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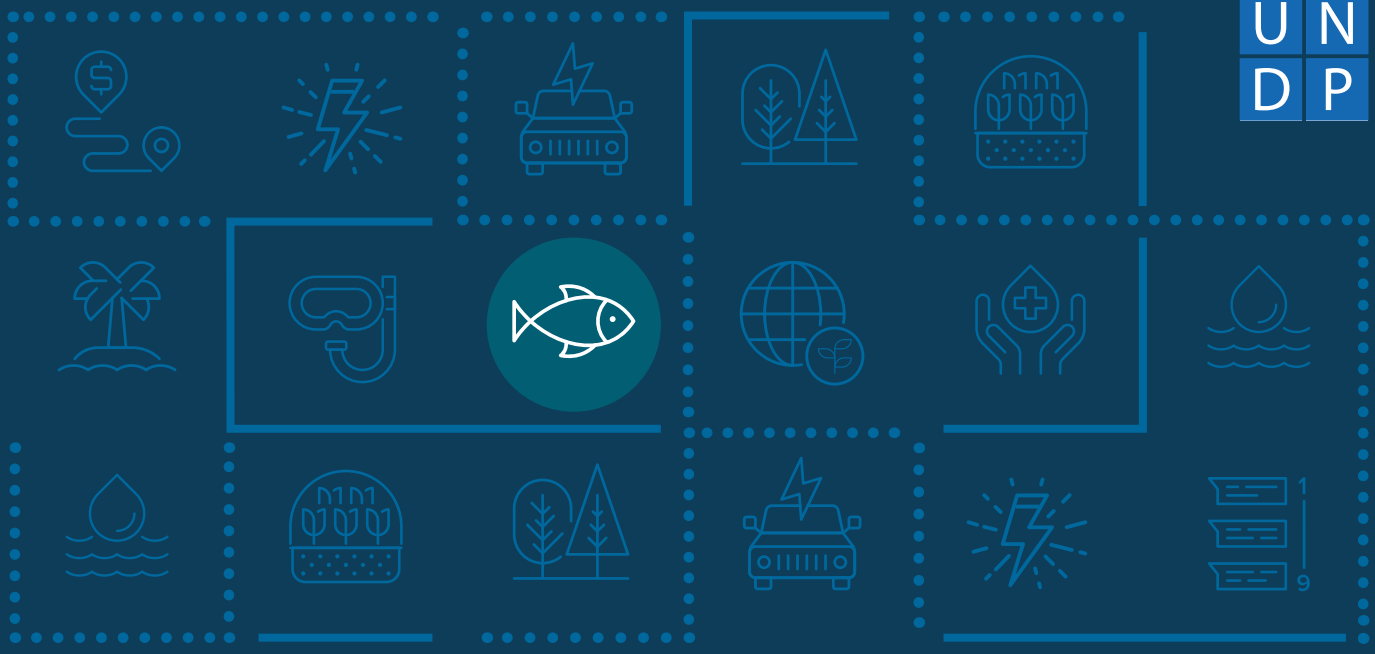

GUIDEBOOK

on the methodology for financial assessments to address climate change

CHAPTER XII: FISHERIES SECTOR

(adaptation to climate change)

2026

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About this publication

This methodology is an update to the first financial assessment methodology, which was released in 2009. The objective of this methodology is to support countries to implement their climate targets and to identify, reallocate, mobilize and manage the required financial resources and to create a fiscal framework conducive for climate action.

The update to this methodology was developed under UNDP's Climate Promise by the *Pledge to Impact* Programme. Delivered in collaboration with a wide variety of partners, the initiative has supported over 120 countries to enhance and implement Nationally Determined Contributions (NDCs) under the Paris Agreement. From Pledge to Impact is generously supported by the governments of Germany, Japan, United Kingdom, Sweden, Belgium, Spain, Iceland, the Netherlands, Portugal and other UNDP core contributors. This programme underpins UNDP's contribution to the NDC Partnership.

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About this Guidebook

As countries identify their national climate change targets—notably through Nationally Determined Contributions (NDCs) under the Paris Agreement—the need exists to break down targets into concrete steps of action, determine a financial framework to implement actions and achieve targets, and identify policy measures to facilitate the necessary changes that support low-emission development and a low-carbon future.

A key component to support this transformation is through assessing national investment flows and financial flows to address climate change. Many countries have used this method to articulate an effective and appropriate national response to climate change.

This Guidebook responds to the needs of countries to have a clear approach to support the implementation of national climate targets in the context of sustainable development that duly accounts for their national circumstances, capacities and resources.

Between 2008 and 2024, 60 investment flow and financial flow assessments were conducted worldwide, with more than 1,000 national stakeholders engaged in the technical and political aspects of the assessments. Since the adoption of the Paris Agreement and the development of NDCs, the methodology has helped countries utilize financial assessments to develop a pathway to NDC implementation.

While this methodology was first developed in 2008, an update has taken place in 2025. This Guidebook is a living document, which will continue to be improved based upon the experiences of those using it. Over the years, the methodology to carry out financial assessments to address climate change has been continually reviewed and updated regarding its user friendliness, feasibility of implementation and sectoral scope. Comments are invited. Please send feedback to Susanne Olbrisch (susanne.olbrisch@undp.org).

For more information, visit https://climatepromise.undp.org/tags/investment-and-financial-flows-assessments.

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List of acronyms and abbreviations

AFSA	Aquatic Sciences and Fisheries Abstracts
BAU	Business-as-usual
BS	Baseline scenario
CBD	Convention on Biological Diversity
CO_2	Carbon dioxide
FDI	Foreign direct investment
FF	Financial Flow
FIN	Fish Info Network
GCF	Green Climate Fund
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gas
IF	Investment Flow
IPCC	Intergovernmental Panel on Climate Change
ISIC	International Standard Industrial Classification
LT-LEDS	Long-term Low-Emission Development Strategy
NAP	National Adaptation Plan
NDC	Nationally Determined Contribution
NGO	Non-governmental organization
O&M	Operation and maintenance
OECD	Organisation for Economic Co-operation and Development
SNA	System of National Accounts
UN FAO	United Nations Food and Agriculture Organization
UN FAO	United Nations Food and Agriculture Organization International
UN FAO ICLARM	United Nations Food and Agriculture Organization International Centre for Living Aquatic Resources Management
UN FAO FIES	United Nations Food and Agriculture Organization Food Insecurity Experience Scale
UNCTAD	UN Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
UNDP	United Nations Development Programme
UK DFID	United Kingdom Department for International Development
UNFCCC	United Nations Framework Convention on Climate Change
V&A	Vulnerability and adaptation
WHO	World Health Organization

Chapters I and II of this guide provide methodology on how to carry out a financial assessment. This chapter provides additional information needed to carry out a financial assessment in the **fisheries sector**. To avoid repetition, some of the information provided in Chapter II that is relevant to all sectors is not included in this chapter. Careful reading of Chapter II before this chapter is highly recommended.

12.1 Introduction

Fisheries (both capture fisheries and aquaculture) play an essential role in global food security. The proportion of fisheries and aquaculture production of aquatic animals used for direct human consumption has increased significantly from 67 percent in the 1960s to about 89 percent in 2020 (that is over 157 million tonnes of the 178 million tonnes of total fisheries and aquaculture production, excluding algae).[1]

The global fisheries sector continues to grow steadily, with production more than doubling since 1990, reaching 179 million tons in 2018. To meet this increasing demand, capture fisheries have grown by 20 percent and aquaculture by 527 percent in the same time period. In 2018 fish exports generated US$164 billion, half of which came from developing countries. With a world population projected to reach 9 billion by 2050, the importance of sustainably harvested fish and seafood in the human diet and in the global economy will only increase. For millions around the world, the fisheries sector, including in-land, coastal and aquaculture fisheries, provides a source of food, jobs, and livelihoods. In 2018, some 60 million people were employed directly in fishing and fish farming across the world.[2]

Moreover, aquaculture is the fastest growing food production industry in the world, growing at a rate almost three times that of terrestrial farmed meat production systems. With its highly diverse cultured species, aquaculture's increasing contribution to global fish supplies and animal protein intake is reducing pressure on wild fisheries in both developing and industrialized countries.

The ecosystems which support fisheries, and fishing-based livelihoods, are subject to climate-related variability, including extreme weather events, floods and drought, changes in aquatic ecosystem structure and increasing sea temperatures.[3] These climate change impacts are changing patterns and abundance of fish stocks and are making the management of the fishing sector more challenging.

Also aquaculture is impacted by climate change through temperature increases, eutrophication, increased acidification, changes in weather patterns and extreme weather events, sea level rise and other physical changes in the sea, water stress and a global decline in ocean productivity.

According to the United Nations Trade and Development (UNCTAD) organization close to 90 percent of the world's marine fish stocks are fully exploited, overexploited or depleted.[4] Furthermore, FAO argues that climate change threatens the sustainability of capture fisheries and aquaculture. As noted above, gradual global warming and associated physical changes are causing major shifts in ocean system productivity and in surface freshwater availability, making adaptation in the fisheries sector more difficult and costlier.[5]

[1] FAO (2022). The State of World Fisheries and Aquaculture 2022. Food and Agriculture Organization of the United Nation: Rome, Italy.
[2] UNIDO (2020). Fisheries Sector. Inclusive and Sustainable Development of the Global Fisheries Sector. Vienna, Austria.
[3] OECD (2024). Climate Change and Fisheries. How to adapt fisheries to climate change? Issue Note. Paris, France.
[4] UNCTAD (2017). "A Man-made Tragedy: The Overexploitation of Fish Stocks". Geneva, Switzerland.
[5] FAO (2009). The State of World Fisheries and Aquaculture 2008. Food and Agriculture Organization of the United Nations: Rome, Italy.

With per capita fish consumption and fish prices expected to climb, opportunities will arise for countries whose regulatory frameworks, management practices and adaptive strategies effectively address the challenges posed by climate change. As such, many countries are turning to blue economy approaches that move away from ocean exploitation and toward stewardship of ocean resources by balancing economic development with environmental protection and social equity.

The scope of the fisheries sector used in this chapter includes the activities listed below, based on FAO definitions[6] and statistical databases. However, the activities that will be selected for a financial assessment in a particular country are entirely country-specific, as discussed below in Section 12.2.

The term 'fisheries' is overarching and includes activities leading to catching, taking and harvesting of fish. It may involve capture of wild fish or raising of fish through aquaculture.

Capture fishery (inland and marine) includes activities to harvest a given fish resource and can be structured by:

- location;
- target resource;
- the technology used;
- the social characteristics (e.g. artisanal, industrial);
- the purpose (e.g. commercial, subsistence, recreational); and
- the season.

Aquaculture (inland and marine) includes the farming of aquatic organisms, such as fish, molluscs, crustaceans, aquatic plants,[7] crocodiles, alligators, turtles and amphibians. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated.

It is also possible to distinguish between capture-based aquaculture, the practice of collecting fish seeds from the wild and subsequently growing them in captivity to marketable size using aquaculture techniques, and hatchery-based aquaculture, which is the practice of producing and using fish seeds from hatcheries through manipulation of adult maturation and reproduction and larval and juvenile rearing.

Depending on the type of water where aquaculture takes place, one can distinguish between the below categories of aquaculture.

- **Freshwater culture:** Cultivation of aquatic organisms raised in freshwater, such as reservoirs, rivers, lakes and canals, in which the salinity does not exceed 0.5 percent.

- **Mariculture:** Cultivation of marine organisms in the sea, in specially constructed rearing facilities, e.g., cages, pens and long-lines. The cultivation takes place in seawater, such as fjords, inshore and open waters and inland seas, in which the salinity exceeds 20 percent.

- **Brackish water culture:** Cultivation of aquatic organisms raised in brackish water, such as estuaries, coves, bays, lagoons and fjords, in which the salinity may fluctuate between 0.5 percent and full-strength seawater.

As in all food production sectors post-harvest activities entail processing, stocking, packaging, transport and post-consumption waste. Processing includes the preparation of fish, including cleaning, cooking, canning, smoking, salting, drying and freezing. Fish processing can take place aboard fishing and fish processing vessels and at fish processing plants.

[6] FAO. 2025. Fisheries Glossary. In: Fisheries and Aquaculture. Food and Agriculture Organization of the United Nations: Rome, Italy.

[7] Aquaculture activities related to aquatic plants are not addressed in this chapter.

12.2 Application of financial assessment methodology to adaptation in the fisheries sector

This section describes how the financial assessment methodology presented in Chapter II would be applied to adaptation in the fisheries sector. Some information provided in Chapter II that is relevant to all sectors is not repeated here, so the reader should refer to Chapter II along with this chapter.

As described in Chapter II, the financial assessment involves a series of steps, which are:

Step 1. Establish key parameters of the assessment.

Step 2. Compile historical IF, FF and O&M cost data (and subsidy cost data if included explicitly) and other input data for scenarios.

Step 3. Define baseline scenario.

Step 4. Identify annual IF, FF and O&M costs (and subsidy costs if included explicitly) for the baseline scenario.

Step 5. Define target scenario.

Step 6. Identify annual IF, FF and O&M costs (and subsidy costs if included explicitly) for the target scenario.

Step 7. Calculate the changes in IF, FF and O&M costs (and in subsidy costs if included explicitly) needed to implement target scenario.

Step 8. Identify policy implications.

Step 1.

Establish key parameters of the assessment.

Define detailed scope of the sector.

In this step it will be determined whether all possible subsectors are to be examined or only certain subsectors, depending on the national target that is being assessed (e.g. NDC, LT-LEDS, other). The subsectors to be included in the financial assessment must be defined, including the specific processes, activities, entities and geographic regions.

The fisheries sector includes recreational, subsistence and commercial fishing and the harvesting and processing. Fish processing of commercial fisheries takes place on fishing vessels, fish processing vessels and at fish processing plants to deliver fish and seafood products for human consumption or as input for industrial processes.

Considerations while scoping the fisheries sector for the assessment include national circumstances, such as current and potential harvests, the main target species for the country, the state of stocks, supply and demand, trade, fishing technology, contribution to the national economy, employment and livelihoods and the potential for sustainable economic growth, as well as their relationship to national and sectoral development plans. The financial assessment should also be scoped depending on data availability, the structure of national government entities in which data reside and the scope of related assessments that have been completed, especially analysis of climate change impacts as part of the national communications, vulnerability assessments, National Adaptation Plans (NAPs) and other studies completed.

A key distinction in the fish-producing sector is between capture fisheries and farming of fish, or aquaculture. Aquaculture is highly diverse, with more than 440 cultured species in different regions, under different management systems and conditions, thus there are multiple impact pathways to consider, both from climate change on the sector and by the sector on the environment.

Manufacturing, marketing and distribution are part of the supply chain by which food products are made available to consumers, which therefore can be included in the detailed scope of the assessment if they are relevant to the fisheries sector in the country. In many countries, the shipbuilding industry is related to the fishing industry and its activities are correlated to the fisheries sector, as well as the food industry. A country may choose to include all or a subset of these subsectors. Some subsectors may be irrelevant in some countries. It is important that the scope does not overlap with other sectors (e.g., water, food security).

Some adaptation measures will result in mitigation benefits in the fisheries sector or in other sectors. The world's marine fishing fleets burn fossil fuels, so reducing fuel subsidies for fishing fleets could promote energy efficiency as well as help reduce overcapitalization in fisheries and diminish social costs. Similarly, using static gear (pots, traps, longlines and gillnets which use less fuel and emit less CO_2) rather than active gear (e.g., trawl nets and seines) may be integrated into both mitigation and adaptation considerations. On the other hand, in aquaculture, sea level rise, saline water intrusion and acidification could impact mollusc culture and reduce its contribution to carbon sequestration. Energy efficiency measures can also be envisaged from harvesting to processing through transportation and marketing.

Specify base year and assessment period.

The most recent year for which historical data is available is recommended as the base year (e.g., 2025). The assessment period should match the time horizon of the target that is being assessed. NDCs often have a time horizon until 2030, LT-LEDS often until 2050. The assessment period should have a considerable length to be sufficiently able to take into account the long lifetimes of infrastructure in the sector.

Identify the target to be assessed and adaptation measures.

The measures to be selected will be determined by the national target that is being assessed (e.g. NDC, LT-LEDS, others). National targets being assessed are often general and visionary and not detailed enough to directly use them for a financial assessment. Therefore, the first step is to break down the overall national target into concrete measures and steps of action that can be used for the financial assessment. Breaking down the national target often includes technical and political considerations, therefore, it is important to do this step in close consultation with national policymakers to ensure their ownership and buy-in of the measures being identified. The selection of options should also consider relevant previous work in the sector, including national and sectoral plans, National Communications, NAPs and National Adaptation Programmes of Action. The selected adaptation options need to be specific and broken down into concrete activities so that investment and financial flows, and O&M costs can be identified in Steps 4 and 6.

Climate change will impact fisheries through a diversity of direct and indirect pathways whose importance will vary depending on the type of ecosystem and fishery, as shown in Table 12.1.

Table 12.1: Examples of potential impact pathways

Type of change	Climatic variable	Impacts	Potential outcomes for fisheries
Physical environment	Ocean acidification	Negative effects on calciferous animals, including slowed rates of coral growth	Declines in production
	Warming upper ocean layers	Poleward shifts in plankton and fished species Changes in timing of phytoplankton blooms Changing zooplankton composition	Changes in production and availability of fished species Potential mismatch between prey (plankton) and predator (fished species) and declines in production
	Sea level rise	Loss of coastal habitats Saline intrusion into freshwater habitats	Reduced production of coastal marine and freshwater systems
	Temperature rise	Less oxygen dissolved in water	Reduction in production and availability of species
Fish stocks	Higher water temperatures	Changes in physiology and sex ratios of fished species Altered timing of spawning, migrations and/or peak abundance Increased invasive species, diseases and algal blooms	Changes in timing and levels of productivity across marine and freshwater systems Reduced production of target species in marine and freshwater systems
	Changes in ocean currents	Effects on fish recruitment	Changes in abundance of juvenile fish and production in marine and fresh water

Table 12.1: Examples of potential impact pathways *(continued)*

Type of change	Climatic variable	Impacts	Potential outcomes for fisheries
Ecosystems	Reduced water flows and increased droughts	Changes in lake water levels and in dry water flows in rivers	Reduced lake and river productivity
	Increased frequency of El Niño and La Niña events	Changes in timing and latitude of upwelling	Changes in pelagic fisheries distribution
	Higher water temperatures	Increased frequency and severity of coral bleaching events Changes in stratification, mixing and nutrients in lakes and marine upwelling	Reduced coral reef fisheries productivity Changes in productivity
Coastal infrastructure and fishing operations	Sea level rise Increased frequency of storms	Coastal profile changes, loss of harbours and homes Increased exposure of coastal areas to storm damage Fewer days at sea, increased risk of accidents Aquaculture installations (coastal ponds, sea cages) at greater risk of damage	Fishing activity less profitable, increased costs (insurance and/or rebuilding), increased vulnerability of coastal households. Reduced viability of fishing and fish-farming as livelihood options; reduced profitability of larger-scale enterprises, increased costs of insurance.
Inland fishing operations and livelihoods	Changing levels of precipitation	Where rainfall decreases, reduced opportunities for farming, fishing and aquaculture as part of rural livelihood systems	Reduced diversity of rural livelihoods; increased risks in agriculture; greater reliance on non-farm income
	More droughts or floods	Damage to productive assets (fishponds, weirs, rice fields, etc.) and homes	Increased vulnerability of riparian and floodplain households and communities
	Less predictable wet/dry seasons	Decreased ability to plan seasonal livelihood activities	

Source: Allison, E.H. *et al.* (2005), modified by Adger *et. al* (2009). Effects of climate change on the sustainability of capture and enhancement fisheries important to the poor. Fisheries Management Science Programme, DFID/ Marine Resources Assessment Group Ltd.

The fishery sector's robustness depends on fishing capacity being commensurate with the productive capacity of the resource during lower productivity phases and the availability of alternative livelihoods during lean periods. For aquaculture, adaptive measures are limited and rely on management approaches, including alternative ingredients, better feed management and reduction of water use (Table 12.2).

Table 12.2: Climate change related impacts and potential adaptation measures in fisheries

Impact on fisheries and aquaculture	Adaptation measures
Capture fisheries – system elements	
Reduced yield	Ecosystem based fisheries management Access higher value markets / shifting of targeted species Explore the availability of alternative fishery resources Investments in flexible technologies and flexible processing chains Reduce costs to increase efficiency Diversify livelihoods Educational and training activities (job requalification) Exit the fishery
Increased variability of yield	Ecosystem based fisheries management Insurance schemes Diversify livelihood portfolio
Change in distribution of fisheries	Ecosystem based fisheries management Migration of fishing effort/strategies and processing/distribution facilities
Reduced profitability	Exit the fishery
Influx of new fishers	Support for existing local management institutions Diversify livelihoods through microcredit Networking civil society
Vulnerability of infrastructure and communities to flooding, sea level and surges	New or improved physical defenses Safer harbours and landings Relocation of facilities Managed retreat/accommodation Disaster risk management, including disaster preparedness Rehabilitation and disaster response Integrated coastal management Early warning systems and education Investment and capacity building on improved forecasting
Increased dangers of fishing	Weather warning system Investment in improved vessel stability/improved safety at sea/communications
Scientific and technological system elements	
Overall impacts	Assess impacts of climate change adverse effects Assess risks of future fish stock variation and likelihood of resource collapse Assess specific cross-sectoral factors which will increase or decrease impacts and adaptation potential
Financial system elements	
Overall impacts	Cluster insurance Emergency funding Pooling of risks Other financial instruments

Table 12.2: Climate change related impacts and potential adaptation measures in fisheries *(continued)*

Impact on fisheries and aquaculture	Adaptation measures
Policy and planning system elements	
Overall impacts	Spread of sector-related risk through contingency plans Relocation allowances Climate-change risk assessments and monitoring Strategy formulation Support initiatives to reduce fishing effort in overexploited fisheries Fiscal incentives Link with disaster management and risk reduction planning Resource allocation long-term planning
Regulatory system elements	
Overall impacts	Changes in legislation and enhancement of tenure and ownership Regulatory tools, including regulations limiting access to resources (i.e., quotas on captured fish)
Governance and institutional system elements	
Overall impacts	Changes in governance and coordination arrangements and institutional mechanisms
Aquaculture – system elements	
Warming	
Raise above optimal range of tolerance of farmed species	Use of better feed More care in handling Selective breeding and genetic improvements (higher temperature tolerance)
Increase in eutrophication and upwelling; mortality of farmed stock	Improve planning and choice of location Establish regular monitoring and emergency procedures
Increase virulence of dormant pathogens and expansion of new diseases	Management to reduce stress set up Biosecurity measures Monitor to reduce health risks Improve treatments Genetic improvements for higher resistance
Limitations on fish meal and fish oil supplies/price	Identify fish meal and fish oil replacement New forms of feed management Genetic improvement for alternative feeds Shift to non-carnivorous species, such as culture bivalves and seaweeds
Sea level rise and other circulation changes	
Intrusion of saltwater	Shift stenohaline species upstream Introduce marine or euryhaline species in old facilities
Reduced catches from coastal fisheries, seed-stock disruptions, reduced aquaculture feeds; income loss to fishers	Make greater use of hatchery seed Protect nursery habitats Develop/use formulated pellet feeds Develop alternative livelihoods for suppliers
Increase of harmful algal blooms	Improve monitoring and early warning systems Change water abstraction points

Table 12.2: Climate change related impacts and potential adaptation measures in fisheries *(continued)*

Impact on fisheries and aquaculture	Adaptation measures
Acidification	
Impact on calcareous shell formation/ deposition	Adapt production and handling techniques Move production zones
Water stress and drought conditions	
Limitations for freshwater abstraction	Improve efficiency of water usage; encourage non-consumptive water use in aquaculture, e.g., culture-based fisheries Encourage development of mariculture where possible
Change in water-retention period (inland systems reduced, coastal lagoons increased)	Use different/faster growing fish species Increase efficacy of water sharing with primary users, e.g., irrigation of rice paddies Change species in lagoons
Reduced availability and period change of wild seed stocks	Shift to artificially propagated seed Improve seed quality and production Efficiency in the use of water
Extreme weather events	
Destruction of facilities; loss of stock and business; mass scale escape with impacts on biodiversity	Encourage uptake of individual /cluster insurance Improve the choice of location and the design to minimize damage, loss and mass escapes Encourage use of indigenous species to minimize impacts on biodiversity, Use non-reproducing stock in farming systems

Source: Modified from FAO (2008). Climate Change for Fisheries and Aquaculture: Technical Document from the expert consultation held on 7 to 9 April, 2008. Food and Agriculture Organization of the United Nation: Rome, Italy. Reference: HLC/08/BAK/6.

Finally, any analysis in the sector should consider the interactions between aquaculture and capture fisheries, e.g. market interactions between aquaculture and fisheries, its impacts on fish prices, rate of technology adoption, share of aquaculture in total fish supply trends, etc. Aquaculture may also help rebuild depleted wild fish stocks, a problem which otherwise is addressed by precautionary fisheries management systems, vessel buy-back programmes, unemployment insurance projects for fishermen and fisheries subsidy reduction plans.

Select analytical approach.

The analytical approaches for a financial assessment in the fisheries sector range from simple spreadsheets to fishery management models identifying interactions between economic and ecological systems (Table 12.3). A combination of approaches, e.g. a bio-economic model supplemented with spreadsheet analyses could also be used. If countries do not have prior experience with a particular model, it is recommended to use spreadsheets to develop the scenarios.

Table 12.3: Examples of fisheries sector analytical tools

Name	Developer	Methodology	Description and website
BioEconomic Analytical Model (BEAM4)	**FAO**	Model	The objective of the is model is to predict yield, value and a series of measures of economic performance as a function of fishery management measures, such as fishing effort control, closed season, closed areas and minimum mesh size regulation. It is a tool for the rational management of exploited living aquatic resources.
FISAT II	**FAO-ICLARM**	Model	Fish stock assessment tools and management options for fisheries, especially in data-sparse, tropical contexts.
FishStat Plus	**FAO FIES**	Tool	Universal software allows users to access fishery statistics of various sorts. Any data having a time series structure can potentially be stored and processed by FishStat Plus.
Ecopath with Ecosim			A free ecological/ecosystem modelling software suite with three main components: Ecopath (a static, mass-balanced snapshot of the system); Ecosim (a time dynamic simulation module for policy exploration); and Ecospace (a spatial and temporal dynamic module primarily designed for exploring impact and placement of protected areas). The model can be used to study the effects of fishing on an ecosystem, evaluate ecosystem recovery after a major disturbance, determine where to locate marine protected areas and model the effects of changing climate.

Step 2.

Compile historical IF, FF, O&M cost data (and subsidy cost data if included explicitly) and other input data for scenarios.

Compile historical annual IF and FF data, disaggregated by investment entity and source.

Countries should collect at least three years of historical investment and financial flows data (i.e., for the base year and two years during the previous decade). Ideally, countries would collect ten years of historical data, i.e., for the base year and the previous nine years.

International forms for national accounts places fisheries into the category “agriculture, hunting, forestry and fishing.” which implies that identifying investments in fisheries alone may be difficult. The most relevant grouping in the System of National Accounts is the classification by economic activity. The economic activity classification recommended by 93 SNA[8] is the United Nation’s International Standard Industrial Classification (ISIC). ISIC is used to classify activity units into industries, in which fishing is included.

[8] International standards for compiling National Accounts statistics were laid out in the System of National Accounts 1993.

Historical data on the fisheries sector, including sector trends (current and potential harvest, state of stocks, supply and demand, trade, fishing technology), as well as investment in the sector (infrastructure, fleet and gear) and financial flows (associated with training and research), will be collected in the country. Such information is generally available through government entities dealing specifically with fisheries (e.g., ministries of agriculture and production), territorial planning bodies, environmental-related bodies and special governmental agencies dealing with development-related statistics. Data may also be found at national statistical agencies and national research institutes specialized in fishing. Studies analyzing investment and operational costs for specific investment decisions, such as vessel acquisition and replacement, may be useful as well.

Additional information can be obtained inter alia from the below sources.

- FAO FishStat is part of the FAO Statistical Database and provides statistics on fish production and primary products.

- FishInfo by FAO provides fisheries and aquaculture technical knowledge and products, including databases, geospatial platforms, software and glossaries.

- Fishery Resources Monitoring System (FIRMS) by FAO provides access to high-quality information on the global monitoring and management of fishery marine resources.

- World Bank statistical information on the fisheries sector provides a database on total fisheries production by country.

- International Institute of Fisheries Economics and Trade of the Oregon State University provides information on marine resource economics, fisheries management, seafood trade and markets throughout the world, including on aquaculture economics and fisheries development.

- **Global information networks on fisheries:**
  - Aquatic Sciences and Fisheries Abstracts (AFSA), an abstracting and indexing service hosted at FAO.
  - FishBase a relational database.
  - Ocean Biogeographic Information System, a global open-access data and information clearing-house on marine biodiversity for science, conservation and sustainable development hosted by UNESCO containing global geo-referenced information on marine species.
  - United Nations Atlas of the Oceans, internet portal with information relevant to the sustainable development of the oceans.

- **Trade information networks:**
  - FISH INFO Network (FIN) consists of seven independent intergovernmental organizations and FAO GLOBEFISH.

After the investment and financial flows information in the fisheries sector has been collected, it should be organized as in Chapter II, Table 2.3: *Template for one year of historical investment and financial flows data*, specifying the amount of investment and financial flows per year, for each kind of investment type, according to the identified policies and measures, plans, actions, programmes and activities.

To facilitate the task, see Table 12.4 which lists different potential investment and financial flows types in the fisheries sector.

Table 12.4: Examples of investment flows and financial flows in the fisheries sector

Year 2025

Types of investment and financial flows	IF (2025 US$)	FF (2025 US$)
Equipment		
Wheelhouse	X	
Environment		
Handling		
Management		
Access higher value markets	X	
Shifting of targeted species		
Exit fisheries		
Technology (aquaculture)		
Harvesting technology		
Feeding technology		
Selective breeding	X	X
Genetic improvement		
Develop and use formulate pellet feeds		
Improve seed quality and production		
Management		
Feed management		
Hatchery seeding		
Fish meal and oil replacement		
Shifting of species alongside sites	X	
Relocation of production sites		
Biosecurity measures		
Water use efficiency		
Monitoring of early warning signals/ emergency procedures		
Develop mariculture options		
Training		
Job diversification		X
Use of new fishing technologies		
Management of aquaculture		
Insurance		
Cluster insurance		X
Pooling of risks		
Financial instruments		
Research		
Forecasting		X
Risk analysis		
Resource monitoring		

Note: X Indicates the likely type of flow.

Compile historical annual O&M cost data, disaggregated by investment entity and funding source.

The number of years for which historical O&M data are collected should be the same as is done for the historical investment and financial flows data (i.e., for three to ten years). Information about the expected lifetimes of the assets in operation during the historical period, and annual fluctuations in O&M costs, also need to be collected. The O&M data that need to be collected may reside in the same locations as investment and financial flows data (e.g., national accounts, ministry records and plans, industry records, statistical agencies, utilities, research institutions). If such data are not available, countries should:

- either: adopt O&M costs from similar assets in other countries and adjust the O&M costs to in-country production and consumption rates;
- or: derive estimates from proportional relationships between O&M costs and total costs, or between O&M costs and capital costs (e.g., 10 percent, 25 percent, or 75 percent), using either standard assumptions about proportional relationships or proportional relationships observed in other countries.

When comparing cost structures of, for instance, selected fleets of different regions, scales and types, the operating costs are typically divided into running, vessel and labour costs. Table 12.5 gives an example of the potential cost structure of O&M in the fisheries sector.

Table 12.5: Example of O&M cost components in a fleet and range of variation in cost structure

Cost items	Description	%
Running costs	Costs of fuel, lubricants, selling fish via auction, preservation and storage of fish, packing materials, harbour dues, bait, salt, ice and food for the crew	29-30
Vessel costs	Vessel insurance, vessel and gear repair, and maintenance expenses	18-24
Labour	Wages and other labor charges (insurance and employers' contributions to pension funds)	22-42
Other costs		5-13
Total O&M costs		**88-96**
Investment flow		4-12

Chapter II, Table 2.4: 'Template for three years of historical O&M cost data for an investment flow in 2023' should be completed with the historical annual O&M cost as identified in Table 12.5.

Compile other input data for scenarios.

Other input data will include socio-economic information, e.g., population and economic growth projections, demand forecasts for products and services, technology development forecasts. Also, development of scenarios will require information about expected future impacts and sector vulnerabilities.

Step 3.

Define baseline scenario.

For the baseline scenario, trends on the evolution of the sector should be defined with the understanding that the historical trends will persist without additional or scaled up measures to adapt to climate change. For example, marine fish stocks will continue to be exploited and due to the impact of climate change there may be a trend of declining capture fisheries and a growth of aquaculture. The overall evolution would most likely show that large-scale, climate-related changes in fisheries will bring either increased economic hardship or missed opportunities.

The baseline scenario should reflect those trends. Any measures that a country already has in place should also be included in the baseline scenario, such as sustainable use regulations, improved standards, management decisions on market approaches or codes of conduct.

Historical data will be needed to project rends. A fisheries sector development plan or investment data may be available in government or private sector sources. Information on tonnes of fish caught or produced per species, tonnes of fish consumed per species, seize and type of fishing fleets, number of fisheries, types of equipment for fish catching, aquaculture technology, etc. can be used to develop the baseline scenario.

Step 4.

Identify annual IF, FF and O&M costs (and subsidy costs if included explicitly) for the baseline scenario.

Identify annual IF and FF for each investment type, disaggregated by investment entity and funding source.

In this step, the IF and FF for each activity identified in the previous step will be identified. For the aspects listed above (e.g., fish production, size of fleet, technology, etc.) the associated investment and financial flows are determined.

The output of this step will be a stream of annual investment flows and/or financial flows for each investment type for the entire assessment period, by investment entity and funding source. These data should be organized as in Chapter II, Table 2.6: 'Baseline scenario: *cumulative* investment and financial flows and O&M' and Table 2.7: 'Baseline scenario: *annual* investment and financial flows and O&M'.

Identify the annual O&M costs for each IF, disaggregated by investment entity and source.

Annual O&M costs for assets purchased during the assessment period, and for assets purchased before the assessment period and that are expected to still be in operation, need to be collected for each activity (i.e. capture, aquaculture, processing, marketing).

Step 5.

Define target scenario.

The target scenario contains the additional and scaled up policies and measures to adapt to climate change based on the national target that is being assessed (e.g., NDC, LT-LEDS, other). Further drivers that shape the fisheries production systems, such as fishing pressure, fuel prices, future changes in trade flows and consumption patterns, are to be taken into account.

The projected climate change may indicate lower output from capture fisheries, implying a need to expand aquaculture in detriment of fisheries.

Step 6.

Identify annual IF, FF, O&M costs (and subsidy costs if included) for the target scenario.

Identify annual IF and FF for ewach investment type, disaggregated by investment entity and funding source.

In this step the IF and FF for each activity identified in the target scenario will be identified. This includes identifying annual IF for the target scenario (facilities, equipment and infrastructure investments), and annual FF for the target scenario (technology, training, insurance and research) for each activity.

Identify annual O&M costs for each IF, disaggregated by investment entity and funding source.

The O&M costs are identified for the target scenario. The output of this step will be a stream of annual O&M costs for each investment type for the entire assessment period, disaggregated by investment entity and source.

The output of this step will be a stream of annual IF, FF and O&M costs for each investment type for the entire assessment period, by investment entity and funding source. These data should be organized as in Chapter II, Table 2.8 ‘Target scenario: *cumulative* investment and financial flows and O&M’ and Table 2.9 ‘Target scenario: *annual* investment and financial flows and O&M’.

Step 7.

Calculate the changes in IF, FF and O&M costs (and in subsidy costs if included explicitly) needed to implement target scenario.

The changes in IF, FF and O&M costs needed to implement the target scenario in the fisheries sector are calculated according to the general methodology in Chapter II, Step 7. The changes in investment and financial flows are obtained by subtracting baseline scenario values from those of the target scenario. The two primary objectives of this step are to determine: 1) how *cumulative* IF, FF and O&M costs would change; and 2) how *annual* IF, FF and O&M costs would change.

If subsidy costs are included explicitly in the assessment, the changes in subsidy costs may be calculated. The accompanying volume on reporting, *Reporting guidelines for financial assessments to address climate change*, contains guidance on how to capture the assessment process and results for policymakers. Excel worksheets are available that can be used to compile and organize information and to perform the calculations.

Step 8.

Identify policy implications.

Step 7 revealed the investment types, investment entities, sources and the timeframes, which need to see the largest shifts and increases in investment and financial flows and O&M to achieve the target scenario in the fisheries sector.

Fishery sector policies and plans will need to be developed with decision makers to induce the relevant entities identified in the assessment to implement the proposed measures and incur the related investment and financial flows. It will be important to also engage relevant stakeholders regarding the regulations and incentives to influence investment decisions. When addressing policy options, social, economic and environmental benefits should be assessed qualitatively.

When developing policies, consider the aspects below.

- Build institutional and legal frameworks that acknowledge climate change impacts and consider them in conjunction with other existing pressures on the sector, such as overfishing and pollution.
- Analyse the long-term trade-offs and conflicts at the national level between fisheries demand and production and domestic supply and international demand to develop effective fisheries policies.
- Identify and quantify the links between the demands generated by human population growth and income level and their effects on natural resources and on capture fisheries and aquaculture.
- Analyse climate change impacts on livelihoods in the fisheries sector, including the exposure and vulnerability of fishery communities and climate change impacts on food access and security.
- Identify and test policies to address demand and supply imbalances at the national level, including incentives, instruments and measures to ensure food security while preserving the environment.

- Use an ecosystem approach for fisheries and aquaculture policy-making and monitor environmental impacts, considering the standards of the code of conduct for responsible fisheries.
- Support initiatives, such as the creation of property rights, and incentive mechanisms to reduce fishing in overexploited fisheries, linked with appropriate financing instruments.
- Eliminate harmful subsidies and perverse incentives, such as subsidizing fishing fleets (through direct funding, cheaper fuel or tax cuts) which allow fisheries to continue over-exploiting fish stocks.
- Strengthen fisheries management policies by providing a comprehensive, long-term view of the dynamics of production and demand for resources.
- Enable fisheries to be properly incorporated into national programmes to model future natural resource demand, demographic trends and climate change evolving scenarios.

United Nations Development Programme
304 East 45th Street, New York, NY 10017

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