.63
4	Thiruvallur Chennai Kanchipuram District Deep Sea FWA	Deep sea-going Gillnet-cum-Longline	150	350	13.13
5	Chennai Mechanized Boat Owners WA	Trawler	200	150	13.13
6	Chennai Singaravelar Gillnet Double and Single Engine Fibre Boat FWA	Gillnetter	70	70	3.50
7	Jeevaratnam Singaravelar Longline Boat Owners WA	Longline	50	50	2.19
8	Thiruvallur Chennai Kanchipuram District Deep Sea Fishers WA	Longline	8	8	0.25
9	Chennai Fibre Boat Labour WA	Motorized FRP boats	100	30	0.19
	Total		1528	1558	128

BOA = *Boat Owner Association; FWA = Fishers Welfare Association*

At the micro-level, Stakeholder Consultation carried out in Chennai provided estimates of the financial value of an all-equipped fishing vessel. These values are comparable to the replacement cost as the information is about buying a nearly similar (may not be an identical) fishing vessel in Chennai, India (***Table 11***). It shows that only in Chennai Fishing Harbour, fishing vessels worth about USD 128 million are being operated.

3.7 Prevailing governmental support to the sector and the scope of reallocation

There are various forms of support provided to the marine fisheries sector by the Government. They can be clubbed into two broad groups: [1] Direct support to the individual and companies, and [2] Support for services to the sector. Direct support to individuals include grant/soft loan for modernization/purchase of fishing vessels (e.g. Deep sea fishing vessels in

India); price support, income support, fuel tax exemption, etc. Support for services to the sector include provision of fisheries infrastructure, R&D, stock enhancement, trade promotion, etc.

In the context of South and South East Asia, provision of the public finance stemmed from various factors such as need for rapid growth through large investments, failure of capital market, poverty and lack of investable capital amongst fishers, controlling of informal credit market, etc. Many of these support, such as price support also doubled up as a form of insurance. This arguably played an important role in the rapid development of the sector. However, there is also the possibility of such support measures to cause over-capacity and depletion of fish stocks. Hence, pursuant to the 12th Ministerial conference (MC) of the World Trade Organization (WTO), an agreement was reached on rationalization/discontinuation of such support or subsidies.

Estimates provided by the OECD (**Table 12**) shows that during 2018, India provided a financial support of USD 44.33 million to the sector nearly equally divided between the personal and sectoral support. Highest amount of support provided by Malaysia, directly to the fishers, estimated at USD 136.06 million. Indonesia provided support mostly to the sector. However, in comparison to the value of marine fisheries, the amount of financial support is less than one percent except for Malaysia.

That is, there is a strong scope of redesigning the fisheries support system in line with the WTO Agreement to meet the disaster risks in the sector. The objective of such support will be to ensure value retention and value capture without contributing to the sectoral capacity. A proper mechanism should be developed to channelize fund from fisheries revenue in a productive way that benefit the sector and the participants in it.

3.8 Estimating Loss & damage for Emergency Relief

In the year 1972, the United Nations Economic Commission for Latin America and the Caribbean (UNECLAC) developed a comprehensive methodology for the assessment of the losses and damages of natural disasters, known as the Damage, Loss and Needs Assessment (DaLA) methodology. It has been widely accepted and became a primary tool to quantify the impacts of the disasters. To estimate the damages and losses closest to the actual value, the methodology has been constantly updated/improved by international agencies such as WHO, PAHO, World Bank, ADB, UNESCO, ILO, etc.

The damage and loss assessment methodology addresses post-disaster relief operations, economic recovery, rehabilitation, and reconstruction. The methodology provides recovery and reconstruction of

Table 12. Financial support to the fisheries sector (Million USD)

Type of support/Country	India	Indonesia	Malaysia
Direct support to the individual and companies	22.97	8.60	130.95
Support for services to the sector	21.36	38.43	5.11
Total support (Million USD)	44.33	47.03	136.06
Value of fisheries (Million USD)	7,892.75	16,447.92	2,632.68
Support/Value	0.56	0.29	5.17

Source: OECD.Stat. Data is for 2018 except Malaysia (2016). Estimate may include support provided to the inland fisheries sector also.

disaster in short-medium-long term needs. In the short term, the assessment aims to address food security, health care, and rehabilitation/ shelter for the people affected by the disaster. In the medium-term, the assessment focuses on agriculture, fisheries, industry, infrastructure, and livelihoods of the affected region, and in the long-term, resilience would be developed.

The UNECLAC methodology developed in the 70s is a bottom-up approach that works in a stock-flow concept. It measures damages as stock and losses as economic flows. Post-disaster damages or direct costs in the short-term such as destruction of any physical assets, infrastructure, natural resources, agriculture, irrigation, bridges, ports, utility, etc. are considered as stock or change of the stock. The damage to the stock is calculated as a replacement cost. Losses are considered changes in economic flows, usually assessed in the medium-term post-disaster. The losses such as loss in income due to the disaster are considered as direct losses and indirect losses are such as production losses of agriculture, livestock, fisheries, industry, infrastructure, utilities, etc.

Under DaLA methodology, the post-disaster assessment plan is usually divided into preliminary assessment and detailed assessment, which are further divided into several sectors, such as social sectors, productive sectors, infrastructure, and cross-sectors, and this way of set-up helps the governments to understand in which sector damages and losses are concentrated.

The DaLA methodology developed by the World Bank has six steps; the methodology is followed by other international agencies such as Asian Development Bank, WHO, etc.

Step 1: Develop a Baseline Assessment:

For the Baseline assessment, two types of information are required: a) information related to demographic and socioeconomic characteristics of the country and b) Sectoral-wise detailed economic activity. More preciously, comprehensive information on the existing/operational physical assets such as houses, schools, health facilities, agricultural area and production, industry area, water and sanitation facilities, electricity, and other infrastructures need to be collected from different reliable sources of local/state/ central government/ international bodies. This information will be useful when the disaster occurs; the monetary and physical value of the post-disaster damages will be considered as the loss of "before and after" asset value. If the baseline asset information is unavailable for the year, the disaster realted information from the previous years are considered for the assessment (GFDRR,2008).

Step 2: Develop Post-Disaster Scenario:

This step involves the assessment of the post-disaster event. A field survey (physical inspection) or an aerial survey (GIS and Remote Sensing techniques) is conducted to identify the assets' damage. In assessing the damage, the assets are divided into the size and capacity of the infrastructure, which allows the authorities to allocate the resources accordingly. It also provides an estimation of the expected reconstruction cost of the assets (housing, infrastructure, etc.,) and the expected recovery of the production (industry, agriculture, etc.,).

Step 3: Post-Disaster Sector Performance:

In this step, the funding/insurance agencies will examine the damage to each economic sector. For example, the impact of a cyclonic event on the fisheries sector. It can be assessed based on the estimation of the production of fish in the period free from cyclones and production with cyclones, the difference between the two will provide the damage to the fisheries sector due to cyclones. Similarly, considering the agriculture sector, the countries that rely on the agriculture sector will have huge economic losses due to a disaster event.

Step 4: Estimating Total Value of Damages and Losses:

In this step, all the sectors' losses and damages will be aggregated. While aggregating the losses, a few sub-sectors may represent/reflect two or more sectors, for example, food processing, which is part of agricultural production and the food processing industry. In such cases, losses of

the particular sub-sector need to be considered only once. Duplication/double accounting of the damages may happen in any of the industries/sectors. In this stage of damage assessment, the losses from agriculture, livestock, and fisheries are measured at production, and not at the wholesale/retail markets. Farm road damage needs to be considered as of the agricultural losses but not in the transport sector.

Step 5: Estimation of Macroeconomic Impact of Damage and Losses:

For the GDP impact, pre-disaster GDP will be collected, i.e., current/nominal value of GDP and fiscal budget (local currency). Value- of losses could be calculated by multiplying the sectorally valued added coefficients with the aggregated damages and losses estimated in step 4. The difference between pre-GDP and estimated value-of losses provides the post-disaster GDP. Further, the impact of disaster is estimated based on the differences in GDP growth rates of the pre-disaster and post-disaster periods.

Step 6: Estimate Impact on Personal/Family Income:

Personal income loss needs to be estimated, to understand the impact of the disaster on socio-economic conditions in the affected country. It provides the relationship between production and labor force of all the sectors, under pre-disaster and post-disaster conditions. By knowing the production loss of each sector, loss in potential employment can be estimated. Further, the impact on different income groups can also be estimated. The obtained information in this step would help to determine the disaster's impact on different income groups in the affected area. Baseline data for the analysis is usually taken from macro-level data such as national accounts of the country, International Labour organizations, and other reliable sources (**Table 13**).

Table 13: Steps followed to assess the Damage and Loss of Disasters

Steps	World Bank	ADB	Insurance Companies
Step 1	Gather baseline data of various socio-economic indicators	Two sets of pre-disaster baseline: – A baseline on physical assets and – A baseline on the performance of production and sales.	Re-insurance companies provide insurance based on the baseline information
Step 2	Collect the preliminary damage information using field surveys and/or aerial surveys.	preliminary calendar or schedule for the reconstruction of physical assets, and a corresponding post-disaster, preliminary performance forecast of economic activities in each affected sector.	Physical verification of local insurance companies/agents will assess damages and losses
Step 3	Damage assessment in each of the sectors in the affected region.	Determine the overall amount of disaster effects, damage, and losses for all affected sectors	
Step 4	Aggregate all the losses by sector-wise and prepare the total value of damages and losses.	Estimate the overall amount of disaster effects	
Step 5	Prepare the damages and losses in percentages of the GDP of the country.	Estimate macroeconomic impact on GDP, the balance of trade and payments, and the fiscal budget.	
Step 6	Prepare the damages by income groups of each affected sector	Estimate impact on personal/family employment and income	

Source: (GFDRR, 2008) (ADB, 2009)

3.9 Examples of DaLA Estimation Processes:

The 2004 Tsunami in the Bay of Bengal washed away palm oil farms in Thailand, which caused substantial economic losses to the country. The country witnessed immediate production loss and a decrease in crop production for the next five years due to salinity. The loss to palm oil plantations is estimated based on the percentage of the palm oil trees that were completely uprooted in the total affected area i.e. 18% of 1,652.3 hectares. The average cost of re-planting the trees in 297.4 hectares (18% of the total) is USD 74.3 million (USD 25,000/hectare), which is the total estimated loss to the palm oil industry due to the Tsunami.

In 2007, Cyclone Sidr, one of the deadliest cyclones in Bangladesh's history, made landfall and disrupted the lives of 2.3 million people, and approximately 3,500 people lost their lives. The estimated damages and losses due to cyclone are worth of USD 1.2 Billion and USD 0.5 Billion (2008 prices), respectively. The cyclone severely damaged the agricultural production, rural infrastructure, and livelihood of the people. The damage assessment was divided into several sectors concerning losses to agro-industry and recovery & reconstruction. Within the agro-industry, it is further divided into three sub-sectors: Agricultural crops, livestock, and fisheries.

The total crop damages were estimated by determining the total crop area and the damaged crop area by type of crop. Among the affected crop areas, totally damaged crop (A) and partially damaged crop (B) will be assessed separately, and the total damaged crop area is estimated as C=A+aB. Further, the production loss is calculated by multiplying the total damaged area of different crop yields (Y), i.e., Q=CxY. The estimated production loss (V) for each crop can be estimated by multiplying the value of each crop/hectare (P), i.e., V = QxP.

Similarly, to estimate livestock production loss, the information on the livestock, i.e., animal poultry deaths is collected in the affected area. After collecting the data on livestock deaths, the damages are calculated by estimating the value of each animal. The value of the livestock will be obtained by multiplying livestock loss by the average price of each animal type (Cows, Buffalos, Goats, Sheep, Chicken, etc.). Further, the damage to the livestock-related infrastructure, such as roads, public buildings, poultry sheds, loss of fodder, and loss of milk, meat, and eggs will be assessed by each sub-sector.

The loss to the fisheries sector will be assessed by collecting the data on fisheries infrastructure and equipment (Ponds, Boats, fishing gear, etc.), and damage to public infrastructure (electric lines, walls, public buildings, etc.). The damage to fisheries infrastructure will significantly affect fish and shrimp stock. Fish and shrimp production will be low until the equipment and infrastructure are repaired or restocked. Washed away fish and shrimp loss to individual households may not be considered a loss to the economy as they enter open water fisheries and their production is likely to increase. The following (**Table 14**) provides an overview of the damage assessment of the agro-industry in the cyclone Sidr-affected areas of Bangladesh. The total estimated damage to the agro-industry is US$ 438 million, i.e., crops $412 million, and livestock: $19.3 million.

Loss and Damage Assessment during cyclones in Odisha: The State of Odisha covers 17% of East coast of India, and the state has witnessed 35% of the severe and very severe cyclones formed in the Bay of Bengal Region. The most prominent cyclones that severely affected the state of Odisha are Super Cyclone (1999), Cyclone Phalin (2013), Cyclone Hudud (2014), Cyclone Titli (2018), Cyclone Fani (2019), Cyclone Bulbul (2019), Cyclone Amphan (2020), Cyclone Yaas (2021), and Cyclone Gulab (2021).

The super cyclone in 1999 severely disrupted the lives of 18 million people in the State of Odisha and claimed more than 10,000 lives. With the experience of Cyclone 1999, the state has taken several preparedness measures subsequently to minimize human casualties. Because of the preparedness and precautionary measures, the state could save

Table 14: Damage assessment of the agro-industry in the cyclone Sidr affected areas of Bangladesh

Sub Sector	Possible losses	Damage and Loss, sector	Damage Value (US$ Million)
Crop	Production losses (MT)		
Rice		Total Damage to the crops	US$ 412 million
Vegetables	804,958		
Pulses/Lentils	177,955		
Mustard	41,630		
Betel Leaves	21,744		
Banana	25,616		
Papaya	93,383		
	24,488		
Livestock	Number of deaths	Damage	
		Loss	US$ 19.3 million
Cows	37,391		
Buffalos	7,211	Public	0.16
Goat	59,804	Private	19.17
Sheep	3,517	Infrastructure	1.01
Chicken	2,219,328	Feed	4.90
Ducks	353,691	Dead	13.26
Fisheries	Units	Damage	US$ 2 million
		Loss	US$ 4.7 million
Damage to ponds/dighis/ghers	113,914 number and 87,096 acres	Public	0.11
		Private	6.6
Loss of fish/shrimp	Washed away fish loss	2.56	
Fish	5,414 tons	Washed away shrimp	2.02
Shrimp	707 tons	Washed away fingerlings	0.13
Damage to fishing equipment	Damage to boats and nets	1.89	
Boats	1,855 number		
Nets	1,721 number		

and rescue thousands of lives in the cyclones that occurred in later years. However, the financial/asset losses have indeed multiplied. This section provides the disaster assessment of the two deadliest cyclones that made landfall on the Odisha coast: Phalin (2013) and Fani (2019).

In 2013, a very severe cyclone "Phalin" made landfall on the Odisha coast, and 18 of 30 districts of Odisha were affected by the Cyclone. The cyclone had disrupted the lives of 13.2 million people and damaged 256, 600 houses (ADB et al., 2013). In the year 2019, an extremely severe cyclonic storm "Fani" made landfall in the state of Odisha. Due to the "Fani", the lives of 16.5 million people in 14 districts were disrupted, and a total of 0.36 million houses were damaged. Due to the prompt response to the cyclone warning, the state authorities were able to evacuate a large number of people to safe places, and as a result death toll drastically reduced (44 deaths in Phalin and 65 deaths in Fani) in comparison to the 1999 Super Cyclone (over 10,000 deaths).

To prepare for the Damage, Loss, and Needs Assessment (DLNA) related to Phalin and Fani Cyclones, the State of Odisha has collaborated with the UN, WB and ADB. Based on the

preliminary data received from the field visits, the physical damages to houses, public buildings, roads, Urban and Rural Infrastructure, Agriculture and Livestock, Livelihood (Fisheries, MSME, Handicraft& Handloom), Energy/Power, and Forest and Plantations were prepared (ADB and GoO, 2019). To prepare the DLNA, the Government of Odisha followed the steps provided in the UN DaLA methodology: i) collection of pre-disaster baseline data from various government agencies ii) collection of post-disaster conditions from field visits iii) examining the disaster's effects and impacts in each sector and identification of the recovery need iv) prioritization and finalization of the recovery need in coordination with state/local government agencies, and v) develop a sector-wise recovery strategy. The assessments also comprised the issues related to the environment, disaster risk reduction and employment, livelihoods, and social protection. To assess the impact of the disaster in qualitative terms, a thorough investigation of each sector was made, and meetings at the grassroots level were conducted to assess the needs of vulnerable communities (ADB and GoO, 2019) (**Table 15**).

Table 15: Post Disaster Damage assessment of the two extremely severe Cyclones Phalin and Fani affected areas in state of Odisha, India

Damage Assessment damage in USD	Phalin (2013)	Fani (2019)
Housing		
Damaged Houses (number)	256,633 (number)	
Reconstruction Cost (USD)	480 million	439 million
Public Buildings (schools, health centres, and other public infrastructure)	12,296	
Damaged Buildings (number)		
Reconstruction Cost (USD)	110 million	172 million
Heritage Buildings reconstruction (USD)	8000	271 million
Roads damaged (USD)	110 million	50 million
Urban Infrastructure	31 million	85 million
Rural Water Supply Sanitation	44.56 million	1 million
Agriculture and Livestock		
Crop loss	287 million	238 million
Horticulture crop loss	25.4 million	
Irrigation infrastructure	110 million	
Livestock	4.4 million	
Livelihood		
Fisheries	97 million	23 million
Handicrafts	41 million	
Handlooms	5 million	
MSME	135 million	
Power Infrastructure	170 million	1,119 million
Forest	3 million	
Total estimated damage and losses	USD 1,450 million (2013 prices)	3,484 million (2019 prices)

3.10 FAO's Methodology for DaLA in Fisheries

DL (FI) (FISHERIES DAMAGE AND DOSS) = FISHERIES PRODUCTION DAMAGE + FISHERIES PRODUCTION LOSS

Fisheries Production Damage PD (FI) is composed of the:

1) Pre-disaster value of stored inputs: **Δqx(stored),j,t × px(stored),j,t-1**

2) Pre-disaster value of destroyed stored capture: **Δqi(stored),j,t × pi(stored),j,t-1**

The term **(Δqx(stored),j,t × px(stored),j,t-1)** represents the quantity of fishing inputs q for by input type (bait, etc.) which have been destroyed by a disaster, valued at their respective price p at pre-disaster level (t-1). Calculations are done by input type for all affected inputs.

The term **(Δqi(stored),j,t × pi(stored),j,t-1)** represents the quantity of stored fisheries that have been destroyed by a disaster, valued at pre-disaster price p at level (t-1).

$$PD\ (FI)i,j = \Delta qx(stored),j,t \times px(stored),j,t-1 + \Delta qi(stored),j,t \times pi(stored),j,t-1$$

Fisheries Production Loss PL (FI) is composed of the:

1) Difference between expected and actual value of fisheries capture in disaster year:
ΔTj,t × yi,j,t × pi,j,t-1

The term **(ΔTj,t × yi,j,t × pi,j,t-1)** represents the fisheries capture which has been lost due to disasters, expressed as the time when fishermen will be prevented from conducting normal fishing activities T (in the number of days) multiplied by the average capture per day in normal conditions y and valued at pre-disaster level prices p at level (t-1).

$$PL\ (FI)i,j = \Delta Tj,t \times yi,j,t \times pi,j,t-1$$

Fisheries Assets Damage AD (FI) is composed of the:

1) Repair / replacement cost of partially / fully destroyed assets at pre-disaster price:
pk,j,t-1 × Δqk,j,t

The term **(pk,j,t-1 × Δqk,j,t)** represents the total asset damage, where the quantity of damaged or destroyed items Δq is valued by their respective repair or replacement cost

$$AD\ (FI)i,j = pk,j,t-1 \times \Delta qk,j,t$$

p at pre-disaster level (t-1). This Assets category includes fisheries-specific infrastructure and equipment, for example, boats, fishing vessels, engines, fishing gear, cold storage, etc.

Information requirement

1. Types of fishing activities in the affected areas (small-scale, industrial, etc.) (minimal requirement);
2. The average volume of daily/weekly/monthly capture by fishing activity (minimal requirement);
3. Number of days fishing activities are suspended due to disaster by fishing activity (minimal requirement);
4. Number of fully and/or partially damaged infrastructure, vessels, equipment, and other assets by asset type (minimal requirement);
5. The volume of inputs and stored capture destroyed by disaster (optimal requirement).

[7] *Based on Conforti, P., Markova, G., & Tochkov, D. 2020. FAO's methodology for damage and loss assessment in agriculture. FAO Statistics Working Paper 19-17. Rome. https://doi.org/10.4060/ca6990en*

Information Readiness in South Asia

Information Status	Bangladesh	India	Maldives	Sri Lanka
Types of fishing activities in the affected areas (small-scale, industrial, etc.) (minimal requirement);	Primary and Secondary data available			
The average volume of daily/weekly/ monthly capture by fishing activity (minimal requirement);	No system of catch reporting. Therefore, may have to be estimated through surveys, and annual data. In Bangladesh, industrial trawlers are reporting catches.		Catch reporting system in progress. In Sri Lanka, catch reporting needs to be improved for inshore vessels	
Number of days fishing activities are suspended due to disaster by fishing activity (minimal requirement);	Based on a survey as no sailing permission is required except for industrial trawlers in Bangladesh		For larger fishing vessels, data can be collected from the administrative record. However, for smaller vessels, a survey will be required.	
Number of fully and/or partially damaged infrastructure, vessels, equipment, and other assets by asset type (minimal requirement);	Aerial survey, ground truthing, and field investigation. Fisher associations, if empowered and trained properly can supply such information.			
The volume of inputs and stored capture destroyed by disaster (optimal requirement).	Except for the part of the fisheries with an established supply chain, such information is difficult to collect. Most of fishing vessels do not have a dedicated supply channel.			

3.11 Estimated damage during weather events: India

In India, the state and the central governments jointly provide group insurance schemes to fishers. Pradhan Mantri Matsya Sampada Yojana (PMMSY) by Government of India covers INR 0.5 million (USD 6,511) against death or permanent disability, 0.25 million (USD 3,257) against partial disability, and INR 25,000 (USD 325) for hospitalization (DoF, 2022). Similarly, the state-run life insurance body, Jiban Bima Corporation (JBC) in Bangladesh, provides community-based insurance for over 2 million coastal fishers (ICSF, 2015). Due to technical advancement, weather departments can predict cyclonic depressions, their chances of converting to Storm or severe cyclonic storm and also the track of cyclonic storms. Based on the predictions, weather departments issue warnings timely to fishers, and because of this, fishing boat accidents and the death toll in the BOB region are reduced in recent times. As per the fishers' community, such warnings increased over the years.

During the warning period, the fishers are expected not to venture into the sea. Depending on the cyclonic depression, on average, fishers lose 10-15 fishing days. Apart from cyclonic warnings, Govt. of India and Govt. of Bangladesh impose a ban on the fishing to increase the productivity. In India, the ban starts between 15th April to 14th June on the east coast (61 days) and from 01 June to 31st July on the west coast. During which mechanized fishing is prohibited. In Bangladesh, there is a ban on fishing from 20th May to 23 July (65 days) and a ban on hilsa fishing for 22 days in October (date varies depending on lunar cycle). In India, the loss to fishers during the ban period is compensated with an amount of INR 4000/month(mahe.gov.in), which is far

below the monthly wage that they receive during the fishing season (INR 11,000, with an average wage rate of INR 382/day and share of by catch which comes to about INR 2000-3500). However, the fishermen community constantly appealing the Government of India to increase the compensation to INR 15,000, with growing demand from fishermen community, the state of Andhra Pradesh increased the amount to INR 10,000 (science.thewire.in).

Therefore, together with the Fishing ban period and cyclonic depression loss days, the fishers lose approximately 70- 75 fishing days per year. Hence, there can be an insurance programme to cover for minimum number of guaranteed fishing days after adjusting for holidays, ban and normal weather disturbances. The insurance scheme can cover for a minimum of 210-220 fishing days per year below which a compensation can be provided at a pro-rata basis. During the fishing holidays, the Government can secure the fishers with fixed income and provide various employment/ enterprise awareness and skill-based training programs.

3.12 Emergency relief: India

In the case of India, The State Disaster Response Fund (SDRF), constituted under Section 48 (1) (a) of the Disaster Management Act, 2005, is the primary fund available to State Governments for responses to notified disasters. The Central Government contributes 75% of SDRF allocation for general category States/UTs and 90% for special category States/UTs (NE States, Sikkim, Uttarakhand, Himachal Pradesh, Jammu, and Kashmir). The annual contribution of the Central government is released in two equal instalments as per the recommendation of the Finance Commission. SDRF is used only for meeting the expenditure for providing immediate relief to the victims. Disaster (s) covered under SDRF are Cyclone, drought, earthquake, fire, flood, tsunami, hailstorm, landslide, avalanche, cloudburst, pest attack, frost, and cold waves. Disaster relief is primarily the responsibility of the state and each state maintains a State Disaster Response Fund. The National Disaster Response Fund (NDRF), constituted under Section 46 of the Disaster Management Act, 2005, supplements the SDRF of a State, in case of a disaster of severe nature, provided adequate funds are not available in SDRF. The Finance Commission of India recommends the allocation size as well as utilization pattern of the fund. For example, the 15th Finance Commission recommended a total allocation of INR 1, 60,153 crores for the State Disaster Risk Management Fund (SDRMF) for the period of 2021-26. Further, the total State allocation for SDRMF has been divided into State Disaster Response Fund (SDRF) and State Disaster Mitigation Fund (SDMF). Within the SDRF there would be three sub-allocations: (i) Response and Relief (40 percent), (ii) Recovery and Reconstruction (30 percent), and (iii) Preparedness and Capacity-building (10 percent). Further, there is an approved list of items (http://wbdmd.gov.in/ writereaddata/ NW719485.pdf) and suggested amounts for different types of damage. For example, compensation for loss of life is INR 0.4 million across India irrespective of HPV. There is also similar fixed compensation for other types of loss and damages.

Timeliness of the emergency relief also remain a major challenge. Many-a-times, news reports were published about delay in providing emergency relief. Such delay also causes a chain effect on the quality of livelihoods. As mentioned earlier, many a times, affected people take personal loan or sale their property to deal with the loss increasing their indebtedness and reducing their asset base.

While this is necessary, for administrative rigor, easiness, speed of application, and transparency, such measures could hide the extent of actual damage. As can be seen from the compensation for loss of life, while all death may cause a similar amount of psychological distress for a family, the loss of

[8] *https://mahe.gov.in/fisheries-fishermen-welfare/*

[9] *https://science.thewire.in/politics/rights/india-monsoon-fishing-ban-small-scale-fishers-insufficient-relief-coverage/*

[10] *https://ndmindia.mha.gov.in/images/gallery/Guidelines%20SDRF%20&%20NDRF.PDF*

life of the breadwinner has far more significant economic implications. However, instead of ex-gratia payment, a state-supported participatory insurance scheme may better reflect the HPV and help during distress. Therefore, it is of utmost importance that a proper loss and damage estimate is carried out following a disaster to understand the true economic loss and how much of it is covered under the state mechanism. Such information will help in the efficient allocation of resources and better risk coverage.

Poor compensation for damaged boats hits fishermen

R Krishnamoorthy

Two months after the disaster, they have just begun to receive the relief for partially damaged boats

Fishermen affected by Gaja cyclone are peeved at what they describe as the tardy pace of the Government

Section 4.0 Insurance as a Risk Mitigation Measure: Status and Scope

4.1 Role of Insurance & Policy Implications

During the COP21 (Paris Agreement), the world countries agreed to combat climate change and address the Warsaw International Mechanism (WIM) for Loss and Damage associated with Climate Changes (Article 8 of Paris Agreement). Further, Article 8 provided the following mitigation aspects: (a) Early warning systems; (b) Emergency preparedness; (c) Slow onset events; (d) Events that may involve irreversible and permanent loss and damage; (e) Comprehensive risk assessment and management; (f) Risk insurance facilities, climate risk pooling, and other insurance solutions; (g) Non-economic losses; and (h) Resilience of communities, livelihoods, and ecosystems. The majority of BOB countries implemented all the mitigation measures except risk insurance pooling solutions, especially India and Bangladesh, which witness severe cyclones yearly. Early warning systems, preparedness, and precautionary measures minimized the death toll, but damages to the physical assets increased in an accelerating manner. In the last five years, both countries have incurred financial losses of USD 27 billion, and only 1% of the losses (approximately 270 million) were insured (EM-DAT, 2022), whereas in developed countries, more than 30% of the financial losses covered through insurance schemes. Post-disaster losses in developing countries are usually met by the Government and aid from international agencies.

WIM, as originally conceived, was comprehensive and covered damages from all factors attributable to climate change, viz., increase in frequency and intensity of extreme weather events as well as slow onset events such as sea level rise and ocean acidification. However, most of the mechanisms identified by the WIM Executive Committee are insurance schemes. Insurance as a risk transfer mechanism applies only against events, which are sudden, accidental, and unpredictable such as tropical storms, and not against impacts on fisheries of gradual events such as rise in temperature of oceans and acidification. Hence, insurance, though necessary, addresses only some of the impacts.

As stated in the Paris agreement, WIM and given the experience with the parametric insurance in the Caribbean countries, Pacific Island countries, and the Philippines, the countries of the Bay of Bengal region need to include macro-insurance at the national level to combat the damages from the tropical cyclones and other natural disasters. And, countries need to encourage individuals to buy insurance for the assets such as housing, vessels, shops, equipment, etc.

4.2 Types of insurance Programmes

There are mainly two types of insurance available: (1) Loss & Damage (L&D) Insurance or traditional insurance, and (2) Parametric or Index-based insurance. L&D Insurance can be delivered through multiple channels, namely,

- Traditional or direct sales by the insurance companies,
- insurance company in partnership with local NGOs/ Micro-insurance
- Mutual insurance
- Community-based organization

The advantage of L&D insurance is that it can be tailor-made to the individual need and capability. It can also be reasonably scaled-down subject to the insurance maxim of the Law of Large Number. However, these products are information-heavy and their implementation usually involves high transaction costs.

Micro insurances is a possible way to deal with high transaction costs and information requirements by grounding it within the community or through mutual insurance. On the flip side, micro insurers are unlikely to take catastrophic or disaster risks and are limited to day-to-day business risks. In the case of fisheries, micro insurance is suitable to cover gear loss, which is not covered by the insurance companies due to the chance of a spurious claim and practical difficulties in validation.

On the other hand, parametric (or index-based) solutions are a type of insurance that covers the probability that a predetermined event will occur rather than making up for actual harm sustained. The insurance coverage is activated whenever pre-established event parameters—measured by an objective parameter or index connected to a particular exposure of an insured—are reached or exceeded. Depending on the characteristic or index, which is the magnitude, wind speed, or precipitation, this occurrence may actually be a tropical cyclone, flood, earthquake or any other disaster event. As a result, parametric insurance solutions are designed to complement current insurance rather than replace it by offering quick assistance following a specific catastrophe. The box below lists the important distinctions between parametric insurance and typical indemnity insurance concerning the payment trigger, recovery, base risk, claims process, term, and structure.

People Mutual of DHAN Foundation

People Mutuals was established in 2003 and registered as a trust under the Indian Trusts Act on December 11, 2003. The institution is a mutual insurance initiative promoted through collaboration between DHAN Foundation, Oxfam Novib, Rabobank Foundation and Eureko Re insurance company. The Micro Insurance Association, Netherlands (MIAN) provides technical support. Under this initiative, insurance coverage is provided for life, pension, crop and livestock. During 2003 - 2011, the number of policies issued under different categories has increased from 76,374 in 2003 to 1,076,427 in 2011. The Initiative started with a risk cover of Rupees 1 billion which has increased to Rupees 33 billion in 8 years showing the scope of the programme.

Therefore, the way forward is a judicious mix of both channels of insurance!

Traditional Insurance vs Parametric Insurance (Swiss Re)

Criteria	Traditional insurance	Parametric solutions
Payment trigger	Payment triggered by actual loss of or damage to a physical asset. For example, a fire causes physical damage to your property resulting in physical damage and business interruption loss.	Payment triggered by event occurrence exceeding the parametric threshold. For example, an earthquake of a minimum magnitude of 7.0 within a defined area.
Recovery	Reimbursement of actual loss sustained. For example, the assessment and claims investigation of actual loss sustained due to a fire.	Pre-agreed payment structure based on event parameter or index value. For example, increasing pay-out amounts with increasing earthquake magnitude.
Basis risk	Policy conditions, deductibles, and exclusions. Traditional policies often include significant deductibles and exclusions, which are efficient instruments in conventional covers to align the interests of the insured and the insurer. This can however leave the insured party with a significant amount of retained risk.	Basis risk is the risk that the trigger index does not perfectly correlate with the underlying risk exposure resulting in the client suffering a loss but the parametric insurance not being triggered. Whilst basis risk can never be fully eliminated when it comes to index-based insurance, it can be minimized by more sophisticated structures such as double trigger events or staggered pay-out structures. For example, in the case of a tropical cyclone, having a partial pay-out for lower category storms and progressively increasing pay-out for stronger storms.
Claims process – loss assessment and payment	Complex and based on loss adjuster assessment. This can take months to several years depending on the complexity of the loss.	Transparent, predictable, based on a parameter or index, quick settlement. Pay-out can be as quick as within four weeks after the event as there is no need for loss adjustment. The only thing we need to establish or measure is the index we are covering. This is typically done by a third-party agent – for example, national weather services.
Term	Usually annual Multi-year deals while possible are more difficult to structure and tend to be less common. Multi-year deals are common, and possible for up to five years.	Single or multi-year

4.3 State of Insurance in the region

The Insurance market in South and Southeast Asia is still in the growth stage. There are 469 insurance service providers in the region, of which 205 companies are focused on life insurance and 260 companies are focused on non-life insurance (**Table 16**). In comparison, there are over 5000 insurance companies in the USA and 235 insurance companies in China. In terms of insurance penetration (life insurance premium as a percentage of GDP), in 2019, Sri Lanka had the lowest penetration (0.47%) followed by Bangladesh (0.51%). Penetration in the countries is below the global median, making them part of the Bottom 50 percent. Among the other countries, Thailand has the highest penetration, followed by Malaysia, India, and Indonesia.

The situation is further worrisome in the context of non-life (general) insurance. Excluding Malaysia and Thailand, who remain the regional leaders, other countries are below global median non-life insurance penetration.

Both the life and non-life insurance industries find the insurance of fishers to be difficult. According to a recent study, 450 000 fishing vessels worldwide—or 15.7%—of the approximately 2.8 million engine-powered (motorized) fishing vessels—have marine hull insurance (Van Anrooy et al., 2022). The lack of insurance in the small-scale fisheries industry is largely to blame for the inadequate coverage. In contrast, marine hull insurance covers virtually all of the estimated 67,800 large-scale industrial fishing vessels and 50–60% of the estimated 430 000 semi-industrial fishing vessels. About 95 percent of the 2.3 million motorized small-scale fishing boats, however, operate without insurance till this time. The majority of small-scale fishers lack proper insurance services. Between 2009 and 2019, underwriting experiences in fishing vessel insurance were generally reported as "Good". What is more, access to accident, life, and health insurance services for the crew on fishing vessels and small-scale fishers in developing countries remains low though it has improved in recent years. However, the underwriting procedure is influenced by global standards, such as the procedure of the London market, which in turn largely caters to the need of the developed countries.

Index-based or parametric insurance remains a new concept as far as capture fisheries is concerned although it has many examples in the aquaculture sector.

Table 16 : State of Insurance market in the region

Country	Life	Non-Life	Total	Source	Insurance Penetration	
					Life Insurance as % of GDP	Non-Life Insurance as % of GDP
Bangladesh	35	46	81	IRDA, Bangladesh	0.51	0.18
India	24	32	56	IRDAI	2.48	0.48
Maldives			5	MMA		
Indonesia	91	109	200	OECD	1.08	0.43
Malaysia	25	25	50	OECD	2.83	1.3
Sri Lanka	12	11	23	OECD	0.47	0.53
Thailand	18	36	54	OIC, Thailand	3.88	1.31
Total	205	259	469			

Penetration data from https://tcdata360.worldbank.org/indicators/hbae5670f

The study says that resultantly, over the past ten years, not much has changed in the risk management procedures for capture fisheries insurance. The characteristics of the fishing vessel insured, however, influence how insurers define their risk assessment criteria. To issue insurance, all insurers conduct pre-acceptance surveys and require supporting documentation from vessel owners. The latter comprises the history of the vessel's management and ownership, its registration status, its valuation certificate, and a history of losses or claims or a log of events.

4.4 National climate Change and Disaster Mitigation Policies and role of insurance

4.4.1 Bangladesh

Bangladesh prepared its National Plan on Climate Change "Bangladesh Climate Change Strategy and Action Plan" in 2009. The main thrust of the policy is to eradicate poverty, increase employment opportunities, ensure food safety, provide access to energy and power and achieve economic and social well-being for all citizens of the country.

For fisheries, there is no special provision in the policy; however, it is mentioned that the climate change action plan is built on following pillars, namely food security, social protection and health, comprehensive disaster management, infrastructure, research and knowledge management, mitigation and low carbon development, capacity building, and institutional strengthening.

Along with the climate change action plan, the country has also adopted the National Plan for Disaster Management (2021-2025) for which the nodal ministry is the Ministry of Disaster Management and Relief. It is focused on Disaster Risk Reduction, Alert warning, Emergency response and Rehabilitation, Reconstruction and Recovery.

As a part of disaster relief mechanism, the Government has taken measures to provide cyclone shelters, Early-Warning systems, Evacuation measures, etc. Recently, the Government has started a program for registering and issuing the identify card for fishers. An *Ex-Gratia* payment of BDT 50, 000 is provided to the family in case of accidental death of a registered fisher.

Adaptation and Mitigation measures

- The government of Bangladesh has recently established a National Climate Change Fund, with an initial capital of 45 million USD, later raised to 100 million USD, which will focus on adaptation.
- Providing over 2000 cyclone shelters to provide refugees for communities from storm surges caused by tropical cyclones and 200 shelters from river floods.
- Coastal greenbelt project involves mangrove planting along the shoreline.
- Integrate capture and culture fisheries into the design and operation of flood management projects by involving communities in planning, construction, and management.
- The National Fisheries Policy – 1998 needs to shed light on how impacts from climate change hazards, such as sea level rise, temperature rise, variation in precipitation, and salinity intrusion have effects on different types of important fish species, their breeding, and subsequent adaptation strategies. The monitoring of impacts of climate change, response measures, institutional strengthening and coordination, and disaster risk reduction issues need to be addressed further.

4.4.2 India

National Action plan on Climate Change-2007

India prepared its National Plan on Climate Change "National Action plan on Climate Change" in 2007. The main thrust of the policy is to develop a national document compiling actions to be taken by India to address the challenge of Climate change. While there is no special provision in the policy on fisheries; it is mentioned that the climate change action plan is built for eight national missions including Sustainable Agriculture and Strategic Knowledge for Climate Change, which are relevant for fisheries.

National Policy on Disaster Management-2009

The country has also adopted the NDRMP prepared by the Ministry of Home Affairs - National Policy on Disaster Management (2009). The objective is to build a safe and disaster-resilient India by developing a holistic, proactive, multi-disaster-oriented, and technology-driven strategy through a culture of prevention, mitigation, preparedness and response. Even though there is direct provision for fisheries, it has a provision like:

- The building standards for coastal embankments and port infrastructures need to be aligned to the safety norms and concerned Departments/Authorities would ensure the requisite actions and measures to ensure the safety.
- Restoration of ecological balance in the Himalayan regions and raising coastal shelter belt plantations need to be incorporated wherever necessary
- To meet the challenges caused by Climate change in a sustained and effective manner, synergies in the approach and strategies for climate change adaptation and disaster risk reduction shall be encouraged and promoted.

Adaptation and Mitigation measures

- States/UTs have to accord the highest priority to building their own Disaster Management capabilities. Plans at all levels will be made in consonance with the guidelines and provisions in the Disaster Management Act, 2005.
- All States should provide to India Meteorological Department with the required infrastructure for the upgradation or establishment of meteorological observation systems. Partnership with the World Meteorological Organisation (WMO), Pacific Tsunami Warning System, and other regional and global institutions may also be considered.
- Communication and sharing of up-to-date information using state-of-the-art Information and Technology infrastructure remain at the heart of the effective implementation of the disaster management strategy.
- Fishers, fish farmers, processors, traders, and exporters should increase self-protection through financial mechanisms
- Financial allocation in the national budget for risk reduction and prevention practices such as early warning systems and disaster recovery programs and relocation of villages from low-lying areas.

The marine fisheries sector of India comprises about four million fisher folk and 0.3 million fishing vessels. The Government provides support to the insurance needs of the fishers through various components under the umbrella scheme of Pradhan Mantri Matsya Sampada Yojana (PMMSY).

These components are:

(1) Group Accident Insurance Scheme (GAIS) for fishers;

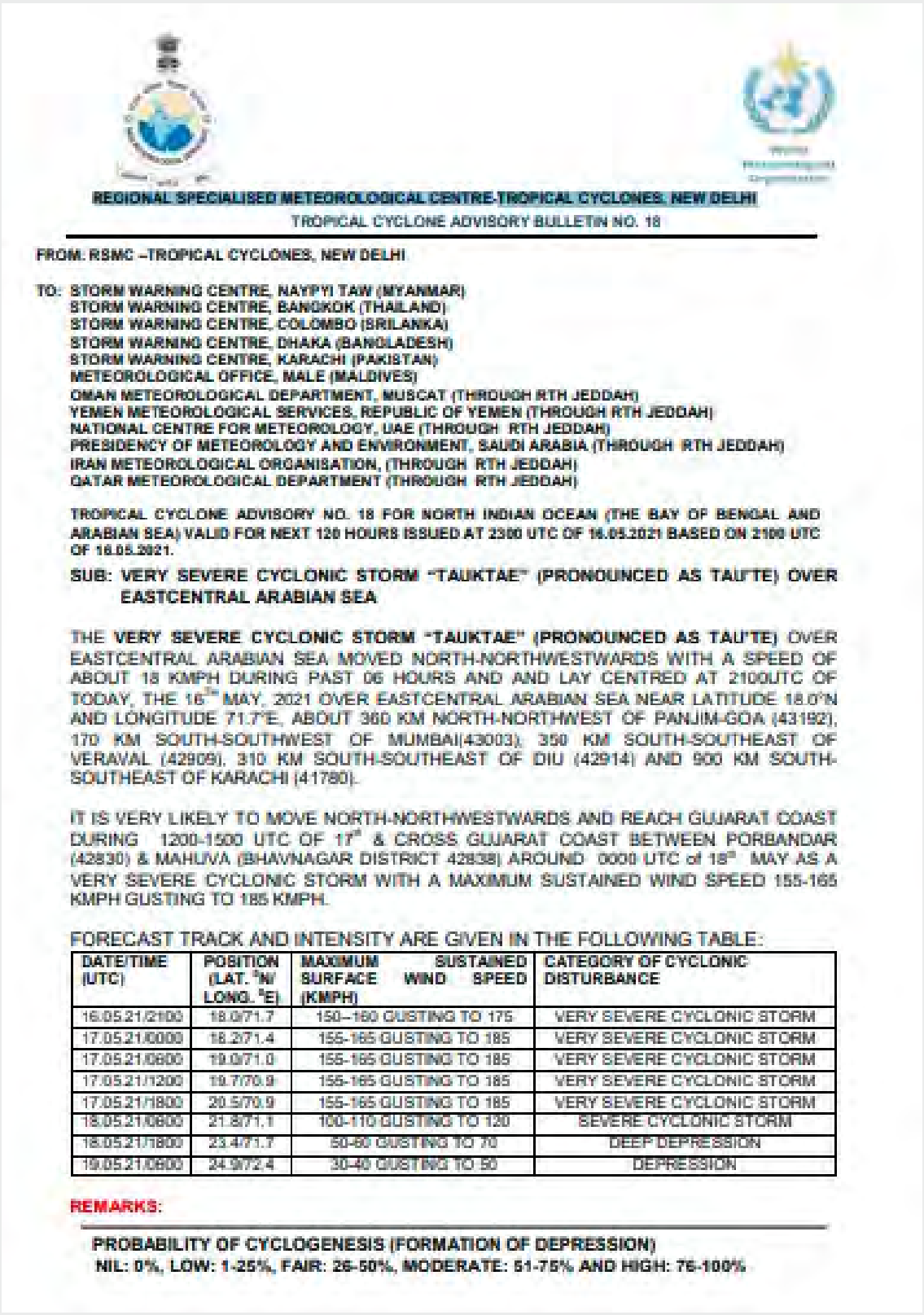
(2) Insurance premium subvention for fishing vessels.

Cyclone warning

- The IMD regional weather stations issue warnings to the fishers if there is any low pressure and depression. Depending on the cyclonic disturbance, IMD alerts the **Figure**

9. Regional Cyclone Warning Bulletin from IMD

- Fishers by providing information such as the average life period of depression, sea condition, height of the waves.
- When the sea conditions become very rough (wave height 4.0-6.0m), IMD advises the fishers not to venture into the open seas for fishing.
- The IMD issues a high alert and total suspension of fishing activity takes place when the wave height is 6 m or above.
- When a deep depression turns into a cyclonic storm or severe, very severe, super cyclonic storm, the IMD alerts the concerned authorities for preparedness such as shifting coastal dwellers to safe places and issues warning to the fishers, coastal habitats, governments, and other agencies.
- In recent years, with the help of satellite images and better forecasting techniques, IMD can accurately predict the directions of cyclonic storms. Due to this, the death toll is minimized to below 100 in any extreme event. Usually, a deep depression stays 3 days, a cyclonic storm 3.5 days, and a very severe or super cyclonic storm 4-5.75 days.
- IMD also provide the similar service to other countries in the Indian Ocean region. This is provided under the Regional Specialised Meteorological Centre-Tropical Cyclones, New Delhi (**Figure 9**).



REGIONAL SPECIALISED METEOROLOGICAL CENTRE-TROPICAL CYCLONES, NEW DELHI

TROPICAL CYCLONE ADVISORY BULLETIN NO. 18

FROM: RSMC –TROPICAL CYCLONES, NEW DELHI

TO: STORM WARNING CENTRE, NAYPYI TAW (MYANMAR)
STORM WARNING CENTRE, BANGKOK (THAILAND)
STORM WARNING CENTRE, COLOMBO (SRILANKA)
STORM WARNING CENTRE, DHAKA (BANGLADESH)
STORM WARNING CENTRE, KARACHI (PAKISTAN)
METEOROLOGICAL OFFICE, MALE (MALDIVES)
OMAN METEOROLOGICAL DEPARTMENT, MUSCAT (THROUGH RTH JEDDAH)
YEMEN METEOROLOGICAL SERVICES, REPUBLIC OF YEMEN (THROUGH RTH JEDDAH)
NATIONAL CENTRE FOR METEOROLOGY, UAE (THROUGH RTH JEDDAH)
PRESIDENCY OF METEOROLOGY AND ENVIRONMENT, SAUDI ARABIA (THROUGH RTH JEDDAH)
IRAN METEOROLOGICAL ORGANISATION, (THROUGH RTH JEDDAH)
QATAR METEOROLOGICAL DEPARTMENT (THROUGH RTH JEDDAH)

TROPICAL CYCLONE ADVISORY NO. 18 FOR NORTH INDIAN OCEAN (THE BAY OF BENGAL AND ARABIAN SEA) VALID FOR NEXT 120 HOURS ISSUED AT 2300 UTC OF 16.05.2021 BASED ON 2100 UTC OF 16.05.2021.

SUB: VERY SEVERE CYCLONIC STORM "TAUKTAE" (PRONOUNCED AS TAU'TE) OVER EASTCENTRAL ARABIAN SEA

THE **VERY SEVERE CYCLONIC STORM "TAUKTAE" (PRONOUNCED AS TAU'TE)** OVER EASTCENTRAL ARABIAN SEA MOVED NORTH-NORTHWESTWARDS WITH A SPEED OF ABOUT 18 KMPH DURING PAST 06 HOURS AND AND LAY CENTRED AT 2100UTC OF TODAY, THE 16TH MAY, 2021 OVER EASTCENTRAL ARABIAN SEA NEAR LATITUDE 18.0°N AND LONGITUDE 71.7°E, ABOUT 360 KM NORTH-NORTHWEST OF PANJIM-GOA (43192), 170 KM SOUTH-SOUTHWEST OF MUMBAI(43003), 350 KM SOUTH-SOUTHEAST OF VERAVAL (42909), 310 KM SOUTH-SOUTHEAST OF DIU (42914) AND 900 KM SOUTH-SOUTHEAST OF KARACHI (41780).

IT IS VERY LIKELY TO MOVE NORTH-NORTHWESTWARDS AND REACH GUJARAT COAST DURING 1200-1500 UTC OF 17TH & CROSS GUJARAT COAST BETWEEN PORBANDAR (42830) & MAHUVA (BHAVNAGAR DISTRICT 42838) AROUND 0000 UTC of 18TH MAY AS A VERY SEVERE CYCLONIC STORM WITH A MAXIMUM SUSTAINED WIND SPEED 155-165 KMPH GUSTING TO 185 KMPH.

FORECAST TRACK AND INTENSITY ARE GIVEN IN THE FOLLOWING TABLE:

DATE/TIME (UTC)	POSITION (LAT. °N/ LONG. °E)	MAXIMUM SUSTAINED SURFACE WIND SPEED (KMPH)	CATEGORY OF CYCLONIC DISTURBANCE
16.05.21/2100	18.0/71.7	150–160 GUSTING TO 175	VERY SEVERE CYCLONIC STORM
17.05.21/0000	18.2/71.4	155-165 GUSTING TO 185	VERY SEVERE CYCLONIC STORM
17.05.21/0600	19.0/71.0	155-165 GUSTING TO 185	VERY SEVERE CYCLONIC STORM
17.05.21/1200	19.7/70.9	155-165 GUSTING TO 185	VERY SEVERE CYCLONIC STORM
17.05.21/1800	20.5/70.9	155-165 GUSTING TO 185	VERY SEVERE CYCLONIC STORM
18.05.21/0600	21.8/71.1	100-110 GUSTING TO 120	SEVERE CYCLONIC STORM
18.05.21/1800	23.4/71.7	50-60 GUSTING TO 70	DEEP DEPRESSION
19.05.21/0600	24.9/72.4	30-40 GUSTING TO 50	DEPRESSION

REMARKS:

PROBABILITY OF CYCLOGENESIS (FORMATION OF DEPRESSION)
NIL: 0%, LOW: 1-25%, FAIR: 26-50%, MODERATE: 51-75% AND HIGH: 76-100%

Figure 9. Regional Cyclone Warning Bulletin from IMD

4.4.3 The Maldives

National Adaptation Program of Action-2006

The Maldives, in 2006, adopted its National Action Plan for Adaptation and a zero-emissions plan with a target of carbon neutrality by 2020. This is the first National Adaptation Programme of Action (NAPA) for the Maldives relating to the adaptation to adverse effects of climate change. Maldives' National Adaptation Programme of Action identifies the following key areas of climate change-related vulnerabilities: land, beach, and human settlements; critical infrastructure; tourism; fisheries; human health; water resources; agriculture and food security; and coral reef biodiversity.

The NAPA envisioned that implementation of the adaptation activities would be overseen by the National Commission for the Protection of the Environment. A special interagency task force would ensure the respective agencies of the government mobilize international financial assistance and allocate public financing to the priority project profiles in the NAPA. In 2011, Maldives announced that it had signed the world's first Strategic National Action Plan that integrates disaster risk reduction and climate change adaptation. The policy was formulated using broad consultations with key sectors including housing, construction, environment, and health, and focuses on governance and decentralization as key to the success of risk reduction and adaptation. The policy is viewed as a landmark initiative within the disaster risk reduction and adaptation communities.

Maldives climate change policy framework-2015

The Maldives has developed this Climate Change Policy Framework (MCCPF) to provide a blueprint to build resilience in concert with our regional and global partners. The MCCPF prescribes strategic policies for the government to respond to climate change impacts over the next ten years (2015-2025). The overarching aims of the framework are to:

- Foster and guide a national plan of action to address current, short, medium, and long-term effects of climate change, in a coordinated, holistic and participatory manner to ensure that, to the greatest possible extent the quality of life of the people of the Maldivians and opportunities for sustainable development are not compromised.
- Set out the strategic priorities for scaling up the commitments of the government to respond to adverse impacts of climate change.
- Promotes a coordinated approach amongst all national stakeholders to strengthen the capacity of Maldives in reducing current and projected climate change impacts and risks such as the risk of loss of land, and life, economic disruption, and damage to the environment and property, and to alleviate poverty in vulnerable groups and islands, thus ensuring a healthy, educated, peaceful and prosperous Maldives.
- Build and strengthen existing policies, plans, and institutional structures and be incorporated them into every sector's development and implementation plans for addressing climate change issues. All sectors of development, the people, government, and non-governmental organizations have a role to play, as the enormity of the challenge will continue to increase if global emissions are not reduced significantly.
- Marine fisheries is by far the largest primary sector activity in the Maldives. It employs about 20% of the population and contributes 6% to the GDP. Insurance is mandatory for larger fishing vessels. However, there is a lack of transparency in the coverage and claim process.
- Maldives is also running an Income-based Insurance Scheme under which subscribing fishers are eligible to get compensation for: (1) lean fishing season; (2) price drop; (3) loss of fishing days due to the adverse weather condition, and (4) if income dropped below MVR 10,000 in a month. However, it is difficult to implement the scheme for the artisanal fleet.

4.4.4 Sri Lanka

National Climate Change Policy of Sri Lanka

The National Climate Change Policy has a vision, mission, goal, and a set of guiding principles followed by broad policy statements

under Vulnerability, Adaptation, Mitigation, Sustainable Consumption and Production, Knowledge Management, and General Statements. Collaborative action at all levels is necessary to transform this policy into a meaningful set of actions to meet the challenges of climate change.

Even though, the policy does not have anything related to fisheries or coastal habitats. It is mentioned that the climate change action plan is to:

- Sensitize and make aware the communities periodically of the country's vulnerability to climate change.
- Take adaptive measures to avoid/minimize adverse impacts of climate change on the people, their livelihoods, and ecosystems.
- Mitigate greenhouse gas emissions in the path of sustainable development.
- Promote sustainable consumption and production.
- Enhance knowledge of the multifaceted issues related to climate change in society and build their capacity to make prudent choices in decision-making.

Further, the policy does not provide provisions for compensation due to changing climate change because it takes timely action to address the adverse impacts on crop and animal production and fisheries sectors due to climate change and minimize the impacts on food production, and ensure food security.

National Adaptation Plan for Climate Change Impacts in Sri Lanka (2016-2025)

The National Adaptation Plan for Climate Change Impacts in Sri Lanka (NAP) is a logical step in the National initiatives for meeting the adverse effects of climate change adaptation. The National Adaptation Plan for Climate Change Impacts in Sri Lanka (NAP) was prepared in line with the broad set of guidelines set forth by the UNFCCC for the development of national adaptation plans. Different sector-wise action plans for various departments have been formulated.

- Assess the changes in the oceanic environment and impacts on livelihood and food security
    i. Under this objective, research studies have been initiated to assess the climate impacts and also strengthen the monitoring of climate change impacts
    ii. Assess long-term structural changes in oceanic habitats and composition of species
    iii. Assess climate change impacts on the lagoon and coastal fisheries
    iv. Assess climate change impacts on reef fish stock
- Strengthen the coastal zone management to face the impacts of sea level rise
    i. Study impacts of sea level rise on coastal habitats over short-medium- and long-term horizons
    ii. Prepare maps on low-lying areas vulnerable to inundation
    iii. Undertake physical protection measures in critical areas like establishing green belts and increasing vegetation covers, undertaking sand nourishment, building coastal defence structures in strategic locations like sea walls, breakwaters, etc.
    iv. Conduct awareness programs on sea level rise and extreme events in coastal communities to empower them to face climate change impacts
- Enhance the resilience of coastal systems against increased extreme events
    i. Identify and declare vulnerable coastal areas to extreme events
    ii. Collect information and prepare maps on vulnerable areas to extreme events
- Sectoral Climate Cells (SCC) will be established for vulnerable sectors to coordinate activities within respective sectors.
- The marine fisheries sector of Sri Lanka comprises about 225 thousand fishers and 53 thousand fishing vessels. Every year 20-25 fishers die at sea and natural hazards are a major cause of the death. An ex-gratia payment of SLR 1 million is paid to the fisher's family when died of a natural hazard. While there is no

specific climate risk insurance in the country several private players run life and non-life insurance schemes.

- Amongst the active fishers, the fishing crew of multi-day fishing vessels are mostly insured. The minimum sum assured is SLR 1 million. However, the crew of artisanal fishing vessels is usually not insured. Although there is no legal compulsion to insure the fishing vessels, most of fishing vessels are insured. The prohibitive cost of acquisition and frequent natural disasters are probable causes for the better insurance coverage of fishing vessels.
- The Government is considering various pathways to improve insurance coverage including compulsory insurance for the fishing crew (multi-day crew at the beginning); promotion of insurance with the support of service providers; revitalization of the Fishers' Pension Scheme, and introduction of climate risk insurance schemes with the support of Agriculture Insurance Board.

4.5 Efficacy of national measures: Experience from catastrophic cyclones

In the South Asia region, India and Bangladesh are the two nations that suffered mostly due to tropical storms. In the last 50 years, both countries lost over 230 thousand lives, and approximately 200 million people's lives were disturbed. Because of technological advancement and early warning systems, in recent years, the death toll has come down below 100 lives. During the same period, the total financial losses were estimated at 72 billion USD, in which 51% of the losses (37 billion USD) were from the last 10 years (EM-DAT, 2022). With technological advancement, meteorological departments can accurately predict extreme events and share the information with the authorities periodically. Based on the information, local governments issue warnings and evacuate the vulnerable population; this preparedness helped to lower the fatalities. However, the financial damages have increased over the years, particularly in India (**Table 1 7**).

Usually, the post-disaster reconstruction activities take 3-6 months, and by the time the damages were repaired, a new cyclone strikes again. In this process, the vulnerable communities remain poor and unable to engage in their daily activities such as agriculture farming, fishing, etc. Due to this, many small farmers and fishers leave their occupations and migrate to urban areas for construction and labour-oriented work. If

Table 17: Total Damages (in Billion USD 2021 prices) due to Tropical Cyclones in India and Bangladesh

Period	India			Bangladesh		
	Total Affected (million people)	Total Damage (billion USD)	Total Affected % of Insured	Total Affected (million people)	Total Damage (billion USD)	Total Affected % of Insured
1971-75	11.46	1.21	0.0%	0.08	0	0.0%
1976-80	16.69	3.55	0.0%	0.01	0.22	0.0%
1981-85	8.43	3.79	0.0%	3.87	0.13	0.0%
1986-90	13.08	6.7	0.0%	13.46	0.04	0.0%
1991-95	0.54	0.31	0.0%	19.35	5.2	3.1%
1996-2000	27.74	8.25	6.3%	4.4	0	0.0%
2001-05	0.64	0.07	0.0%	0.18	0	0.0%
2006-10	5.77	0.41	0.0%	13.21	3.35	0.0%
2011-15	14.62	10.73	6.8%	4.38	0.07	0.0%
2016-21	41.62	25.38	0.9%	8.67	2.25	0.0%

Source: Authors, a calculation based on EM-DAT (2022).

insurance companies get a prominent role in addressing the disaster losses, the post-disaster activities burden would be lower on the Governments and they may focus on better preparedness activities.

4.6 Global and cross-sectoral experience with insurance

4.6.1 Agricultural insurance in Bangladesh

Agricultural crop insurance was first introduced into Bangladesh on a pilot basis in 1977 by the state-owned insurance company, Sadharan Bima Corporation (SBC). There has been no history of private sector commercial agricultural insurance prior to 2014. Starting in 1977, SBC introduced a conventional individual-grower multiple-peril crop insurance (MPCI) yield-shortfall policy that provided coverage against a wide range of climatic perils, including the potentially catastrophic climatic perils of floods, droughts, and winds and biological perils of pests and diseases.

In 1980, SBC launched a livestock insurance pilot project for cattle, using a traditional individual minimal indemnity-based cover. The policy insured against accidental mortality and diseases in cattle, but excluded epizootic or Class A epidemic disease, catastrophes, poisoning and starvation of animals, and theft. The sum insured was based on the value of the loan and the policy carried a flat premium rate for all insured's that varied over time from a low of 3.0 percent to a high of 5.0 percent. By the early-2000s SBC had effectively ceased underwriting the livestock insurance program.

The SBC shrimp policy was introduced in the 1990s as a named-peril cover restricted to floods, cyclones, and tidal surges, and diseases were specifically excluded. The policy was marketed on a voluntary basis with a fixed premium rate of 0.99 percent of the sum insured, which was based on the input costs (stock, feed, etc.) for each 120-day shrimp production cycle. On account of the very poor underwriting results, SBC withdrew this cover in 2004.

Current initiatives in Agricultural Insurance Bangladesh

Formal sector

IFC-Green Delta weather index-based crop insurance:

Since 2013 IFC has been working closely with Green Delta Insurance Company to design the first commercial insurance company WIBCI product for Bangladesh

SBC-ADB-Basix weather index-based crop insurance:

Asian Development Bank entered into a three-year agreement in 2014 with the Government of Bangladesh and Sadharan Bima Corporation the state insurance company to develop a pilot weather index-based crop insurance, WIBCI, project initially to cover excess rainfall or rainfall deficit for selected crops and districts in Bangladesh. ADB is in discussion with GoB to provide 50% premium subsidies on this WIBCI project to make crop insurance more readily accessible and affordable to small and marginal farmers in Bangladesh.

Oxfam-Pragati insurance company Flood Index Insurance:

Flooding is a recurrent problem in Bangladesh and 30% of the country experiences annual flooding. At the same time, extreme floods affect up to two-thirds of the country and can cause severe losses to the agricultural crop, livestock, and fisheries sectors. Although agricultural insurance is widely available in more than 50% of countries, public and private insurers have traditionally shied away from offering flood insurance protection to the crop, livestock, and fisheries sectors.

The Oxfam meso-level flood index cover is a business interruption policy that makes payouts according to the duration of flooding in each defined flood risk zone. The Meso-level Flood Index Insurance program was launched in 2013 with 1,661 poor households identified as the beneficiaries in 14 villages in Sirajganj District with Pragati Insurance Limited acting as the local insurer and reinsurance protection from Swiss Re.

(c) temperature (d) wind speed; (e) a combination of the above; and (f) hail and cloudburst (IRDAI, 2022). Several weather-based indices are constructed for this purpose. Various state governments select and notify crops (Raju et al., 2016).

The problems of information asymmetry, moral hazard, adverse selection, and co-variability are more pronounced in crop insurance, particularly in traditional insurance schemes. WBCIS has many advantages compared to traditional insurance products. Index insurance avoids the issues of adverse selection and moral hazard because all buyers of the same contract pay the same premium, and the insurance unit receives the same compensation, regardless of their activities. Thus, a farmer with rain insurance has the same financial incentives to manage the crop as an uninsured farmer. Quick claim settlement, non-requirement of documents as proof of loss, and lower transaction costs are some of the merits of the scheme compared to traditional crop insurance schemes.

Weather is a common factor that affects the performance of both agriculture and fisheries. Studies have suggested that innovative products such as weather index-based insurance schemes can use satellite data and inputs from weather stations to trigger insurance payments in the event of weather abnormalities leading to crop loss. This model could be used as an alternative risk-covering mechanism in the fisheries sector too, both for capture and culture fisheries (Shinoj et al., 2017). The weather information obtained through the weather stations, combined with geospatial tools and protocols, can be used to map the losses occurring to culture fisheries, such as disease, damage from natural disasters, and other hazards. Inputs from such platforms can be used to compensate coastal assets of fishers, sea cages, aquaculture farms, and other fisheries-related infrastructure. Applications of remote sensing and Geographic Information Systems can be relied upon to create an inventory database of insured farms in the case of culture fisheries. This can also be used in marine fisheries too, with suitable modifications.

The index insurance can be used for some additional purposes, mainly to aid disaster relief and development mechanisms (Hazell et al., 2010). Index insurance for disaster relief would protect people—their lives, health, and assets—from catastrophic losses. Including fishing equipment such as vessels and gear in this category will help a large fishing community re-engage the fishing activity after the disaster. Index insurance helps farmers to

Index insurance is a risk finance linked to an index that is highly correlated with local yield. Contracts are written against specific hazards or events (e.g., local yield loss, drought, cyclone, flood, etc.) that are defined and recorded at local levels (e.g., at a local weather station) (Hazell et al., 2010). Indemnifications are triggered by pre-specified index patterns instead of actual returns, eliminating the need for in-field valuations. Also, since the insurance product is based on an independently verifiable index, it is re-insurable, thus allowing insurance companies to transfer part of their risk to international markets (Hazell et al., 2010; Raju et al., 2016; Al-Maruf et al., 2021). Insurance contracts are regionally based, meaning all buyers in the same area are offered the same rates per rupee of coverage. Pay-outs can be structured in various ways, from a simple zero/one contract (i.e., if the threshold is exceeded, the pay-out rate is 100 percent) to a layered payment schedule (Hazell et al., 2010).

Informal Insurance Sector

PKSF-DIISP Livestock micro insurance:

Palli Karma-Sahayak Foundation (PKSF) has been helping a group of 40 MFIs distributed throughout Bangladesh to design, rate and pilot test a range of micro-insurance products including life, health, and livestock insurance. The Developing Inclusive Insurance Sector Project (DIISP) is a livestock-credit insurance policy specifically designed for MFIs to protect their loans to members under a beef fattening program.

The DIISP-designed policy carries a flat premium rate of 0.7% for a six-month cover period and given the elevated level of insurance protection provided this premium rate is competitive when compared with the earlier annual policies for mainly dairy cattle offered by SBC, Proshika, and Grameen.

Sajida Foundation Livestock Insurance Program

Under the DIISP program individual Microfinance institutions insuring small numbers of cattle are very exposed to first loss with the fixed 0.7% premium rate.

Problems in Agricultural Insurance (including fisheries) in Bangladesh

- Agricultural insurance provision in Bangladesh is still extremely low and very few farmers have any knowledge or understanding of, or access to, crop, livestock, or fisheries insurance.
- Lack of time-series data to design and rate crop, livestock, and fisheries insurance products.
- Lack of technical know-how on the part of the insurance companies in the design and rating and implementation of crop and livestock and aquaculture insurance.
- Lack of insurance ability especially for catastrophe risk.
- Lack of an enabling legal and regulatory framework.

4.6.2 Agricultural Insurance in India

Agriculture insurance is a type of protection policy that covers loss resulting from damage to crops, livestock, and farm equipment. It provides financial support to farmers toward unforeseen events and tax exemption benefits, which further improve the efficiency of the agriculture insurance market.

Pradhan Mantri Fasal Bima Yojana (PMFBY) scheme was launched in India by the Ministry of Agriculture & Farmers Welfare, New Delhi from the Kharif 2016 season onwards.

There are Two Schemes under the said operational Guidelines.

- Pradhan Mantri Fasal Bima Yojana (PMFBY)
- Restructured Weather Based Crop Insurance Scheme (RWBCIS)

Weather-based crop insurance schemes in India

The experience of the crop insurance schemes in India has several lessons to offer to the parametric insurance attempts in the fisheries sector. Crop insurance in India is implemented through two major schemes- the Pradhan Mantri Fazal Bima Yojana (PMFBY) and the Restructured Weather Based Crop Insurance Scheme (RWBCIS). PMFBY provides insurance cover to farmers in case of any notified crop failure due to natural calamities, pests, or diseases. In the year 2017-18, a total of 50.1 million farmers were covered under PMFBY, out of which 75% availed insurance as part of mandatory coverage along with crop loans. The total sum insured was 1,910 billion with the average coverage per farmer at 0.98 ha, and the total premium collected was about INR 232.16 billion. On average, the farmers paid a premium of INR 4634. The insurance companies had a net margin of INR 70 billion, accounting for about 25% net operating margin in 2016-17 (IIMA, 2019). It was noted that the PMFBY faces several issues including implementation issues like delayed payment of claims and exclusion (Goik, 2021).

In the RWBCIS, farmers are compensated for crops using climate parameters (Vishnoi et al., 2020). The WBCIS was first implemented in 2007 and it provides insurance cover and financial help to farmers in case of crop damage, including adverse weather and later crop failure. The adverse weather events fall into the domains of (a) rainfall (b) relative humidity;

protect their investments and can open doors to income-enhancing avenues (For example, contract farming and access to credit), and can be part of a broader strategy to help farmers escape poverty. One of the basic features of the index insured scheme is that it can be bundled with institutional credit delivery. In Brazil, the government envisaged the transfer of federal programs to state agencies and private insurance companies through a credit-linked crop insurance scheme (Raju et al., 2016). Index insurance is also used as collateral security against bank credit. This method can be adapted to fisheries as well. Besides farmers and fishers, index insurance can benefit other stakeholders as well: governments, relief agencies, financial service providers, input suppliers, businesses, agricultural processors, food companies, and farmers' organizations, to mention a few (Hazell et al., 2010). In this background, stakeholders in fishing and allied activities like input suppliers, crew members, and auctioneers can participate in the WIBCI scheme.

An added advantage is that the administrative offices can provide timely weather information through the mobile application to the farmers so they can take precautionary measures to protect their crops or fish farms, reducing the severity of the losses. Weather and climate are major factors that affect all types of fisheries, including aquaculture. For example, heavy rainfall impacts shrimp production either directly or indirectly (Buike, 2018). Some of the major weaknesses in the insurance programs include delays in settling the claims, the complexity of the system, and inadequate awareness among farmers (Kaur et al., 2021).

4.6.3 Fisheries Insurance in Indonesia

Indonesian Law number 7 of 2016 on the protection and empowerment of fishers, fish farmers, and salt producers set up the ground for public support for fisheries risk mitigation. Under the Act, the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia organized a program of insurance premium assistance for fishers (BPAN) in collaboration with PT Asuransi Jasa Indonesia to provide a personal accident insurance scheme for the fishers. This insurance product is only for registered fishers with fishing cards issued by the Ministry of Maritime Affairs and Fisheries of the Republic of Indonesia.

The amount of compensation under the program is as follows:

Accidents at sea	100% Death Price Insured or Rp. 200 million
Permanent disability	Fixed Defect Maximum 50% Sum Insured or maximum Rp. 100,000,000.00
Cost of Treatment	Maximum 10% Sum Insured or maximum Rp. 20 million (as per bill)
Not due to marine accidents	80% Death Price Insured or Rp. 160 million

4.6.4 Fisheries Insurance in Malaysia

Since the middle of the 1980s, various insurance programs for fisheries have been implemented in Malaysia. However, only one of these plans, which involves personal accident insurance is successful. Its popularity is largely attributable to the fact that vessel licensing now includes it as a requirement. A special program that was launched in combination with a loan program for vessel purchase/upgrading, however, failed. Participation by borrowers was needed during the first year of the loan but was optional during later years. As a result, after the first year, most borrowers did not renew their insurance. A group personal injury insurance program that provided members of fishers' associations with extensive coverage at low prices also failed, primarily due to its voluntary character and the lack of promotion by local, village-level agents. According to a 2015 news

[11] *Karin Amelia Safitri, (2018), "The Role of Insurance for Protection against the Risk of Fishing Accidents" in The 2nd International Conference on Vocational Higher Education (ICVHE) 2017 "The Importance on Advancing Vocational Education to Meet Contemporary Labor Demands", KnE Social Sciences, pages 1328–1335. DOI 10.18502/kss.v3i10.2851*

report, more than 50,000 fishers in the country are uninsured and have yet to obtain a fisherman's card with the Malaysia Fisheries Development Authority (LKIM). The LKIM informed that there are more than 100,000 fishers in the country but only half of them have obtained the fisherman's card, which will automatically enable them to be covered under the Fishers Welfare Insurance.

4.6.5 Thailand

Thailand is developing and improving the insurance coverage and proposing two schemes for implementation: 1) insurance for small-scale fishers in capture fisheries with less than 10 GT fishing vessels, and 2) insurance for aquaculture, Vannamei Shrimp farmers as a pilot project. Under the first scheme, 54,814 fishing boats of less than 10 Gross tonnage (GT) that registered with the Marine Department would be covered. In addition, there is a Voluntary Fishers Insurance policy (Micro Insurance).

Under this insurance, cover is provided to any subscribing fishing vessel (whether less than 10 GT or commercial fishing boats of 10 GT and greater). Reasons for the low penetration of insurance in Thailand are multi-faceted. On the demand side, fishers' lack of awareness, expectations of receiving ex-gratia payment in time of distress, and high premiums are barriers. From the supply side, the insurance market size, lack of domain knowledge of the insurance companies, and inadequate damage and risk assessment mechanisms are major constraints. To deal with the situation the Government is promoting competition amongst insurance companies and is also providing incentives for the development of a suitable methodology.

4.6.6 Fishery Mutual Insurance Scheme of Japan

Japan has one of the most advanced and well-penetrated fishing insurance schemes that has been running for over 80 years. It was established at the request of fishermen and has for many years provided a cushion against a variety of losses. The basic principle of the scheme is to make payments that cover production costs and thus allow fishermen to stay in business in the face of major losses and to offer an element of stability in the uncertain environment in which they operate.

The types of policies available under the scheme are:

- "Harvest" or marine insurance
- Aquaculture insurance
- Specialized aquaculture insurance
- Gear insurance

The program is essentially an assistance mechanism operated and administered by the fishermen themselves through the Fisheries Co-operative Associations (FCAs), the prefecture-level Fishery Mutual Insurance Associations, and the National Federation of Fishery Mutual Insurance Associations.

Fishing Vessel Insurance

As a part of Japan's national fisheries disaster, a countermeasure program is designed to provide an element of stability in the management of fishery operations. Coverage is provided for losses in the event of accidents, as well as unforeseen costs and liabilities incurred in the operation of a fishing vessel. Policies also cover unforeseen loss or damage to products being carried by a fishing vessel. This insurance program is organized on a multi-tiered basis, involving FCAs, the prefecture-level Fishing Vessel Insurance Associations, and the Central Society of Fishing Vessel Insurance supported by the central government. There are three broad categories of vessel insurance contracts: individual, compulsory, and group. A variety of policies is available, the main ones being basic fishing vessel insurance, owner-operator insurance covering unforeseen liabilities of such operators, and cargo and equipment insurance. The fishing vessel insurance association is a non-profit protection system that legally operates under the Act on Compensation of Damages Related to Fishing Vessels of 1952. It is not regulated under the Insurance Business Act of 1939. The main purpose of the mutual insurance scheme is to contribute to stabilizing the management of small- and medium-sized fisheries. Fishermen

enter into an insurance contract with the fishing vessel insurance association.

Government's role in reinsuring damage and loss occurrence to fishing assets

The most successful and unique underwriting characteristic is certainly the one observed in the subsidy's insurance program in Japan.

How it operates

- The condition for obtaining the subsidy is that all the fishers operating vessels with a gross tonnage between 1 and 100 tons should be part of a fishing cooperative and enter a contract with the insurance association.
- This arrangement provides an incentive to maximize the coverage of insurance and to better share risks and reduce costs.
- The government reinsures the fishing vessel insurance association by a **"Stop of Loss"** method.
- The government reinsurance activates when the insurance association has paid out claims, which exceed 109 percent of the net premium income of one fiscal year. The government will reimburse 85 percent of the amount of pay-out's exceeding 109 percent.
- Besides providing reinsurance and subsidizing the insurance premiums, the government provides tax exemption, approves the articles of the associations and the insurance stipulations including the insurance premium rates. The government also supervises the association and the central society or apex body.

4.6.7 Index-based Insurance in the Caribbean Project

In recent times, a few small countries in the Caribbean, the Pacific, and Africa have introduced macro-insurance schemes to cover the risk due to disaster-related events. The Caribbean Catastrophe Risk Insurance Facility (CCRIF) of Caribbean countries provides index-based parametric insurance "Catastrophe Risk Insurance" to its members to recover from post-disaster events such as tropical cyclones, excess rainfall, and earthquakes. One of the prominent features of Catastrophic Risk Insurance is its quick pay-outs (within 14 days of the event) to natural disasters. Since 2007, under the insurance scheme, a total of USD 245 million pay-outs has been made to the member countries for the rehabilitation of critical infrastructure and it supported over 3.5 million people. In 2021, Haiti received a pay-out of USD40 million, which was the largest pay-out in the Caribbean counties, for the post- earthquake disaster, which was the largest pay-out in the Caribbean counties by CCRIF. Due to quick pay-out, in 2021, Barbados, Trinidad, and Tobago quickly recovered from impacts of Tropical Cyclone Elsa (Nordlander et al., 2020). Because of its success, the CCRIF has purchased Catastrophe Risk Insurance with coverage of US$1.2 Billion for the year 2022-23, which is a 10% increase from the earlier year, i.e., 2021 coverage (CCRIF, 2022).

Similarly, the World Bank initiated a macro-parametric insurance scheme "Catastrophe Risk Assessment and Financing Initiative (PCRFI) insurance scheme" for Pacific Island Countries to meet immediate damages from climate and seismic hazards in the Pacific region. With the insurance scheme, Tong and Vanuatu received a quick pay-out of USD 1.27 million in 2013 (World Bank, 2014) and USD 1.9 million in 2015 (Government of Vanuatu, 2015). Unlike CCRIF, PCRFI insurance scheme coverage is less, and because of this reason, the insurance scheme supported quick interim recovery rather than complete recovery. The insurance scheme covered USD 1.9 million against a total damage cost of USD 449.4 million (Government of Vanuatu, 2015).

In Asia, the Philippines is one of the worst affected countries by Tropical Typhoons. In the year 2017, the World Bank and the Government of the Philippines (GoP) collaborated to minimize disaster risk from Typhoons, by initiating disaster risk finance and insurance (DRFI) and disaster risk management (DRM)

programs. A new parametric insurance scheme "The Philippine Parametric Catastrophe Risk Insurance Program" was initiated to transfer typhoon and earthquake-related catastrophe risk through international reinsurance markets. Because of its success, the GoP increased the coverage from USD 206 million (in the year 2018) to USD 406 million (in the year 2019). The insurance scheme supports the local and national governments for a quick sufficient recovery from losses of major typhoons in the Philippines. Based on the initial assessment of the damages and losses of the typhoons, quick pay-out transfers were made from the international reinsurance market to the Reinsurer (International Bank for Reconstruction and Development) -> to Insurer (Philippine Government Service Insurance System (GSIS) -> to the Policyholder (Local and National Governments). Parametric Insurance scheme pay-outs are based on certain conditions, such as rainfall, wind speed, and climatic variables. The schemes support immediate relief that any nation requires from a natural disaster.

In India, agricultural farmers receive weather-index-based insurance, farmers receive a pre-fixed compensation/insurance payout if the rainfall is above or below a certain agreed threshold. The government also introduced two new parametric schemes, Fasal Bima Yojana (FBY) and Cattle Insurance. For FBY, the government conducts a survey to measure yield, if they found yield goes below the threshold, the insurance company verifies it and pays the compensation. In case of cattle insurance, if the milk yield goes below the threshold due to climatic impact, insurance is triggered.

As per the insurance experts, moving forwards parametric or index-based insurance is the best solution to cover climate risks. Agriculture and fishing are very different from each other, because of this weather-based/raifall based parametric may not be applicable for the fisheries sector. A specially designed parametric insurance (based on cyclonic disturbance) will be helpful for the fishermen. Private insurance companies will show interest to provide parametric insurance if a maximum number of fishermen cover under the insurance scheme (risk pooling), the insurance premium will be lower. Further, restricted insurance to Extreme/Severe Cyclones or Wind Speed above a certain threshold level (MSW>88 kmph) will lower the premium.

4.7 Developing a better mechanism for risk management

From the above analysis, the following salient points can be drawn:

- from the national policies, it is evident that insurance is yet to be recognized as a significant policy tool for disaster management. There is a need and scope of providing governmental support to the marine fisheries sector provided that such support is in line with the WTO Agreement.
- Disaster relief is one such area.
- Current mechanism of disaster relief does not provide a clear statement of loss and damage (L&D) assessment method.
- L&D assessment should be sufficient to bring the fisheries back to the pre-disaster level.

ARTICLE 11: FINAL PROVISIONS

11.1 Except as provided in Articles 3 and 4, nothing in this Agreement shall prevent a Member from granting a subsidy for disaster[19] relief, provided that the subsidy is:

(a) limited to the relief of a particular disaster;

(b) limited to the affected geographic area;

(c) time-limited; and

(d) in the case of reconstruction subsidies, limited to restoring the affected fishery, and/or the affected fleet to its pre-disaster level.

- Proper L&D can also help in identifying the insurance need and improve insurance coverage.

Further, these estimates underline the need for developing suitable mitigation measures to safeguard the evolving fisheries businesses and the livelihoods of the fishers. Such measures may include species-specific management plans, improving stock monitoring; value chain development, etc. Considering that such measures need adequate investment over the horizon, the Government may consider development of Blue Bonds.

Such measures can also assist in ex-ante and ex-post measures of disaster mitigation by developing suitable instruments. Quantifiable risks could be covered under insurance. However, insurance may not be adequate to cover for slow changes. For slow changes, suitable compensation schemes can be developed to assist fishers in moving towards viable alternatives.

The World Bank defines blue bonds "as a debt instrument issued by governments, development banks or others to raise capital from impact investors to finance marine and ocean-based projects that have positive environmental, economic and climate benefits."

Illustrative Example: Life Insurance Coverage Gap in India

40 years old fishers having dependent children, spouse, and parents. Expected to retire at 60 years of age.

Heads	Value (Rs.)	Notes
Estimated annual household income	2,72,400.00	Single source of income
Current life insurance coverage	-	
Estimated monthly household consumption expenditure	74,244.00	National Financial Inclusion Survey or NAFIS 2016-17
Estimated annual net income	1,98,156.00	The disposable income will be less as families have to pay for education, health, debt, rent, etc
Insurance required (HPV method)	32,11,000.00	https://lifeinsurance.adityabirlacapital.com/tools-and- planners/human-life-value-calculator
Approximate premium per year (Term insurance)	15,108.00	https://www.policybazaar.com/life-insurance/term-insurance-calculator/
Death benefits		
With insurance	32,11,000.00	
Without insurance		
Accidental death (GAIS)	5,00,000.00	Under the Pradhan Mantri Matsya Sampada Yojana (PMMSY) scheme
Accidental death (Disasters)	4,00,000.00	Under the State Disaster Response Fund
Premium as % of net income	5.55	This will increase as % of disposable income. Coupled with the seasonality of income, there could be stress on the family to pay.
Ex-gratia as % of insurance need (GAIS)	15.57	While ex-gratia payments are providing relief to the fisher families in case of accidental death, they may not be adequate to cover for financial distress of the family.
Ex-gratia as % of insurance need (SDRF)	12.46	

Claims under the Group Accident Insurance Scheme in India

The GAIS is now provided under the flagship PMMSY scheme of India. It is a fully paid central sector scheme, and to access the scheme the fisher should be registered fisher, and he should be a member of a cooperative. The scheme is operated through the state government. However, despite free access, the coverage of the scheme failed to reach all fishers. In some cases, the State government does not participate in the scheme or has launched its own scheme curbing the reach of the GAIS.

The highest number of claims occurred in Puducherry (46.8/100,000) which is far below the internationally reported figure of casualties (80/100,000) (**Figure 10**). However, this is in tune with the number of accidental deaths in India (31.5 in 2019)

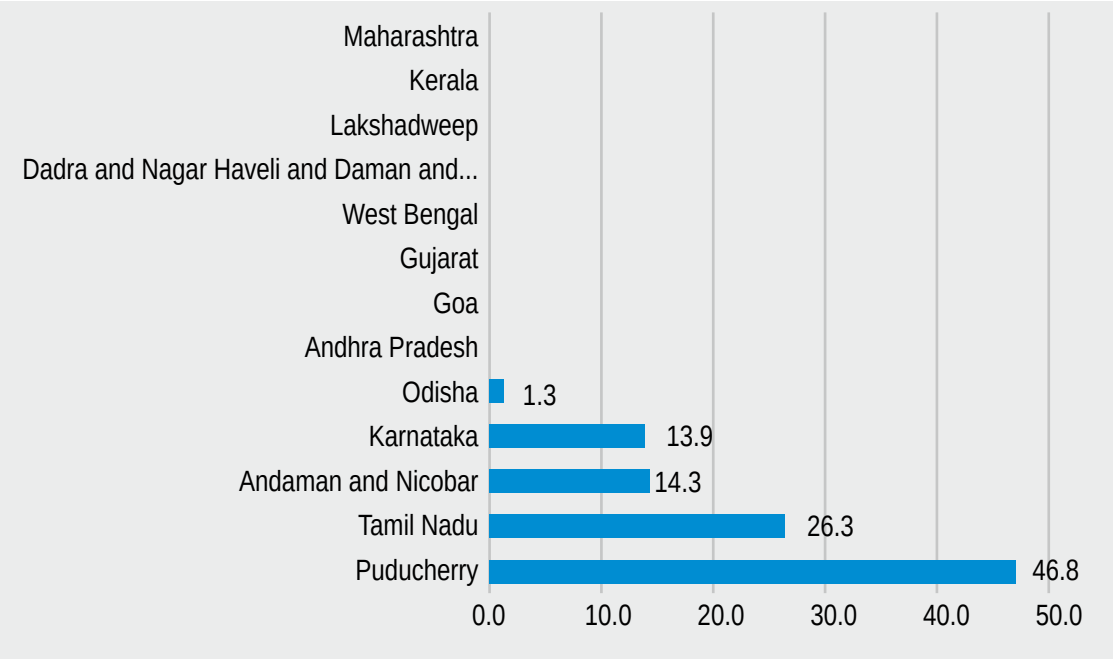
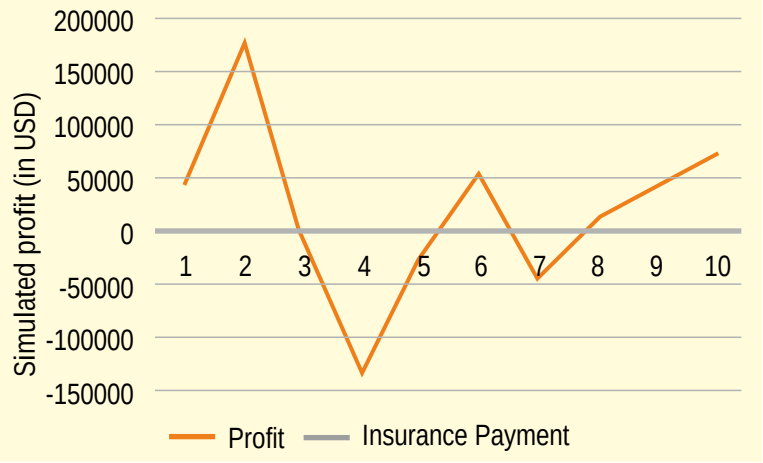


Figure 10: Number of claims per 100000 beneficiaries in different states and UTs of India in 2021 (Source: NFDB)

Insuring a trawler in India

Components	USD	Premium (USD)
Hull	41389	1241.67
Main engine(s)	10652	319.56
Equipment on deck (e.g. cranes, beams)	5000	150
Fishing gear with a lifespan of 3 years or more	15000	1500
Electronic devices (navigation, fish finding and communication)	3431	343.1
Other items	3611	361.1
Total	79083	3915.43
Insurance/Total (%)	5%	



The trawler is likely to make loss in 40% of time. Although, the premium is 5-8% of the profit in normal years, in the bad years, in can increased upto 38%. Therefore, fishers have a reason to perceive the insurance premium as too costly. Flexi-pay may help fishers to cut the cost.

Estimated from Narayanakumara, R and Shinoj P (2020)

Section 5.0 Strategies for Enhancing Coverage and Penetration of Climate Risk Insurance Solutions

5.1 Methodology

A series of stakeholder consultations were carried out to present the findings from the desk review to the fishers and policymakers. A questionnaire survey was implemented (in India only) followed by Focus Group Discussions (FGDs) (four countries) for stakeholder consultations. However, during the questionnaire survey, it was apparent that fishers are not familiar with insurance mechanism and their primary concern lies with the scale of the premium paid. Even in states like Tamil Nadu and Kerala, where there is an above-average penetration of vessel insurance owing to persuasion from the Government, insurance is not a part of the management strategy. In addition, fisher's familiarity with parametric insurance is understandably negligible as it is not something that they have experienced.

Especially, in India, fishers are accustomed to Government relief following a disaster and their sublime strategy is waved around the belief that the Government will and should provide the necessary support to recover from a disaster. While from a business angle, the timeliness of the Government support and its adequacy as shown in the 'value at risk' section, could be a concern, such issues were not forthcoming from the fishers.

Therefore, to statistically determine the insurance need and willingness of the fishers, a larger dedicated study would be required. In the earlier section, a methodology was proposed to measure the willingness to pay. The same can be used for further research, however, the same is beyond the scope of this work and a limitation of the study. **Table 18** gives the details of stakeholder consultations and surveys carried out during the project.

Table 18: List of Stakeholder consultations and Surveys

Date	Location	Topic	Number of Participants	
			Women	Men
06/05/2022	Chennai, India	International Symposium on Insulating Marine Fisheries Sector in South Asia from Uncertainties: Global Experiences with Insurance	20	50
16-18/06/2022	Versova, Mumbai, India	Face-to-Face survey		10
21-23/06/2022	Balasore, Odisha, India	Face-to-Face survey		10
14/07/2022	Veraval, Gujarat	Face-to-Face survey		10
14/07/2022	Trivandrum, Kerala	Face-to-Face survey		10
16/07/2022	Chennai, India	Insurance as a Tool for Managing Marine Fisheries and Building Resilience	1	22
16/07/2022	Mangaluru, Karnataka	Training of Survey Enumerators	1	4
18/07/2022	Balasore, Odisha, India	Face-to-Face survey		10
16 – 18/07/2022	Trivandrum, Kerala	Face-to-Face survey		10
16 – 18/07/2022	Kochi, Kerala	Face-to-Face survey		10
28/07/2022	Chattogram, Bangladesh (Online)	Insurance as a Tool for Managing Marine Fisheries and Building Resilience		30
15/08/2022	Male, Maldives	National policy and priorities on insurance	4	10
18/08/2022	Colombo, Sri Lanka (Online)	Insurance as a Tool for Managing Marine Fisheries and Building Resilience	8	22
24 – 30/ 07/2022	Karnataka, India	Current status of insurance and willingness to pay for insurance		15

5.1.1. Results from field Survey in India

Enquiry	Response
Engagement in the marine fishing activities	> 10 Years (80%)
How many boats do you or your family own and operate?	1 -2 boats (50%)
What types of boats do you own and operate?	Trawler, gillnetter, FRP
Your boat and assets in it are insured?	24% (Higher in Tamil Nadu and Kerala)
If not insured, are you considering insuring the boat?	No (74%)
During the last 5 years, have you ever incurred any damage to any of your fisheries assets (boats, nets, etc.)?	Yes (74%)
How many days the boat was out of operation due to damages?	10 - 15 days (80%)
Who paid for the damages?	Self (90%)
Did you have to sell any assets to cover the loss?	Yes (15%)
If you received compensation, what percentage of total loss was the compensation?	50 %
Are you interested in buying a life insurance plan or increasing the cover of the existing plan	Yes (90%)
Have you purchased (or covered in) any health insurance policy?	Yes (12%)
Have you purchased any insurance for the fishing nets?	No separate policy
Do you know someone who lost his/her life in fishing-related incidents? What was your relationship with him/her?	Yes. From the same village
Do you like to invest more in your fishing business?	Yes (38%)
Would you like to purchase insurance for your fishing assets (boats, nets, etc.)?	Yes (44%)

N = 89

5.1.2. Result from the Focus Group Discussions

Bangladesh

The BOBP-IGO jointly with the Marine Fisheries Office (MFO), Chittagong, Department of Fisheries, Government of the People's Republic of Bangladesh organized an online stakeholder's consultation meeting on "Insurance as a Tool for Managing Marine Fisheries and Building Resilience in Bangladesh" on 28th July 2022. Mechanized and artisanal fishing boat owners from Chittagong, Officials from MFO, Chittagong, Bangladesh, took part.

During the interaction, the fishers' representatives presented a positive outlook for the marine fisheries growth in Bangladesh brought about by the Hilsa Management Plan. However, they were concerned about the increasing cost of fishing, the prevalence of IUU fishing, and piracy/robbery.

On insurance, fishers viewed that while many of the steel-body fishing vessels (industrial trawlers) are insured, insurance is not provided for the wooden fishing vessels. There is also no insurance for crew or against piracy/robbery. In case of an accident, crew are at the mercy of the boat owner to provide some compensation. It was reported that the boat owners usually provide compensation of Taka 0.05 million to Taka 2 million for injury and death, respectively. However, in cases, when the whole boat is sunk and human casualty is high, the boat owners find it difficult to compensate. Both fishing crew and boat owners do not have an alternative mechanism for risk pooling. It was further informed that to

diversify risk a boat owner needs at least two boats and single boat owners often go out of business for failure to deal with losses from accidents and loss and damage incidents.

However, boat owners are reluctant to purchase an insurance policy as they consider it an investment without return/profit. They viewed that the premium should be refunded in case of claim-free years or adequate credit should be given. On climate risk, there were instances when a boat went out for fishing despite cyclone signals. However, overall, there is a decline in the number of fishing days due to harsh weather.

Boat owners viewed that the Government of Bangladesh should issue a guideline on insurance and facilitate the insurance of fishing vessels. It was also proposed that the Government of Bangladesh may consider buying an insurance scheme on behalf of the boat owners collectively and recover the premium through a surcharge on the license fee or through a tax on sales. It is assumed that the premium in such a case will be lower than that of the possible premium for individually buying the policies. The boat owners suggested that the Government may consider a holistic policy covering perils faced by the crew and the vessels. The fishers also welcomed the concept of a Bay of Bengal-wide insurance program to cover perils faced by the fisheries sector of its member countries.

Field survey in Balasore, Odisha

India

Marine fisheries insurance: Case of Chennai, India

The stakeholder consultation with fishers of Chennai was held on 16th July 2022 in collaboration with the Department of Fisheries, Government of Tamil Nadu (DoF-TN) and Tamil Nadu Dr. J Jayalalithaa Fisheries University (TNJFU).

In prospect of the fisheries sector, especially because of climate change, the fisher representatives informed that in the Chennai Fishing Harbour (CFH), fisheries is suffering from low catch and reduced operational days. They informed that about half of the fishing vessels that used to operate from CFH have stopped operating. The fishers' representatives also informed that the number of fishing days has reduced from 210 days per year to 150 days per year during the last decade. While part of this decline is due to the increased fishing ban period from 45 to 60 days, worsening climatic conditions and bad weather days also played a significant role.

Regarding the measures that can help fishers in improving their business, the fishers' representatives deliberated on various measures. They said that the focus of the governmental intervention in fisheries should balance welfare and productivity measures from the existing tendency in favour of the

Field survey in Versova, Maharashtra

welfare measures. They were also of the view that the fishers need to be trained on value addition, better marketing, by-product development, etc. They need to be exposed to the best practices adopted in other countries and other places in India through exposure and training.

On insurance, the fishers' representatives informed us that currently both life insurance and vessel insurance are in vogue. Life insurance in the form of a group insurance scheme (GIS) is available to all the fishers registered with a cooperative society. The GIS is funded by the central Government and is available free of cost to the fishers. Under the Group Insurance Scheme, the compensation for the loss of life or permanent disability is INR 2 million and for partial disability INR 1 million. In case of hospitalization, INR 10,000 is provided under the scheme. However, the GIS is not extended to the migrant fishers from other States in India and working in CFH. The migrant workers usually are not registered with any local fisheries cooperatives and this keeps them out of the purview of the GIS in place in Tamil Nadu. In the case of migrant workers, owners usually provide an ex-gratia payment of INR 0.1-0.2 million to the worker or his family in case of death or permanent disability.

In case of accidents at sea, if the body is not found the victim is considered 'missing' and no insurance payment is provided unless the legal hair provides the necessary evidence before a Court of Law on the contrary. As per the Indian Evidence Act, 1872, in the case of a missing person, a procedure to declare that person dead can be initiated after 7 years of a wait unless necessary evidence is provided. However, in case of an accident at sea, non-retrieval of the body of the deceased and non-availability of necessary evidence are quite common. Therefore, according to the fishers' representatives, a suitable solution might be explored to settle the legal procedure in such cases.

In the case of asset insurance, it was informed that following the 2004 Indian Ocean Tsunami devastation of fishing assets, the DoF-TN took a policy measure to link sales tax rebates on the purchase of fuels with vessel insurance. This has increased insurance penetration in the case of fishing vessels in the State. However, the policy does not specify the insurance requirement and it was evident during the discussion that in some cases fishers were under-insuring their fishing assets. According to fishers' representatives, apart from increasing premium cost, the other issues with the fishing vessel insurance are: (1) conflict over amount of admissible claim; (2) lengthy claim settlement process, and (3) insurance policy covers loss only and any damage to the fishing vessel, no matter how significant, is not admissible. Conflict over admissible claims resulted from the inability of boat owners to implement rules and regulations concerning vessel registration and vessel operation *in toto*. For example, it is a legal requirement that the engine driver should have a driving license. However, licensed drivers are in extremely short supply and vessel owners usually manage with informally trained drivers. In case of insurance claim settlement, if it was found that the driver was not certified then the insurance company deducts 10 percent from the admissible claim. In CFH, 80 percent of professional drivers are without licenses and therefore most fishing vessels are liable for a penalty. Delay in claim settlement was another major issue from the perspective of the fishers as on average it takes eight to ten months to settle a claim. According to the fishers' representatives and the officials from DoF-TN most of the delays happened during the submission of the report by the insurance surveyor and the actual settlement of a claim. Finally, insurance policies do not provide for partial damages. Therefore, in case of loss of fishing gear or loss of electronic equipment, which are usually the third and fourth costly items in a fishing vessel (after hull and engine), and is quite frequent, the fishing vessel owner cannot raise a claim. Income from fishing operations plays an important role in determining insurance coverage. During the Consultation, a boat owner narrated that since his income from the fishing vessels is declining during the last few years, he has also reduced the insurance coverage from INR 1 million to just 0.2 million to meet his ends.

On parametric insurance products to cover the business loss, the fishers' representatives said that an insurance product to cover their business loss would be helpful as there is an increasing number of the adverse situation when their fishing vessels got damaged without any scope of compensation. The participants informed that the following situations were quite normal in the case of fishing operations where compensation is not paid. On many-a-times, a fishing vessel learned about an impending storm when at mid-sea. These boats have no choice and were forced to stay mid-sea or seek shelter in the nearest foreign port incurring a significant loss.

The Fisher representatives also discussed voluntary catch reporting and vessel monitoring in this context. While they were not opposed to catch reporting and agreed that the same could be the foundation for a rational insurance policy, they were of the view that further discussions are needed on its implementation. They were also aware of a catch reporting program implemented by the Marine Product Export Development Authority for catch certification of exportable consignments. It was suggested that adherence-linked stimulants may be provided for catch reporting.

The following broad lessons can be drawn from the Stakeholder Consultation relevant to the objectives of the Insurance Project:

- The asset insurance penetration has improved following the policy intervention.
- Asset insurance is not an integral part of the business strategy of the fishers yet. This is evident from fluctuations in coverage. However, practical difficulties in meeting the insurance clauses and the lengthy claim settlement process render insurance a bad investment strategy.
- Parametric or index-based insurance is an unfamiliar concept for the fishers. While they can relate to the concept, further education is necessary.
- Migrant workers are likely to have insufficient life insurance coverage. As the number of migrant workers in the fishing industry keeps growing, this group is becoming more vulnerable. They are unlikely to belong to the fishing community and are less likely to access benefits from government programs.
- The current legal mechanism may not be suitable for fisheries-related accidents. There is a need to explore a suitable strategy.

Stakeholder consultation on Marine fisheries insurance in Chennai, India

Marine fisheries insurance: Case of Kerala, India

The focused discussions and interviews conducted in Cochin indicated that the adoption of fisheries insurance shows a marked difference between artisanal/ traditional fishers and trawl fishers. The Matsyafed, a cooperative organization, under the aegis of the Government of Kerala, provides insurance to the traditional fishers. The insurance includes both for life and engine and craft. It is a mandatory requirement while availing credit from Matsyafed. Presently, for the fishers who availed credit from Matsyafed, it is mandatory to avail of insurance during the loan period (usually three years). The life insurance is for INR 1 million, with a premium of less than INR 500 per year. The fishers avail loans for craft and carrier boats at zero percent interest rate up to a combined maximum of INR 2.5 million. Insurance for craft and gear is clubbed with the credit. The total premium is about four percent of the loans for engines and two percent of the loans for the craft. As a case, out of about 3850 members of the Narakkal-Nayarambalam Fishers Development Welfare Cooperative Society (FDWCS) in Cochin, the basic units of Matsyafed, only about 900 members have availed of life insurance in the year 2022. Out of those who availed of a life insurance policy, about half have availed it along with the credit. The demand by non-loanee members for insurance was quite low (10-15%). Besides Matsyafed, the Kerala Fishers' Welfare Fund Board (KFWFB) also offers life insurance coverage (of INR 1 million) to its subscribers at a minimal premium (of about INR 100). Fish workers in general are reluctant to avail the life insurance coverage even at the subsidized rate of premium because insurance is considered as an additional expenditure rather than a risk mitigating/spreading mechanism, clearly pointing towards the need to create awareness.

Insurance is voluntary for mechanized boats including trawl operators. The penetration of insurance is quite low in the sector- the FGD pointed out to the total absence of vessel insurance. A high premium is the most important detriment highlighted. The cost of a mechanized fishing vessel ranges between INR 10-15 million, warranting a high premium. Fishers perceive that with the advancement of vessel technologies, communication mechanisms, and strict implementation of regulations coupled with more accurate weather warnings, the number of accidents at sea has been reduced over the years. The fishers undertake mutual help in case of severe damages including death. Compared to the vessel, gear is most prone to accidents and losses. But insurance for gear is not in vogue due to the issues of verifiability. The frequent attrition of fish workers, migration of labourers, and certain changes in the policy norms including the need to register policy with individual fish workers instead of a group, hold the vessel owners back from availing policies.

Most boat owners, particularly mechanised boat owners, have a life insurance policy. One favourable factor is the availability and accessibility to life insurance companies, its promotional activities, and frequent canvassing by its agents.

The result from field surveys

Web-based analysis shows that the insurance industry is well-established in all the Bay of Bengal countries both for life and non-life insurance. However, most of the offerings are traditional insurance products. There are some parametric insurance products available either with the Government or with a donor agency and are run mostly on an experimental basis.

In terms of life insurance, a host of products are available at various price points. Apart from compensation for loss of life, insurance products are available for accident, disability, health, and retirement planning.

In the case of non-life insurance, various types of asset insurance are available. As regards to marine fisheries, marine hull insurance products are usually available in the market. In the case of India, United India Insurance Company Limited (UIIC) provides a marine hull insurance product. It covers any loss or damage to ships tankers, bulk carriers, smaller vessels, fishing boats, and sailing vessels from (i) Fire or explosion; (ii) stranding sinking, etc.;

(iii) Overturning derailment (of land conveyance); (iv) Collision; and (v) General average sacrifice salvage charges.

In Indonesia, Chubb Insurance provides hull insurance which provides coverage for the hull, along with its machinery and equipment, against damage or loss arising due to shipping risks and perils of the seas. However, this insurance product is a supplementary product that can be taken to complement the primary coverage of cargo products that Chubb provides and hence may not be useful for marine fishing vessels.

The Maldives

The BOBP-IGO conducted consultations in the Maldives on 15th August 2022 to understand the fisheries insurance landscape. Officials from the Ministry of Fisheries, Agriculture and Marine Resources, the Government of Maldives, the Maldivian Fisher Association, and Maldivian fishers – an NGO working on the sector took part.

1. **The Maldives has a robust universal social security mechanism** that covers both life and health insurance. In addition, in 2019, the Government of Maldives enacted a new law (Maldives fisheries Law 14/2019) which mandated the Pension Office to come up with a pension and insurance scheme for fishers. Currently, the following insurance programs are active in the country:
    a. **Life Insurance Scheme:** The fishers have to pay the premium for the life insurance scheme in the Maldives, which provides partial cover for life-threatening accidents and disabilities.
    b. **Health Insurance Scheme (ASANDH):** The total coverage is Rf 200,000 with a cap of Rf. 10,000 for a specific case.
    c. **Minimum Income Guarantee Scheme:** Under this subscription-based scheme, fishers can participate by paying an annual premium of Rf 250. If a vessel crew did not get MVR 10,000 per month, then they can claim to get insurance to pay compensation up to MVR 10,000.
    d. **Pension scheme:** Under this scheme, there is a 15-year premium payment term during which fishers need to pay Rf. 500 per year. From 16th Year, the fishers can receive a pension of Rf. 5000 per month.
    e. **Vessel Insurance Scheme:** It is a mandatory requirement for registration of the larger fishing vessels. Insurance is also mandatory to secure a loan from the Bank.

Expectations from the stakeholders

2. **Disability Insurance:** Work-related injuries are common in the Maldives. Especially there are many cases of accidental eye damage while hooking in pole and line fisheries. In the last two years, 10 such cases were reported. However, the existing insurance schemes do not cover disabilities arising out of occupational hazards.
3. **Managing Baitfish Grounds:** In recent years, due to shortage, fishers are deep diving to catch the bait fishes, which is not sustainable in long term.

    As bait fish availability is dwindling, traditional methods of catching bait are gradually becoming less common. Each vessel has 4-6 divers in south atolls, where pole and line fishing is booming. From 2005-06 onwards, Addu atoll fishers started diving for bait fish. Now all pole and line boats in the vicinity have divers and there are 30 fishers in every boat of about 100 ft – 120 ft LOA for diving. Divers have 15-20 min of bottom time and they used to target Silver sprat, and Anchovies, which were good for 1-2 days of fishing. Now they are targeting cardinal fish available in the deep grounds and is good for 1 week of fishing.
4. **Need to Increase DECO facilities**: Fishers dive up to 60 metres to catch bait. The Professional Association of Diving Instructors (PADI) defines 18 to 30 metres (60 to 100 ft) as a "deep dive" in the context of recreational diving, and considers deep diving a form of technical diving. In technical diving, depth below about 60

metres (200 ft) is considered as deep dive, where hypoxic breathing gas becomes necessary to avoid oxygen toxicity.. In professional diving, a depth that requires special equipment, procedures, or advanced training may be considered a deep dive. However, Maldivian fishers are diving without any special equipment based on their natural skills, which is risky. In the last 2 years, about half a dozen cases of oxygen toxicity were reported where fishers need to be put into a decompression (DECO) chamber. Currently, there are three such facilities in the Maldives.

5. **Strengthening Health Insurance Cover:** While health insurance covers initial hospitalization, it does not pay for revisits. Traveling from islands to Male and neighboring countries for treatment is a costly affair that is not covered in the insurance plan, which puts strain on fishers.

   Further, the decomposition chamber treatment needs USD 5500. Until now, >26 DECO cases have been treated and, but not paid *(Source: Shangrilla Resort dive operations company. Silver Sands Pvt Ltd).* The existing scheme does not factor in this issue.

6. **Livelihood Insurance:** Hospitalization and injuries lead to prolonged alienation from fishing to the active fishers. The current insurance programs do not cover loss of income during hospitalization.

7. **Partial Vessel Damage:** In the case of vessel insurance (Marine Hull Insurance), only total loss is covered, which is very rare to happen. Partial damages are to be covered under insurance.

8. **State-sponsored premium:** The fishers also feel that the Government should purchase the insurance scheme for them covering all perils and health requirements. The current universal health cover and pension cover render the insurance schemes less attractive. Considering the risk involved for the lives and livelihoods of the fishers in the Maldives a tailor-made scheme has to be developed to make it attractive. Fishers can pay the premium if the insurance is attractive.

9. **Ease claim settlement:** Fishers also find it difficult to make a claim due to documentation requirements. Because of the complex process and requirement of more evidences, life insurance is difficult to claim.

10. **Attracting youth to the sector:** Fish catch is dwindling and hence the wages. The minimum wage scheme of Maldives has led to jobs in the tourism sector more attractive. Due to these factors, the number of youths entering the fishing sector is decreasing, which needs to be checked with appropriate schemes.

11. **Stakeholders Interaction:** Fishers are educated and well-informed. There is a need to conduct a Stakeholder Consultation to seek their perspectives for charting the future action to make the sector attractive for the next generation.

Other Suggestions from Stakeholders

12. An awareness plan is necessary to educate fishers about the insurance programs and their benefits including the process of settling claims.

13. There should be holistic schemes covering both life and health risks. There is a need to introduce a scheme to cover pensions and also compensation when someone is in danger.

14. The paradox is that diving beyond 45 meters is not allowed. However, fishers are diving up to 60 meters to get adequate bait fish. These activities are not covered by insurance and they also get limited support from vessel owners.

15. New rules should be framed to ensure the safety of fishers and cover them under insurance. They should be given the necessary training and equipped with quality equipment. Dive computers to be used which can help in tracking depths.

16. SOPs are to be established to treat and also to investigate instances of DECO cases. Certification of divers is essential.

17. R&D Needs: There is a need to standardize optimum descending, ascending time, and bottom time which can be arrived at by analyzing data, and the need to develop a new dive table and software for the fishers of Maldives.
18. Fishers constitute a major part of the population and their livelihood needs greater and more focused attention.

Sri Lanka

The BOBP-IGO jointly with the Ministry of Fisheries & Aquatic Resources, Government of Sri Lanka (MFAR) organized an online stakeholder consultation on "Insurance as a Tool for Managing Marine Fisheries & Building Resilience in Sri Lanka" on 18th August 2022. Boat owners from different parts of Sri Lanka operating multi-day and single-day boats, Sri Lanka Insurance Company, the national insurance provider, and fisheries officials from different fishing districts took part.

Mr. Dhammika Ranatunga, DG (Technical); MFAR; Mr. S.J. Kahawatte, DG, Department of Fisheries and Aquatic Resources conducted the session. In his opening remarks, Dr. P. Krishnan, Director, BOBP-IGO provided an overview of emerging challenges in the fisheries sector and the need for marine fisheries insurance in Sri Lanka in the light of changing climate.

There was a very positive view about the future of the sector from the fishers that: Fishery industry is highly connected to nature, and hence the fishing industry will continue as long as the ocean remains.

The perspectives of the representatives of fisher associations as shared during the consultation are summarized hereunder:

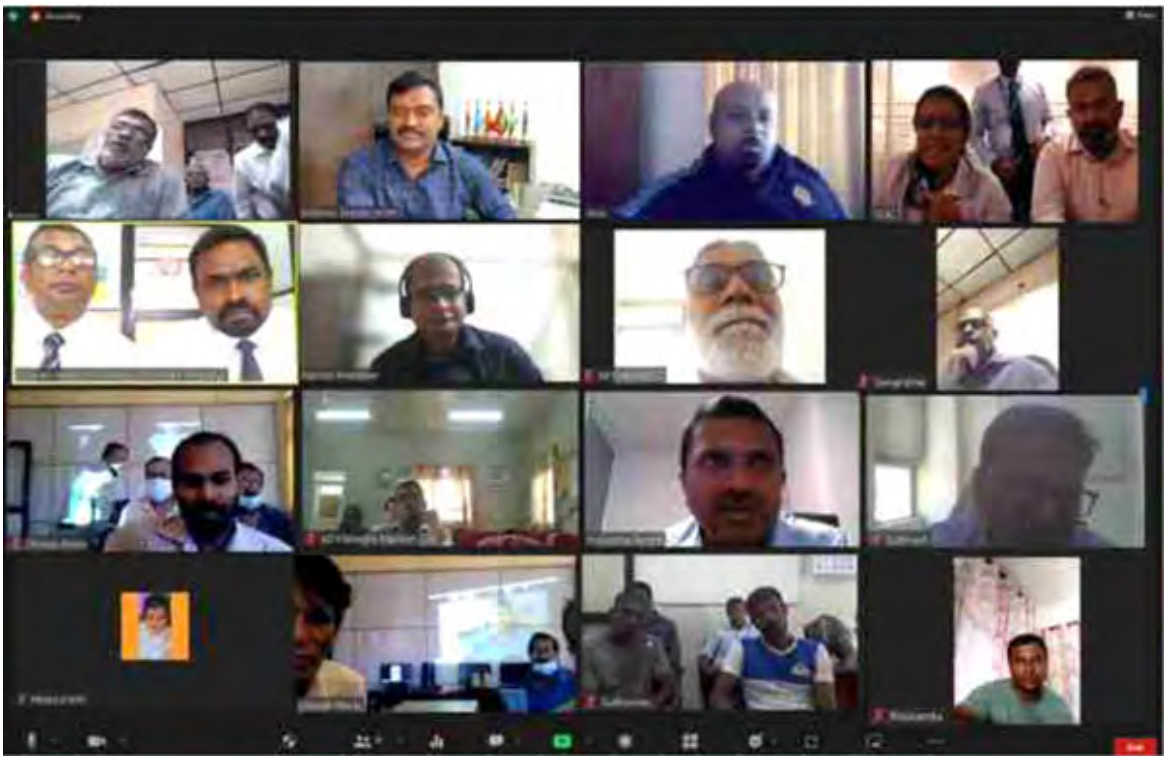
1. **Challenges for the sector:** There is a decline in fish stock, poor living conditions for fishers, a reduction in income, and high instances of unauthorized fishing, which is hampering the prospect of the marine fisheries sector in the country. IUU fishing and gear damage from intruding vessels are also major issues of concern. The foreign vessels also damage the ecosystems which affects the overall fishery in the region. A regional mechanism to regulate IUU fishing and compensate for losses needs to be evolved.

   Due to unstable income, fishers often failed to pay the premium on time which affects the coverage and future claims.
2. **Existing insurance:** Insurance in Sri Lanka is arranged by State-owned Company called Sri Lanka Insurance Company (SLIC). Life insurance is compulsory in Sri Lanka, while vessel insurance is voluntary. However, most of the fishers take insurance.

   The fisheries insurance scheme in Sri Lanka has six components viz., personal accident cover (covering full and partial disability), and death due to natural causes, missing fishers' compensation, hospitalization allowance, repatriation travel, and education allowance for the children.

   The feedback from the fishers suggested that the innovative components of the insurance by the state-owned insurance company have not reached all the stakeholders, which highlighted the need for wider sensitization and implementation of a better grievance redressal mechanism.
3. **Social security of crew:** The boat owners take insurance for 5 crew members. There were grievances expressed by some fishers regarding zero and /or incomplete compensation from the insurance companies and also in particular instances by the government. However, they mentioned the existence of functional fisher societies, which provide timely compensation for damage or loss of assets and/or life.

   When fishing is not done due to bad weather, usually the vessel owners give some kind of assistance to the crew members but in the form of a loan, which they recover during the normal fishing days. Sometimes, the fisher society also helps them in emergencies.
4. **Partial damage Insurance:** While marine hull insurance is available, which covers full damage or loss of the vessel, there is no coverage for partial damages, which are



Stakeholder consultation on Marine fisheries insurance in Sri Lanka

very common. The existing insurance policy does not cover damage due to natural calamities and any damage due to inclement weather conditions when the vessel is berthed.

5. **Insurance for Fishing Equipment:** Insurance cover is not available for equipment and gear, which is a major problem. Some opined that the gears supplied to fishers are of inferior quality and thus they get damaged much sooner and the same are not covered in insurance.
6. **Disability Insurance:** Fishing is a risky vocation. The life insurance scheme does not provide for covering disabilities like loss of limbs, fingers, etc. which make the person completely out of fishing.
7. **Livelihood cover:** There is a need for insurance cover to compensate for the loss in fishing days due to poor health, inclement weather, disabilities, etc.
8. **Issues in Accident Insurance:** Insurance covers only the loss of life during fishing (Accidental death) and not a natural death. Further, the rate of claims under this category is very less. It is perceived that over 90% do not claim/get this benefit as there is a need to prove that death is not due to natural causes.
9. **Ease the claim process:** Fishers were also concerned about the time taken (3-5 months) to process the claim and the lack of credit for claim-free periods. In the case of life and accident insurance, fishers pointed out procedural issues in establishing the cause of death (natural or accidental) and legal compulsion in case of a person presumed dead but the body is not found.
10. **Insurance for Loss due to poachers:** This is a typical issue faced by the fishers of Sri Lanka as an Island Nation and the fishers wished for a special insurance cover to compensate for their losses.
11. **Perception on Insurance:** Fishers perceive that the insuring companies make a huge profit as the claim rates are very less. Hence, the company should pay the premium when there is no claim or reduced premium rate. They wish for a share in benefits accrued by the insurance company.
12. **Perception on parametric/livelihood insurance:** The fishers welcomed the idea of parametric insurance. They informed that fisheries cooperative societies usually assist in dealing with damage and loss. However, they are not familiar with the concept and further discussion would be necessary.

5.2 Salient Findings from the stakeholder consultations

Stakeholders Views on Areas of Inquiry

Issues in the Fisheries sector

Bangladesh

- Current management measures showing good results as hilsa catch improved. However, there are inherent risks such as IUU fishing, and piracy which may affect the fishery.

India

- Fisheries management measures need to be improved as near-shore waters seem to be depleted. The next generation is not interested in fisheries but workers are coming from the hinterlands to fill the gap.
- Measures are needed to curb destructive fishing and poaching by foreign fishers.

Maldives

- Relative remuneration from fisheries is less and is discouraging the new generations.
- While tuna catches seem to be improving there are issues in bait fishery as well as marketing tuna which are affecting the profitability of the sector.
- Given the practice of catching bait fishes by diving from the deep sea, there is a need for building their competence in the short term and implementing baitfish stock enhancement programs in the long term.

Sri Lanka

- There is an urgent need of conserving near-shore fisheries and curbing poaching by foreign fishing vessels.
- Fisheries remain one of the major livelihood options, however, return from fisheries needs to be improved to ensure economic sustainability.

Regional implication

- Relative economic return from fisheries is emerging as a major issue in the region, especially where livelihood opportunities are more diversified.
- While labor may not be a serious issue in the future due to regional disparity and migration, the need for ensuring social security for local and migrated workers will be a challenge. Curbing IUU fishing is another major challenge for the region.

Views on traditional insurance

Bangladesh

- Insurance is not provided for the wooden hull.
- There is also no insurance for the crew. In case of an accident or incident, crews are at the mercy of the boat owner to provide compensation.
- Boat owners often build multiple boats to diversify risk.
- Boat owners are reluctant to purchase an insurance policy as they consider it an investment without return/profit.

India

- User dissatisfaction citing high premium, partial coverage - loss of gear and equipment not covered and settlement of a claim is a lengthy process.
- The crew is covered under a Government-sponsored scheme. However, there is a problem in settling the claim for missing persons.
- No recognition of claim-free period.

Maldives

- The Maldives has a well-developed social security system however; it is failing to keep pace with professional changes.
- One of the persistent problems is eye injury during pole & line fishing for which coverage is limited to first-time hospitalization only.
- Diving for bait fish is becoming popular, which however is not covered by insurance.
- The Maldives also shares the problem of non-availability of insurance for partial damage.

Sri Lanka

- An incomplete list of perils covered under insurance, delays in claim settlement are major issues.
- In case of accident insurance issues of income loss, disability is not covered. It is also difficult to prove death is accidental and not natural.
- Many fishers perceive that insurance companies are earning significant profit at their cost.
- Premium should be refunded/adjusted for claim free period.

Regional implication

- There is a likely case of market failure at the national level that stemmed from incomplete information, lack of mutual trust, and differences in risk assessment. The government needs to play a proactive role here to incentivize investment.

Climate risk

Bangladesh

- Overall awareness on the scope of insurance is low.
- An increasing number of bad weather days but fishers often ignore warnings.

India

- The number of fishing days lost due to bad weather increasing.
- Boats in harbors often get damaged due to storms. These damages are usually not accounted for and compensated for.

Maldives

- No significant issue is raised.
- The country is also working with India to provide potential fishing zone advisory to fishers.

Sri Lanka

- Climate risks are observed and the concept of a Bay-wide insurance program is welcomed.

Regional implication

- Fishers are likely to have a short time horizon and hence long-term climate change effects are not known or recalled.
- Awareness raising on monitoring climate risks may bring improvement.

Policy suggestions

Bangladesh

- The government may consider buying an insurance scheme on behalf of the boat owners collectively and recover the premium through a surcharge on the license fee or through a tax on sales.
- A holistic policy covering perils faced by the crew and the vessels should be designed.
- A Bay of Bengal-wide climate-risk insurance may be developed.

India

- Penetration of insurance can be improved if it became a regulatory requirement.
- Parametric or index-based insurance is an unfamiliar concept for the fishers. While they can relate to the concept, further education is necessary.
- Social protection for migrant workers should be reviewed.
- Government facilitating insurance is welcomed.

Maldives

- Redesigning insurance products across categories to meet emerging issues.
- Support from the Government to meet individual insurance needs as a part of social protection.
- Awareness building.
- Regional insurance program

Sri Lanka

- Streamlining traditional insurance products.
- Insurance against IUU fishing.
- Regional insurance program supported.
- There is a need for wider sensitization of the insurance components and a better grievance redressal mechanism.

Regional implication

- Exploring the scope of the Bay-wide climate insurance program
- Advocacy for greater involvement of the Government in fisheries insurance.

5.3 Views of the Insurance agencies

The insurance companies are actively working with IRADA to minimize losses and damages due to natural events (as stated in Paris Agreement). According to the insurance agencies, moving forwards parametric or index-based insurance is the best solution to cover climate risks. The market for parametric insurance is growing. Parametric insurance is the way forward to deal with the loss and damages due to natural disasters.

The main advantage of parametric insurance is its simplicity. The insurance can be remotely triggered based on indices reported by a third party (e.g. weather parameters such as temperature, rainfall, wind speed, etc. reported by Meteorological Department or Satellite maps/data from Govt. agencies such as Bhuvan). Based on the threshold level (if it is above or below the threshold level), the sum insured will be disbursed to the insurer's bank accounts within a week's time. The insurer or the insured does not need to go through a claim verification and settlement process, reducing the transaction cost of the program.

Parametric insurance also may be designed to apply to un-materialized weather alarms/warnings, which can give fishers incentive to follow weather warnings.

The main design challenge in parametric insurance is identifying the risk components and establishing a clear relationship between the possible damage and the risk factors. For example, in the case of an event such as a cyclone, a relationship may be drawn between the speed of the wind, rainfall, humidity, etc., and the possibility of damage for a particular area to develop a threshold. When wind speed is over the threshold, it will trigger the insurance whether there was actual physical damage or not. The insurance does not look at the asset damage, it follows the weather indices and provide the pay-outs to the insurer.

The incentive for good practices is imbibed in parametric insurance. While it does not differentiate between the personal levels of risks, good behavior may be incentivized. For example, in a flood-prone area, all homeowners will get the benefit of parametric insurance in case of a flood. However, homeowners, who have constructed houses suitable for a flood-prone area will have little damage and the insurance is a reward for their effort. While those with poor housing construction can use the money to carry out repair work.

As a rule of thumb, the premium depends on the risk of occurrence in a particular area. If it occurs once in five years, the premium will be roughly 100/5 = 20%. If once in 10 years, then 10%. It follows from above that spreading is important to decrease the risk of occurrence. In the Bay of Bengal cyclone happens every year. Therefore, the states bordering the Bay of Bengal have a relatively higher chance of facing a cyclone in a year. Accordingly, for a scheme covering only the Bay of Bengal region, the premium will be relatively higher. However, if it is possible to cover a larger area under the insurance scheme (risk pooling), the insurance premium will be lower. For example:

_ In India, the east coast comprising the states of Tamil Nadu, Andhra Pradesh, Odisha, West Bengal, and the Union Territory (UT) of Puducherry borders the Bay of Bengal while the states of Kerala, Karnataka, Maharashtra, Goa, and Gujrat and UT of Dadra & Nagar Haveli are located in the west coast along the Arabian Sea. The number of cyclones in the Arabian Sea is increasing though it is still calmer than the Bay of Bengal. Therefore, if the risk can be pooled for both the Bay of Bengal and the Arabian Sea, then the likelihood that both coasts will be affected together is less than 100%.

- Therefore, by having an insurance scheme covering both coasts, India can better handle the risk at a relatively lower premium rate.
- Restricted parametric insurance to Extreme/Severe Cyclones or Wind Speed above a certain threshold level will lower the premium

However, at present, no specific insurance is available for the fishers. A few insurances plans

are available for shrimp cultivation, but as per the insurance companies, the inland fishing industry is extremely loss-making, and because of this, usually, the premiums are very high.

In traditional insurance, the experience of Sri Lanka Insurance Company is that the proposed insurance scheme is to be compulsory to the entire fisherman population to enable insurers to grant a better benefit at a reasonable premium. The efficiency and effectiveness of the Insurance scheme would be better in the case of a Group Insurance policy with an anniversary date, rather than insuring each fisher separately. While the insurers recognized the need of the fishers, it is cost-prohibitive to offer tailor-made products. Increasing the market size is one solution.

The spurious claim is another major issue constraining the to offer of tailor-made products. For example, Sri Lankan Insurance Company (SLIC) was offering partial damage cover until 2009, and then, they declined the same due to many reasons including increasing spurious claims. The SLIC recognized that while the incidents like theft of net/hooks at sea, sinking due to heavy catchment of fish, etc. could happen at sea, these events could not be independently verified. Hence, currently, they provide for total damage/loss only.

5.4 Lessons learned from the Weather-based crop insurance schemes in India

Initial implementation cost: The risk pay-out structure entirely depends on local weather data. The index-based or parametric insurance requires establishment of a battery of weather stations, and a monitoring and dissemination system. The issue can be addressed by the involvement of the government, private companies, and the NGOs, while the collection of weather data from marine water requires alternative strategies.

Addressing technological gaps: Accuracy of the weather data is key to the success of the program (Nair, 2010a; Raju et al., 2016; Vishnoi et al., 2020). It is observed technical collection of data for land-based activity is easier, as, in the case of crops and livestock, but it is relatively difficult to maintain accuracy in marine waters for aquaculture activities.

In areas without meteorological data, virtual weather stations (VWS) need to be created by constructing interpolated meteorological surfaces at better resolution using standard spatial interpolation algorithms and estimating the uncertainties arising from the input data and the interpolation technique used to map the weather station density (Vishnoi et al.,2020). The usage of remote sensing data is highly warranted, particularly in marine water bodies.

A negative temperature coefficient (NTC) thermistor-based sensor can be used to measure sea surface temperature. Many technological devices are available in the market to obtain reliable and accurate weather information data.

Showing a correlation between the weather/weather index and the loss of craft, gear, and assets: Establishing an accurate correlation between the weather and weather index and the loss that may occur to the craft, gear, and other assets is of critical importance. In marine fisheries, proper field-level information is required, to find the value of assets at risk and the damage that may occur to various assets at various levels of deviation from the weather index. A failure in establishing a correct correlation would largely benefit the insurers, thus weakening the confidence of the insured, within the system.

Design of the insurance product: The design of the insurance product needs to be attractive to clients when presented with information details. The sum assured needs to be sufficient to incentivize the adoption of insurance. The design needs to be simple and easily understood by the fishers, as the majority of them have a low level of education. It also needs to be more responsive to catastrophic risks (Nair et al., 2010b). The WBCIS has several examples to highlight in this regard.

Index insurance contracts are subject to basis risk: The index used are not perfectly correlated with the yield loss on each farm,

leaving some residuals. If carefully designed, index insurance products can be effective in transferring severe weather-related risks that result in income shocks and perpetuate poverty (Vishnoi et al., 2020). In marine fisheries, several fishing days are lost due to adverse weather conditions, which can also be compensated for by innovative schemes that can utilize the weather information.

Lack of awareness about the insurance schemes: Confidence in the insurance scheme is critical in its adoption, particularly by small and marginal farmers, as shown in the case of WBCIS. This issue can be addressed to a great extent by providing a clear statement about weather index insurance and its coverage in the form of client awareness programs through fishers' cooperatives, NGOs, and government agencies.

Cost of insurance: The risk premium is high in the case of risky events that are more likely to occur, this leads to an increase in the premium amount to be paid. This calls for financial support in popularising the risk insurance cover benefits amongst fishers. In crops, the support usually goes along with the credit. But in marine fisheries, the penetration of formal credit is almost negligible, and fishers depend largely on non-formal sources. These warrants devising ***special purpose vehicles*** **(SPV)** for popularising insurance schemes.

Addressing the governance issues: Non-acceptance and delay in payment of claims are major drawbacks of insurance programs, which need immediate attention. It is necessary that the index developed should have a high correlation with the risks involved.

Improving governing structure of the insurance sector: Cases of non-payment or delayed payment of claims are widely reported. This further dents confidence in the system and its popularization. These lessons apply to the fisheries sector as well. The farmers were willing to pay significantly higher premiums in the case of PMFBY, if they could expect prompt payments in case of damages (IIMA, 2019; GoI, 2021). The Standing Committee on Agriculture of Seventeenth Lok Sabha, Government of India (GoI, 2021) has provided operational guidelines to implement insurance schemes under PMFBY, several of which could be useful for streamlining parametric insurance programs in the fisheries sector.

Policy statements

The marine fisheries in the south & South East region generate revenue of USD 33 billion a year. It is playing an important role in the regional economy as a source of food and livelihood. Therefore, ensuring that risks are mitigated to the best possible extent is of paramount importance.

A suitable insurance model for the region should cater, in particular, to the characteristics of the small-scale fisheries sector.

There is no single insurance solution. Parametric insurance should complement traditional insurance. To address the various issues of traditional insurance (high transaction cost, high premium, unsuitable design, etc.) various models of micro insurance should be considered especially for the artisanal fisheries sector.

Countries should develop national DaLA mechanisms in line with international best practices to ensure that compensation is sufficient to keep businesses on their natural growth path.

The possibility of using insurance to mitigate business risks is not widely understood. Therefore, Insurance education for all, especially the marginal section of fishers should be considered in partnership with NGOs and other suitable agencies.

Issuance of a national policy statement delineating appropriate financial risk mitigation measures including the role of different actors like the Government and the Insurance companies is of immediate need. This will accelerate and mainstream the Paris Agreement and the Sendai Framework for Disaster Risk Reduction while exhibiting the political support behind these instruments (UNDRR, 2022).

While Governmental support to the fisheries sector in the region remain abysmal, in view of the recent WTO negotiation, there could be a reallocation of the Governmental Support to the fisheries sector. Such an reallocation can be used for improving resilience of the sector through public support in insurance programmes.

5.5. Recommendations

1

What to be done

- *Develop a Strategic Plan for the Bay of Bengal region, on the lines of the Caribbean Multi-Country Strategic Plan (2022-26).*
- *The Plan, inter alia, should focus on quantification of disaster risk, improved climate reporting, and creation of a pooled fund for disaster finance.*

Why to be done

- *Unlike the Caribbean countries, Bay of Bengal rim countries vary significantly in size and nature.*
- *Despite this, similarities can be drawn from the elevated risk exposure, shared ecosystem, and level of economic development.*

Level

Bangladesh, India, Sri Lanka

2

What to be done

- *All-peril insurance for "unnamed crew" for all fishing vessels may be made mandatory, by linking it to licensing.*

Why to be done

- *This study shows that moral persuasion by the Government positively influences the adoption of insurance.*

Level

Bangladesh, India

3

What to be done

- *Develop a pooled risk insurance scheme for the Bay of Bengal region to ensure speedy disposal of the adequate fund during a calamity.*

Why to be done

- *While the Bay of Bengal region as such has an elevated risk profile, country-to-country exposure to risk year-wise varies indicating ample scope for risk pooling.*
- *Post-COVID, the structural financial stress faced by the countries has increased, which poses challenges to ensure adequate finance available for disaster recovery.*
- *A pooled fund would help the countries in meeting their commitment to the Paris Agreement and contribute to SDG 13 and ensure adequate finance for recovery.*
- *Further, it is evident from historical data on damages and losses within the Bay of Bengal region, these countries usually meet the recovery of the damages through national resources and aid provided by International NGOs.*
- *The role of insurance companies is limited to the individual policyholders, based on claims submitted by individuals, wherein, the insurance companies assess the damage loss and claim settlement process accordingly.*
- *Due to several issues, the penetration of the insurance market is low in developing countries, which exacerbates the overall burden on individual nations, at times of disasters.*

Level

Bangladesh, India, Sri Lanka

4

What to be done

- *All-peril marine hull insurance may be made mandatory for all fishing vessels by linking it to licensing.*

Why to be done

- *The study shows that linking insurance to fisheries regulations is beneficial and shows positive results.*

Level

All countries

5

What to be done

- *Using the data collected by the Government about details of fishing vessels (including price during registration) will help to buy an all-peril insurance cover for the fishing vessels.*
- *The Government may use tax revenue to buy re-insurance products from the market for risk coverage.*

Why to be done

- *This measure of an umbrella program will improve insurance coverage in the country, as study findings show a higher level of compliance to insurance when the Government facilitates and funds such initiatives.*
- *It will also encourage FBEs to register and get licenses to take insurance coverage, e.g., the Philippines is currently developing such a program.*

Level

All countries

6

What to be done

- *Imposition of National/ Central Cess on the Licensing Fee to generate funds, which can be used by the government to facilitate/fund the purchase of "an all-peril" insurance policy under an umbrella program of the government.*

Why to be done

- *The study findings reflect that FBEs are more likely to pay for an increased license fee rather than subscribe to insurance coverage from the market.*

All countries

Level

Bangladesh, India, Sri Lanka

7

What to be done

- *Issuance of guidelines seeking insurance companies to reserve a fund for catastrophic risks.*

Why to be done

- *The study shows that insurance companies are waiting for a clear signal from the market and such a push may accelerate their action.*

Level

All countries

8

What to be done

- *Increasing the limits of the Group Insurance Scheme (GIS) because of the increased occupational risks.*
- *Countries that do not have a GIS, may consider implementing such schemes for fishers.*

Why to be done

- *Findings of a study from India show that GIS cover is low as compared to the increased risk and the rising cost of living.*
- *Therefore, to ensure adequate social protection for fishers, limits of the GIS may be doubled.*

Level

India

9

What to be done

- *Exercise special care to ensure that migrant workers are covered in insurance programs.*

Why to be done

- *Migrant workers are likely to have insufficient life insurance coverage. As the number of migrant workers in the fishing industry keeps growing, this segment of workers is becoming more vulnerable.*
- *The study found that migrant workers are likely to be excluded from the benefits that accrue to the local fishers.*

Level

India and Maldives

10

What to be done

- *Parametric or Index-based insurance can mitigate business loss due to climate change and provide immediate relief.*
- *One example of parametric insurance could be Cyclone Insurance, where the FBEs would be compensated at a fixed rate, once the event is triggered. The fixed rate will depend on the fund size.*

Why to be done

- *Lessons learned from the agriculture sector, Caribbean Insurance program, and pilot-scale experiments in other countries have demonstrated successful implementation of these initiatives*
- *However, macro-level data does not show any significant impact of catastrophes on production/income. At a micro level, income volatility may increase and there could be a redistribution of catch from artisanal to higher scale fishing vessels.*
- *Further to this several FBEs are below the poverty line and loss of income may lead to hunger and related issues. Hence, there is also a need to provide immediate relief rather than rely only on traditional insurance based on damage assessment.*

Level

All countries

11

What to be done

- *A specially designed parametric insurance (based on cyclonic disturbance) will be helpful for the fishers.*

Why to be done

- *Private insurance companies will show interest to provide parametric insurance if a large number of fishers are covered under the insurance scheme (risk pooling) and the insurance premium will be lower. Further, restricting such parametric insurance to extreme/severe cyclones or wind speeds above a certain threshold level (e.g. MSW>88 kmh, that is Severe Cyclonic Storm) will lower the premium.*
- *Also, when a given insurance company offers both traditional and parametric insurance, the pay-out based on pre-determined triggers for immediate relief could be set off against subsequent damage assessment-based payment. This way, insurance companies can offer comprehensive dual insurance at reasonable premiums. Government subvention would further make the product affordable so that small-scale fishers could also be covered.*

Level

Bangladesh, India, Sri Lanka

12

What to be done

- *Mainstream catch documentation by instituting a mechanism to collect data on; the type and quantity of fish caught by the fishers. This will aid the industry in developing an insurance product that will effectively compensate for the days lost due to adverse weather conditions.*

Why to be done

- *Access to data on the average catch by the fishers spread over different periods, will provide an opportunity to design insurance products, which can compensate for the loss proportionate to the actual catch by the fishers.*
- *This data will also be used for better catch management and improving stock status thus triggering a cascade of mitigation measures.*

Level

All countries

13

What to be done

- *Consider various forms of insurance including micro-insurance, community-based insurance, and market-based insurance apart from public insurance schemes.*

Why to be done

- *Experience from Indonesia and Malaysia shows that insurance schemes may be linked to the social conditions for better implementation at a lower cost.*
- *The representatives of the fishers from Chennai opined that the adaptation of a mutual guarantee program for coverage of loss would stop the outflow of money to the insurance companies.*

Level

All countries

14

What to be done

- *Design insurance products that adhere to the principles of SUAVE (Simple, Understood, Accessible, Valuable, and Efficient) (Micro-insurance Centre)*

Why to be done

- *Findings from stakeholder consultations show that fishers depend on sales agents to understand the benefits of the insurance scheme and later find it difficult to meet the conditions for filing a claim creating an "over promised-under delivered" situation which erodes their trust in market-based insurance products.*

Level

All countries

15

What to be done

- *Design insurance products to cover partial damage to fisheries assets.*

Why to be done

- *Existing insurance products get triggered only in case of complete loss of the fishing vessel, while in most instances the damages are only partial and do not trigger any insurance pay-out.*

Level

All countries

16

What to be done

- *Development of a Model Parametric Insurance Scheme to guide the insurance sector and implementation at a pilot scale.*

Why to be done

- *This is required to demonstrate the potential use of existing data to mitigate climate risks; ascertain the data requirement and issues in their collection. However, the scheme could be improved over time with a more granular data collection network.*

Level

All countries

17

What to be done

- *Safe working days for fisheries should be estimated. In case of the Bay of Bengal region, from historical data, with a high probability, 295 days are safe days for fishing (Excluding fishing ban and holidays). Insurance can be paid if the fishing days' decrease below 295 days (Excluding fishing ban and holidays as applicable under national laws).*

Why to be done

- *Under the parametric insurance claims are paid for the loss of working hours/days, for any unavoidable situation, if workers did not get enough working hours/days. Similarly, parametric insurance for protecting the fisher's working days needs to be implemented.*

Level

Bangladesh, India

18

What to be done
- *Exploring option of co-pay in case of asset insurance*

Why to be done
- *Difficulties in validating the claim is one of the major impediments from the point of view of the insurance companies. One possible option is to ask insure to co-pay. Under this principle, insurance company will not bear full cost of damage but a share of it (75-80%). The insured person will make the payment first and that would partially meet the need of validation of the claim. Such measures are use in health insurance where similar problem of validation of claim exist.*

Level
All countries

19

What to be done
- *Claim adjustment*

Why to be done
- *Given the diverse requirement of the fishers there the total sum assured can be made of multiple claims. For example, one vessel insurance policy may cover for hull, gear and electronic equipment. If the fishers make a valid claim for gear loss, a part of the sum assured will be provided and this will be adjusted from the total sum assured.*

Level
All countries

Reference

ADB., 2009. Damage, loss and needs assessment: An introduction for staff of the Asian Development Bank. Asian Development Bank, Manila.

ADB and GoO., 2019. Cyclone Fani: Damage, Loss, and Needs Assessment. Asian Development Bank, World Bank, United Nations and Govt. of Odisha.

ADB, GoO, & World Bank., 2013. India Cyclone Phailin in Odisha: Rapid Damage and Needs Assessment Report.

Ahmed, N., Occhipinti-Ambrogi, A. and Muir, J.F., 2013. The impact of climate change on prawn postlarvae fishing in coastal Bangladesh: socioeconomic and ecological perspectives. *Marine Policy*, 39, pp.224-233.

Akter, S., Brouwer, R., Choudhury, S., and Aziz, S., 2009. Is there a commercially viable market for crop insurance in rural Bangladesh? . *Mitigation and Adaptation Strategies for Global Change*, 14, pp. 215–229.

Akhter, S., Qiao, F., Wu, K., Yin, X., Chowdhury, K.A. and Chowdhury, N.U.M.K., 2021. Seasonal and long-term sea-level variations and their forcing factors in the northern Bay of Bengal: A statistical analysis of temperature, salinity, wind stress curl, and regional climate index data. *Dynamics of Atmospheres and Oceans*, 95, p.101239

Al-Maruf, A., Mira, S.A., Rida, T.N., Rahman, M.S., Sarker, P.K. and Jenkins, J.C., 2021. Piloting a weather-index-based crop insurance system in Bangladesh: understanding the challenges of financial instruments for tackling climate risks. *Sustainability*, 13(15), p.8616.

Barange, M., Merino, G., Blanchard, J.L., Scholtens, J., Harle, J., Allison, E.H., Allen, J.I., Holt, J. and Jennings, S., 2014. Impacts of climate change on marine ecosystem production in societies dependent on fisheries. *Nature Climate Change*, 4(3), pp.211-216.

Botzen, W.J.W (2013). Managing Extreme Climate Change Risks through Insurance, Cambridge University Press.

Brammer, H., 2016. Floods, cyclones, drought and climate change in Bangladesh: a reality check. *International Journal of Environmental Studies*, 73(6), pp.865-886.

Buike, P., 2018. Rainy seasons effect on shrimp grow-out ponds. Global Seafood Alliance. https://www.globalseafood.org/advocate/effects-of-weather-and-climate-on-aquaculture Accessed on: 09/2022

CCRIF. 2022. CCRIF's Member Governments Purchase US$1.2 Billion in Coverage for Catastrophe Risk Insurance for 2022/23 Against Climate-related and Seismic Hazards. https://www.ccrif.org/news/ccrifs-member-governments-purchase-us12-billion-coverage-catastrophe-risk-insurance-202223?language_content_entity=en . Accessed on: 09/2022

Charpentier, A., 2008. Insurability of climate risks. Geneva Papers of Risk and Insurance – Issues and Practice, 33(1), pp. 91-109.

Dailey, P., Huddleston, M., Brown, S., and Fasking, D., 2009. The Financial Risks of Climate Change: Examining the financial implications of climate change models and insurance catastrophe risk models, Association of British Insurers.

Das, I., Lauria, V., Kay, S., Cazcarro, I., Arto, I., Fernandes, J.A. and Hazra, S., 2020. Effects of climate change and management policies on marine fisheries productivity in the north-east coast of India. *Science of the Total Environment*, 724, p.138082.

DOF. 2022. Pradhan Mantri Matsya Sampada Yojana. https://pmmsy.dof.gov.in/ Accessed on:09/2022

EM-DAT. 2022. The international disasters database. https://www.emdat.be/ Accessed on: 09/2022

FAO.2022. Fishery manager's guidebook: Management measures and their application. FAO Fisheries Technical Paper, (424), 231p.

Fuks, M., and Chatterjee, L., 2008. Estimating the willingness to pay for a flood control project in Brazil using the contingent

valuation method. *Journal of Urban Planning and Development*, 134(1), 42–52.

FRAD_CMFRI 2022. Marine Fish Landings in India 2021. Technical Report, CMFRI Booklet Series No. 26/2022. ICAR-Central Marine Fisheries Research Institute, Kochi.

Gagain, M., 2012. Climate change, sea level rise, and artificial islands: Saving the Maldives' statehood and maritime claims through the constitution of the oceans. *Colorado Journal of International Environmental Law and Policy*, 23, p.77.

GFDRR. 2008. Disaster, Damage, Loss and Needs Assessment—Training Guidelines. Global Facility for Disaster Reduction and Recovery. https://www.humanitarian library.org/sites/default/files/2014/07/13 019_530020WP0P110410Box345586B01P UBLIC1.pdf . Accessed on:09/2022

Government of India. 2021. Standing Committee Report on Pradhan Matri Fasal Bima Yojana- An Evaluation. Standing Committee on Agriculture Twenty-Ninth Report, Ministry of Agriculture and Farmers' Welfare. Loksabha Secretariat, New Delhi.115pp

Government of Vanuatu. 2015. Vanuatu: Rapid Post-Disaster Needs Assessment—Tropical Cyclone Pam.

Hanemann, W.M., Loomis, J., and Kanninen, B., 1991. Statistical efficiency of double-bounded dichotomous choice contingent valuation. *American Journal of Agricultural Economics*, 73, 1255–63.

Hazell, P., Anderson, J., Balzer, N., Hastrup Clemmensen, A., Hess, U. and Rispoli, F., 2010. The potential for scale and sustainability in weather index insurance for agriculture and rural livelihoods. World Food Programme (WFP). 153pp.

Haab, Timothy C., & Kenneth E. McConnell., 2002. Valuing environmental and natural resources: The econometrics of Non market valuation. Cheltenham: Edward Elgar.

Heal, G. and Kriström, B., 2002. Uncertainty and climate change. *Environmental and Resource Economics*, 22(1), pp.3-39.

Hoeppe, P. and Gurenko, E.N., 2015. Scientific and economic rationales for innovative climate insurance solutions. In Climate Change and Insurance (pp. 15-28). Routledge.

ICSF. 2015. Insurance to help Bangladesh's 'forgotten' fishers. https://www.icsf.net/ newss/insurance-to-help-bangladeshs-forgotten-fishers/ Accessed on: 09/2022

IIMA. 2019. Performance Evaluation of Pradhan Mantri Fasal Bima Yojana (PMFBY) Part II. Final Report. Centre for Management in Agriculture. Indian Institute of Management, Ahmedabad. Pp.74

IMD. 2021. Cyclone Warning in India Standard Operation Procedure. India Meteorological Department, Ministry of Earth Sciences, Government of India. 229p

IRDAI.2022.www.irdai.gov.in/ADMINCMS/cms/ Uploadedfiles/NLP1718/191.pdf Accessed on: 09/2022

IUCN. 2012. Climate Change and Fisheries and Livestock in Bangladesh. https://www.iucn.org/sites/dev/files/imp ort/downloads/fisheries.pdf Accessed on: 09/2022

Jyoteeshkumar Reddy, P., Sriram, D., Gunthe, S.S. and Balaji, C., 2021. Impact of climate change on intense Bay of Bengal tropical cyclones of the post-monsoon season: a pseudo global warming approach. Climate Dynamics, 56(9), pp.2855-2879.

Jin, J., Wang, Z., and Ran, S., 2006. Comparison of contingent valuation and choice experiment in solid waste management programs in Macao. *Ecological Economics*, 57(3), 430-441.

Kaur, S., Raj, H., Singh, H. and Chattu, V.K., 2021. Crop Insurance Policies in India: An Empirical Analysis of Pradhan Mantri Fasal Bima Yojana. *Risks*, 9(11), p.191.

Khan, T.M.A., Quadir, D.A., Murty, T.S., Kabir, A., Aktar, F. and Sarker, M.A., 2002. Relative sea-level changes in Maldives and vulnerability of land due to abnormal coastal inundation. *Marine Geodesy*, 25(1-2), pp.133-143.

Kong, F. and Sun, S., 2021. Better understanding of insurance mechanism in dealing with climate change risk, with special reference to China. *International Journal of*

Environmental Research and Public Health, 18(6), p.2996.

Kousky, C. and Cooke, R.M., 2009. Climate change and risk management: Challenges for Insurnance, Adaptation and Loss Estimation. Discussion paper no. RFF DP 09-03, Resource for Future, Washington, DC

Kunreuther, H., 1996. Mitigating disaster losses through insurance. Journal of risk and Uncertainty, 12(2-3), pp. 171-187.

Laury, S. K., McInnes, M. M., and Swarthout, J. T., 2009. Insurance decisions for low probability losses. *Journal of Risk and Uncertainty*, 39(1), pp. 17-44.

Luu, Q.H., Tkalich, P. and Tay, T.W., 2015. Sea level trend and variability around Peninsular Malaysia. Ocean Science, 11(4), pp.617-628.

Markantonis, V., Meyer, V., and Schwarze, R., 2012. Valuating the intangible effects of natural hazards–review and analysis of the costing methods. *Natural Hazards and Earth System Sciences*, 12(5), 1633-1640.

Marfai, M.A., 2014. Impact of sea level rise to coastal ecology: a case study on the northern part of Java Island, Indonesia. *Quaestiones Geographicae*. 33(1), pp.107-114.

Mathiventhan, T., Gorman, D. and Jayasingam, T., 2022. Sea-level rise, coastal salinity and vegetation changes in Sri Lanka. *Philosophical Transactions of the Royal Society A*, 380(2221), p.20210142.

Mishra, T. and Malakar, K., 2020. Loss and damages from cyclone: a case study from Odisha, a coastal state. In Development in coastal zones and disaster management (pp. 281-291). Palgrave Macmillan, Singapore.

Nair, R. 2010a. Crop insurance in India: Challenges and Strategies. Economic and Political Weekly. 14(6).pp.19-22.

Nair, R. 2010b. Weather-based Crop Insurance in India: Towards a Sustainable Crop Insurance Regime? *Economic and Political Weekly*. 45(34). pp. 73-81

Nordlander, L., Pill, M. and Romera, B.M., 2020. Insurance schemes for loss and damage: fools' gold? *Climate Policy*, 20(6), pp.704-714.

Parappurathu, S., Ramachandran, C., Gopalakrishnan, A., Kumar, D., Poddar, M.K., Choudhury, M., Geetha, R., Koya, K.M., Kumar, R.N., Salini, K.P. and Sunil, P.V., 2017. What ails fisheries insurance in India? An assessment of issues, challenges and future potential. *Marine Policy*, 86, pp.144-155.

Perry, C. T., and Morgan, K. M. 2017. Bleaching drives collapse in reef carbonate budgets and reef growth potential on southern Maldives reefs. *Scientific Reports*, 7(1), p.40581

Putri, A.R., Zainuddin, M. and Putri, R.S., 2018. Effect of climate change on the distribution of skipjack tuna Katsuwonus pelamis catch in the Bone Gulf, Indonesia, during the southeast monsoon. *Aquaculture, Aquarium, Conservation & Legislation*, 11(2), pp.439-451.

Raju, K.V., Naik, G., Ramseshan, R., Pandey, T., Joshi, P., Anantha, K.H., Rao, A.K., D Shyam, M. and Kumara Charyulu, D., 2016. Transforming Weather Index-Based Crop Insurance in India: Protecting Small Farmers from Distress. Status and a Way Forward. Research Report IDC-8. 36pp.

Rohit, P., Sivadas, M., Abdussamad, E.M., Rethinam, A.M.M., Koya, K.P.S. and Ganga, U. et al., 2018. The Enigmatic Indian Oil Sardine: An Insight. *CMFRI Special Publication No. 130*.

Rudi, E., Iskandar, T., Fadli, N. and Hidayati, H., 2012. Impact of mass coral bleaching on reef fish community and fishers catches at Sabang, Aceh Province, Indonesia. *Aquaculture, Aquarium, Conservation & Legislation*, 5(5), pp.309-320.

Sahoo, B. and Bhaskaran, P.K., 2016. Assessment on historical cyclone tracks in the Bay of Bengal, east coast of India. *International Journal of Climatology*, 36(1), pp.95-109.

Sarkhel, P., and Banerjee, S., 2010. Municipal solid waste management, source-separated waste and stakeholder's attitude: A contingent valuation study. Environment, Development and *Sustainability*, 12(5), pp. 611–630.

Shinoj, P., Ramachandran, C., Gopalakrishnan, A., Koya, M., Narayanakumar, R., Salini, K.P. and Sunil, P.V., 2017. Marine Fisheries Insurance in India: Status and prospects.

Marine Fisheries Information Service; Technical and Extension Series, (233), pp.3-6.

Sridevi, B. and Sarma, V.V.S.S., 2021. Role of river discharge and warming on ocean acidification and pCO2 levels in the Bay of Bengal. *Tellus B: Chemical and Physical Meteorology*, 73(1), pp.1-20.

UNDRR. 2022. https://www.undrr.org/implementing-sendai-framework/what-sendai-framework Accessed on: 09/2022

UNFCCC. 2012. Myanmar Initial National Communication (INC) Project Report to the UNFCCC. 313P. Accessed on: 09/2022

Van Anrooy, R., Espinoza Córdova, F., Japp, D., Valderrama, D., Gopal Karmakar, K., Lengyel, P., Parappurathu, S., Upare, S., Tietze, U., Costelloe, T., & Zhang, Z. 2022. World review of capture fisheries and aquaculture insurance 2022. *FAO Fisheries and Aquaculture Technical Paper No. 682.* Rome, FAO.

Van Anrooy, R., Mukherjee, R., Wakamatsu, H., Song, L., Muawanah, U., Jin Cha, B., Narayana Kumar, R., Parappurathu, S., Yadava, and Y.S., Tietze, U., 2020. Techno-economic performance review of selected fishing fleets in Asia. *FAO Fisheries and Aquaculture Technical Paper No. 653/3*. Rome, FAO.

Vishnoi, L., Kumar, A., Kumar, S., Sharma, G., Baxla, A.K., Singh, K.K., and Bhan, S.C., 2020. Weather-based crop insurance for risk management in agriculture. *Journal of Agrometeorology*, 22(2), pp.101-108.

Vivekanandan, E., Hermes, R. and O'Brien, C., 2016. Climate change effects in the Bay of Bengal large marine ecosystem. *Environmental Development*, 17, pp.46-56.

Web Cyclone eAtlas. 2022. Cyclone eAtlas – IMD - electronic atlas on Tracks of Cyclones and Depressions (C and Ds) over the North Indian Ocean during the period from 1891 to 2021.

UNFCCC. 2013. Decision 2/CP.19, Warsaw International Mechanism for loss and damage associ- ated with climate change impacts, (UN Doc FCCC/CP/2013/10/Add.1).

UNFCCC. 2015. Decision 1/CP.21, Adoption of the Paris Agreement (UN Doc FCCC/CP/2015/10/Add.1).

UNFCCC. (2022). Introduction to loss and damage | UNFCCC. https://unfccc.int/topics/adaptation-and-resilience/the-big-picture/introduction-to-loss-and-damage

World Bank. 2010. World Development Report 2010: Development and Climate Change. World Bank. https://openknowledge.worldbank.org/handle/10986/4387

World Bank. 2014. Tonga to Receive US $1.27 Million Payout for Cyclone Response. https://www.worldbank.org/en/news/pressrelease/2014/01/23/tonga-to-receive-payout-for-cyclone-response . Accessed on: 09/2022.

World Bank. 2021. Climate Risk Country Profile: Sri Lanka (2021): The World Bank Group and the Asian Development Bank.

Yahya Surya, M., He, Z., Xia, Y. and Li, L., 2019. Impacts of sea level rise and river discharge on the hydrodynamics characteristics of Jakarta Bay (Indonesia). *Water*, 11(7), p.1384.

Annexure 1:

Measuring willingness to pay (WTP) for insurance premium

The two possible methods that can be used for this include the contingent valuation method (CVM) and choice modelling (CM), and these methods were originally developed for the valuation of environmental goods not traded in any market.

To examine the WTP, we create a hypothetical insurance market and examine the fisher's choices of insurance. When creating a hypothetical market, CVM and CM are the most frequently applied technique (Markantonis et al., 2012) when creating a hypothetical or contingent market. A comparative study concluded that both CVM and CM methods can be applied for such a purpose and can arrive at similar estimates (Jin et al., 2006). The precision and efficacy of the approach depend upon the availability and quality of data as well as the available resources. This also means that the appropriate method for estimating the demand for the non-existent market commodities can be a "case-by-case" basis.

CVM and CM will be estimated by obtaining information from fishers. A structured questionnaire (socio-economic survey) will be used to identify the choices of fishers to buy insurance. Their WTP depends on the occurrence of the event and the claim rate of the insurance. The study also examines the fishers' awareness of the frequency, severity, and impacts of cyclonic storms in the BOB region and their risk assessment. The awareness of the loss and damage due to increased cyclonic storms plays a big role in the fisherman's decision to buy the insurance.

> *Studies that examined the impacts of climate change on the demand for insurance point out that individuals do not voluntarily adopt cost-effective measures to reduce the damage from future catastrophic events, when the probability for such an event is low (Kunreuther, 1996; Heal et al., 2002; Laury et al., 2009). Kunreuther's (1996) study observed that the increase in the likelihood of a catastrophic event would increase the demand for insurance.*

However, if the higher premiums of the insurance deterring the fishers to buy, the future study may explore the fisher's preferences and their willingness to pay for insurance in the presence of adaptive programs (early warning system, the contribution of state and local authorities to insurance premiums, etc.) which may reduce the premium.

To calculate risk probabilities, the insurance sector uses models such as Bayesian models, extreme value distributions, etc. Since, extreme weather events provide more fat tails than any other events (Kousky et al. 2009; Charpentier, 2008), it is appropriate to calculate the risks using extreme value distributions to estimate losses in the presence of different adaptation measures and how they can reduce premiums and increase take-up of insurance.

Our study will use the extreme value theory to calculate the threshold levels and examine the tail distribution to measure the accurate risk, expected loss, and corresponding probabilities. The calculated probabilities and risks will be used further to assess the individual willingness to pay, insurance premiums, and government disaster risk management programs. The study intends to use various reports of IMD and weather-related data of the Bay of Bengal, and the data and reports will be used to estimate probabilities of extreme events in this region.

The estimated probabilities will be used in the socio-economic survey to examine the WTP of Fishers. The questionnaire will have two sections - in the first part, it will examine the fishers' choices and WTP of insurance when fishers not having information/awareness of the impacts of cyclonic storms and available insurance schemes; in the second part of the questionnaire, the survey would capture the probabilities of the cyclonic events, impacts, expected damages and various mitigation measures to fishers and would aid in examining whether the awareness has any impact on their WTP for insurance.

As already stated, a hypothetical insurance market will be created using the CVM in this study. Among the different CVM approaches like single-bounded dichotomous choice (SBDC), double-bounded dichotomous choice (DBDC) and open-ended CVM, DBDC which is the most widely used approach is selected. . This approach has been utilized widely in estimating the willingness to pay/notional demand curve of non-marketed goods (Akter et al., 2009; Fuks & Chatterjee, 2008; Sarkhel & Banerjee, 2010). Hanemann et al. (1991) and Haab & McConnell (2002) demonstrated that the DBDC is statically more efficient than SBDC and CVM. It gives a higher level of precision to elicit the WTP of the respondents, especially when there are fewer observations. Hanemann et al. (1991) noted that the double-bounded logit model reduces the variance of the estimated parameters significantly and that there is a consistent decline in covariance terms in comparison to the SBDC method. This immediately translates into a tighter confidence interval around the median WTP. The efficiency of the DBCVM lies in the fact that it defines more precise boundaries for the WTP in a closer neighborhood of the willingness to pay/demand curve than that allowed for by the SBCVM. The demand for a hypothetical premium for minor to major assets including health insurance against two extreme events such as cyclone and failure of machines, halting of fish catch due to personnel or climatic conditions was evaluated through a fisher's household survey using the above-cited method, that is, DBCVM. Bid design is very important from the point of view of the efficiency of the estimators because the variance-covariance matrix is determined by these when they are used as the only response variables.

To design the bid structure, a pilot study will be conducted for finding the possible range of bid premiums with open-ended questions. In addition, we intend to consult the experts in the Department of fisheries. For the actual data collection, eight different start-up premium bids will be designed and assigned randomly across the respondents to avoid the starting-point bias (Mitchell & Carson, 1989). Social variables represent the basic characteristics of the fisher's family, including household size, the proportion of household members in the labor force (including all types of employment in the household), and average annual household income. Household size is expected to have a negative impact on fisher's demand for insurance because a bigger household needs more money to cover fixed expenditures and as a result little is left to be spent on insurance (Tian and Yao, 2015). The financial burden can be effectively alleviated if a high proportion of household members are in the labor force and if the household receives a high income. This enables them to cope with natural disasters while reducing their WTP for insurance (Bhutto and Bazmi, 2007). Some studies have also noted that fishers' demand for insurance has a significant correlation with their affordability of insurance premiums (Chien and Yeh, 2009). Risk variables reflect risk exposure by landholding per member of the household and financial loss suffered by fish farmers in the previous years. Those who have suffered huge losses are keen to participate in insurance programs, but they may be incentivized to provide misleading information to receive a low premium. This can lead to a situation where those fish farmers with lower risks are squeezed out of the market. Attitude variables mainly focus on fisher's education and their awareness of insurance. There exists a notable relationship between these two variables (Hill et al., 2013). It is widely accepted that the more educated people are, the more likely they are to take extensive and in-depth risk prevention measures (Burn, 1999; Choi et al., 2007; Seifert et al., 2013; Zhang and Stenger, 2014). Overall, the insurance awareness indirectly reflects fishers' knowledge of aquaculture insurance, thereby influencing their WTP.

Each respondent will have to answer the two questions regarding willingness to pay: (1) Is he/she willing to pay an initial amount of premium (start-up bid) to mitigate climate risk / see development? and based on the response to the initial question and the second questions Is he/she willing to pay a higher or lower premium (follow-up bid). If the response to the start-up bid was “YES” then a higher follow-up bid will be presented, and if the response to the start-up bid was “NO”, then a lower follow-up bid will be presented.

Based on these two questions, the following four possible outcomes for the WTP exercise.

1. WTP (YY) = 1 Accepting both the start-up bid and the follow-up bid

2. WTP (YN) = 2 Accepting the start-up bid and rejecting the follow-up bid

3. WTP (NY) = 3 Rejecting the start-up bid and accepting the follow-up bid

4. WTP (NN) = 4 Rejecting both the start-up bid and the follow-up bid

A double-bounded Logit model can be employed to analyze the data. Following Hanemann et al., (1991), where Pi is a probability that the dependent variable Yi = 1 if the fisher is willing to pay for extension services and 0 if otherwise, "a" is the constant intercept, "b" is the coefficient of the factors that determine fishers' likelihood to pay for extension services, the response probabilities obtained for the double bounded Logit model are:

〖PYY〗 _i=1/(1+e^(-(a+b Higher Bid))) 1

〖PNN〗 _i=1/(1+e^(-(a+b Lower Bid))) ...2

〖PNY〗 _i=1/(1+e^(-(a+b Lower Bid)-(1+e^(-(a+b First Bid))))) ...3

〖PNN〗 _i=1/(1+e^(-(a+b First Bid)-(1+e^(-(a+b Lower Bid))))) 4

where First Bid = Start-up bid value, Lower Bid = Follow-up lower bid value in the case of 'No' to start-up bid value, Higher Bid = Follow-up higher bid value in the case of 'Yes' to start-up bid value. The Chi-square was used to measure the goodness of fit of the model and the significance of the model. The functional form of double-bounded log-likelihood to estimate the probability of a household's willingness to pay for the proposed insurance program is

LDB=iYYilogPYYi+iYNi logPYNi+iYNi logPYNi+iNNi log pNNi 5

where, i = 1,... ... , 240. indicates the response category of individual respondent 'i'.

Mean willingness to pay will be estimated using the formula:

WTP*=a/b 6

The truncated or restricted mean will be calculated by

WTP*=log⁡(1+ea)b 7

The confidence interval can be estimated using the following parameters: the estimated logit model, that is, the estimated parameter vector ˆb, and the estimated variance-covariance matrix, denoted by Vˆ. Random drawings were taken to create a new parameter vector ˆˆb from a multivariate normal distribution with the variance-covariance vector Vˆ and mean ˆb. WTP can be calculated for each drawing of ˆˆb. Using the complete set of replications, an empirical distribution for WTP can be then obtained. A (1– α) confidence interval will be obtained by ranking the vector of calculated WTP values and dropping α/2 values from each tail of the ranked vector.

Premium bid system in insurance of fishery-related assets

Particulars		Initial Bid	Followup lower bid	Followup higher bid	Remarks
1.	Consumable items	A	B	C	The bid value of the premium will be based on the item's utilizable life
2.	Permanent assets	A	B	C	
3.	Life insurance	A	B	C	
4.	Bundle of all	A	B	C	

BOBP is a Regional Fisheries Advisory Body (RFAB) of the countries bordering the Bay of Bengal region. The core objectives of the BOBP-IGO are to increase awareness and knowledge of the needs, benefits and practices of marine fisheries management; enhance skills through training and education; transfer appropriate technologies and techniques for development of the small-scale fisheries; establish regional information networking; and promote women's participation in marine fisheries value chain.

The World Bank helps countries promote strong governance of marine and coastal resources to improve their contribution to sustainable and inclusive economies by supporting sustainable fisheries and aquaculture, making coastlines more resilient, reducing pollution, and developing knowledge and capacity around ocean health.

Nalanda University was established in November 2010. Nalanda University is mandated to be an “international institution for the pursuit of intellectual, philosophical, historical and spiritual studies”. It is premised on the shared intent to rediscover and strengthen “educational co-operation by tapping the East Asia Regions centers of excellence in education and to improve understanding and the appreciation of one another’s heritage and history.

ICAR-Central Marine Fisheries Research Institute is a leading tropical marine fisheries research institute in the world. Important mandate of CMFRI is to Monitor and assess the marine fisheries resources of the Exclusive Economic Zone (EEZ) including the impact of climate and anthropogenic activity and develop sustainable fishery management plans and also Consultancy services; and human resource development through training, education and extension

ICAR-Central Institute of Fisheries Technology is a national centre in India where research in all disciplines relating to fishing and fish processing is undertaken. The organisation carries out Basic and strategic research in fishing and processing and also Design and develop energy efficient fishing systems for responsible fishing and sustainable management.

ICAR-National Institute (formerly Centre) of Agricultural Economics and Policy Research (NIAP) was established by the Indian Council of Agricultural Research (ICAR) in March 1991 to strengthen agricultural economics and policy research in the national agricultural research system. Application of principles of economics in planning and evaluation of agricultural R&D and policy research to promote science-led agricultural and rural development have been the main goals of ICAR-NIAP.

The Global Network for capacity building to increase access of small-scale fisheries to financial services (CAFI SSF) is an FAO initiative endorsed by rural finance stakeholders from Africa, Asia-Pacific, Latin America and the Caribbean. The CAFI SSF Network aims to address this challenge by increasing the capacity of policy makers, financial service providers and fishers’ and fish farmers’ organizations to promote, design and implement appropriate financial services in support of small-scale fisheries and aquaculture.