FINAL REPORT ON SOURCES OF FISHERIES, AQUACULTURE, SOCIO-ECONOMICS, AND ENVIRONMENTAL RELATED DATA (RESEARCH AND STATISTICS) IN EAST AND SOUTHERN AFRICA

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ACRONYMS

ABES	Africa Blue Economy Strategy
AFRM	African Fisheries Reform Mechanism
AU-IBAR	African Union-InterAfrican Bureau for Animal Resources
AU	African Union
AU-MS	African Union Member States
AUC	African Union Commission
AWFISNET	African Women Fish Processors and Traders Network
CAMFA	Conference of African Ministers of Fisheries and Aquaculture
DREA	Department of Rural Economy and Agriculture
EU	European Union
GDP	Gross Domestic Product
IUU	Illegal, Unreported, and Unregulated fishing
LVBC	Lake Victoria Basin Commission
LVFO	Lake Victoria Fisheries Organization
MDAs	Ministries, Departments and Agencies
NaFIRRI	National Fisheries Resources Research Institute
NEPAD	New Partnership for Africa's Development
PFRS	Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa
RECs	Regional Economic Communities
RFBs	Regional Fisheries Bodies
RSCs	Regional Seas Conventions
SAP-FL	Special Action Program to Combat Forced Labour
SARNISSA	Sustainable Aquaculture Research Networks in sub–Saharan Africa
ToR	Terms of Reference
WBC	Water Basin Commission

EXECUTIVE SUMMARY

Freshwater and marine aquatic ecosystems contribute to economic growth, national GDPs, livelihood sustenance, food security, and poverty alleviation in the five regions of the African continent. However, a key challenge of the sector includes inadequate governance at national and regional levels associated with insufficient data for evidence-based decision-making. Thus, there was a need for the development of appropriate mechanisms for access to quality information products on African fisheries and aquaculture by the African Union (AU) stakeholders.

To address this gap, the African Union Inter-African Bureau for Animal Resources (AU-IBAR) in collaboration with the African Union Development Agency (AUDA-NEPAD), contracted the National Fisheries Resources Research Institute (NaFIRRI) to "*commission studies on identification of sources of fisheries, aquaculture, socio-economics and environmental related data (research and statistics) in the East and Southern Regions of Africa*''. The major expected output from this assignment was a comprehensive technical report on the sources of fisheries, aquaculture, socio-economics, and environmental related data (research and statistics) in East and Southern Africa regions as well as mechanisms for regular updating.

NaFIRRI undertook an extensive review of AU policies and strategies, identified relevant data sources and gaps, and developed mechanisms for access, use, sharing, and updating. Four major approaches for improved fisheries and aquaculture management identified included the ecosystem Approach, Transboundary, Blue economy, the Nile Basin Initiative, and Marine and Lacustrine Protected areas. The key data sources were in country Ministries, Departments, and Agencies (MDAs) responsible for fisheries and aquaculture management and development, research institutions, the Food and Agricultural Organisation (FAO) of the United Nations, the World Bank, and World fish centre. These datasets mainly included annual fish catches, fishing efforts, aquaculture production, imports and export records, and occasionally recreational fishing. The key gaps identified included limited socioeconomic and environmental data from the AU-MS and data gaps in the trend in data availability. In addition, online access to the available data was mainly difficult for Zimbabwe. These should be improved by the development of standardized regional databases, mobilization of scientists and stakeholders into regional working groups, development and adoption of customized online electronic data collection infrastructure, strengthening partnerships and collaboration, organizing periodic regional, continental, and international symposia, and capacity building for resource users. In conclusion, regular data collection and updates in the fisheries, and environment, at national and

regional levels in Africa will be successful once there are harmonised strategies and tools for all the African Union Member States.

1. INTRODUCTION

1.1 Background

The African continent has productive aquatic ecosystems, both marine and freshwater, that support significant fisheries and aquaculture activities (**Figure 1**). Currently, the fisheries and aquaculture sector contributes to economic growth, livelihoods, and food security. The sector has enormous potential to significantly increase its contribution to Gross Domestic Product (GDP), food security, and poverty alleviation in the 5 regions of the continent.

The African Union Inter-African Bureau for Animal Resources (AU-IBAR), a specialised technical office of the Department of Rural Economy and Agriculture (DREA) of the African Union Commission (AUC), has coordinated and supported the utilisation of livestock, fisheries, aquaculture, and wildlife as resources for both human wellbeing and sustainable economic development in the AU-MS.

Between 2014 and 2018, AU-IBAR implemented its first fisheries and aquaculture continent-wide intervention through the EU-funded project "*Strengthening institutional capacity to enhance governance of the fisheries sector in Africa*, commonly called **Fisheries Governance Project** (**FishGov 1**). This project aimed at addressing the following challenges: poor coordination among stakeholders, lack of coherence in governance instruments and approaches, increased incidences of Illegal, Unreported, and Unregulated (IUU) fishing associated with insufficient capacity in the African Union Member States (AU-MS), weak evidence to foster reform, weak capacity and poor infrastructure and lack of inclusive governance.

There was a follow-up phase (2021-2025) "*Enhancing sustainable fisheries management and aquaculture development in Africa: A program for accelerated reform of the sector*" (**FishGov 2**), that aimed at achieving the AU Agenda 2063 objectives of food security, livelihoods, and wealth creation. Its specific objectives were to ensure that:

i) AU decisions on sustainable fisheries and aquaculture policies are evidence-based;
ii) Fisheries and aquaculture policies in Africa are coherent with the PFRS and other AU priorities and coordinated at all levels; and,
iii) There is effective and adequate representation of Africa in international fisheries and aquaculture fora and able to domesticate relevant global instruments.

This AU-IBAR intervention is guided by the Policy Framework Reform Strategy (PFRS) for fisheries and aquaculture in Africa, which aims at improving governance of the sector for increased sustainable contribution to food security, livelihoods, and wealth creation.

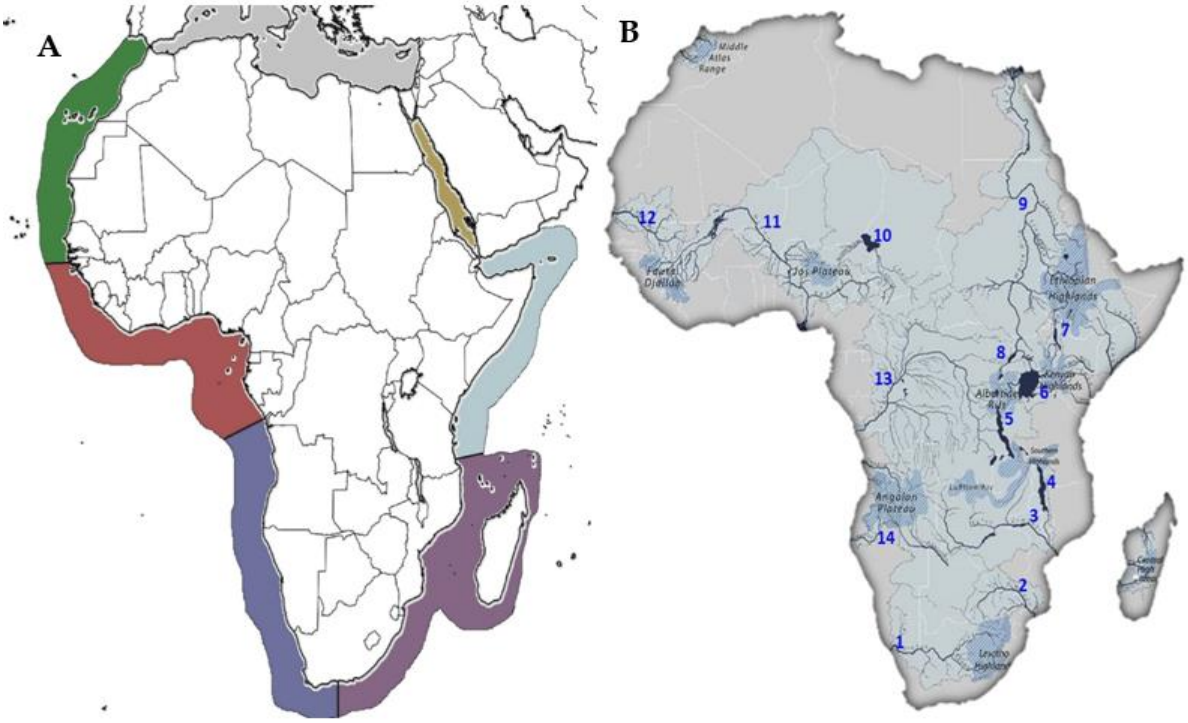

*Figure 1: Map of Africa showing, A: Large Marine Ecosystems (Blue area Benguela Current LME, Red area Guinea Current LME, Green area Canary Current LME, Grey area Mediterranean LME, Orange area Red sea LME, Light Blue area Somali Current LME, Purple area Agulhas Current LME), and **B**: Major freshwater ecosystems (lakes and rivers) (1= R. Orange; 2= R. Limpopo.; 3= R. Zambezi; 4= L. Malawi;5=L. Tanganyika; 6= L. Victoria; 7=L. Rudolph; 8=L. Albert; 9=R. Nile.; 10=L. Chad; 11= R. Niger.; 12= R. Senegal R.; 13= R. Congo; and 14= R. Okavango). Source: AU-IBAR, 2021*

1.2 Status of the Fisheries and Aquaculture sub-sector in the AU-MS

Ministries, Departments, and Agencies (MDAs) undertake the management and development of fisheries and aquaculture within the AU-MS, in collaboration with research institutions and other private organisations that are responsible for the provision of scientific data. However, several challenges impede the sustainable development of the fisheries and aquaculture sector in Africa. These include; inadequacy of data and scientific knowledge on the state of the resources for optimum exploitation and utilisation, over-exploitation, pollution, habitat degradation, and climate variability and change, consequently leading to loss of aquatic biodiversity and resource depletion. On one hand, data sources from aquaculture are inadequate with gaps or poorly reported by institutions managing aquaculture production. The traditional management arrangements have largely focused on increasing fish production and revenue generation while ignoring the overall environmental sustainability, livelihoods, and social welfare of fishing communities. When properly

and effectively managed, these aquatic resources have the potential to support sustainable socio-economic development and the cultural heritage of African countries. Therefore, governance of the fisheries and aquaculture sector must give due consideration to the collection and analysis of quality data to ensure sustainable socio-economic development, environmental protection, and increased aquaculture production, with emphasis on climate change, environmental protection and ecosystem restoration and strengthening linkages between key stakeholders for collective fisheries and aquaculture management.

1.3 Justification

Sustainable fisheries and aquaculture management and development require evidence-based approaches and strategies to ensure coherent interventions. The FishGov 2 project highlighted key challenges that included inadequate governance at national and regional levels for the management of fisheries due to insufficient data for evidence-based decision-making. Therefore, the project recommended the development of appropriate mechanisms for access to quality knowledge products on African fisheries and aquaculture. Thus, the current project focuses on providing a platform to support and facilitate the collection, collation, centralization, and dissemination of fisheries, aquaculture, environmental, and socio-economics related data and information within AU institutions and to establish a mechanism for regular updates.

1.4 Objectives and expected results

The overall objective is to ensure that AU stakeholders have access to quality information products on African fisheries and aquaculture.

The specific objectives of the consultancy are to:

i) Identify sources of fisheries, aquaculture, socio-economics, and environmental related data (research and statistics) in East and Southern Africa and establish a mechanism for regular updating.
ii) Undertake studies to advance an interdisciplinary approach in fisheries management to improve fisheries strategies and programmatic investments.

These objectives are addressed in the following result areas;

Result 1: Identify sources of fisheries, aquaculture, socio-economics, and environmental related data (research and statistics) from relevant institutions AU-MS and establish a mechanism for regular updating.

Result 2: Identify capacity and gaps in fisheries and aquaculture biostatistics, Socioeconomics, environmental data, data collection methods, and their utilization for coherent fisheries and aquaculture development.
Result 3: Develop proposals to enhance the interdisciplinary approach in fisheries management.
Result 4: Support regional training activities in database utilization, inputting, retrieval, and dissemination.
Result 5: Production of advocacy and position papers including the Africa Fisheries and Aquaculture report as well as enabling their dissemination.

1.5 Scope of the consultancy

The study focused on identifying quality sources of data in fisheries, aquaculture, socio-economics, and the environment. The study identified the gaps in data collection approaches or methods and how best they could be utilised in fisheries and aquaculture development. Included also are suggested mechanisms for regular data update, capacity building, developing proposals for interdisciplinary approaches in management as well as advocacy and dissemination strategies for quality data collection and utilisation in fisheries and aquaculture management.

The study covered the AU-MS in Eastern and Southern Africa in liaison with relevant regional institutions including Regional Economic Communities (RECs), and Regional Fisheries Bodies (RFBs). The countries covered in Eastern Africa included: Comoros, Djibouti, Eritrea, Ethiopia, Kenya, Madagascar, Mauritius, Rwanda, Seychelles, Somalia, South Sudan, Tanzania, and Uganda while those in the South comprised: Angola, Botswana, Eswatini, Lesotho, Malawi, Mozambique, Namibia, South Africa Zambia, and Zimbabwe. The consultancy targeted national authorities and institutions involved in fisheries and aquaculture data management as well as other indicated disciplines including biology, ecology, technology, legal, economics, and social sciences in East and Southern Africa.

2. IMPLEMENTATION APPROACH AND DESIGN

2.1 Inception briefing

Upon being awarded the consultancy, NaFIRRI organized an online inception briefing with AU-IBAR staff. The meeting led to a comprehensive understanding of the assignment by NaFIRRI, aligning expectations and enabling AU-IBAR to provide clarity on any outstanding issues.

2.2 Reviewing relevant AU policies and strategies

Extensive efforts were dedicated to familiarising with AU policy instruments and strategies relevant to the assignment. This entailed thorough literature searches and reviewing of AU policies and development strategies such as the Pan-African Strategy on Fisheries and Aquaculture Data Management; the Technical Guide to Harmonized Fisheries Data Collection, Management and Analysis for the African Union; the Policy Framework Reform Strategy (PFRS); and the African Fisheries Reform Mechanism (AFRM) and the African Blue Economy Strategy (ABES).

The aim was to identify and define the nature of data and information requirements crucial for policy formulation and decision-making. Furthermore, selected reports encompassing those from the implementation of FishGov 1 and other relevant institutions were scrutinised with a focus on fisheries, aquaculture, socio-economics, and climate/environmental data (research and statistics). This evaluation assessed the alignment of specific objectives with the needs of the intended beneficiaries.

2.3 Identifying data sources from relevant regional and national institutions in AU-Member States and establishing a mechanism for regular update

Various approaches were used to identify data sources, starting with the definition of variables corresponding to thematic areas necessitating data, including fisheries, aquaculture, socio-economics, climate, and environmental factors. These variables, such as catch per unit effort (CPUE), annual fish catches, fishing effort or capacity (e.g., number of canoes and industrial fishing vessels), and annual fish exports from capture and aquaculture, provided a framework for objective engagement with potential data source institutions. They were categorised based on fishing effort, delineating industrial fisheries, artisanal fisheries (both marine and inland), aquaculture, export data, socio-economics, and environmental data. Information sought for each variable encompassed data description, units of measure, spatial and temporal coverage, disaggregation, compilation practices, computation or derivation methods, data accessibility and availability, and frequency production.

A comprehensive data holder assessment was conducted through extensive searches and a self-administered survey targeting institutions within and outside the region, considered potential data holders or sources. Stakeholder engagement occurred at various stages of the assignment, involving the issuance of questionnaires, interviews, and continent-wide stakeholder consultative meetings/workshops to obtain details about the data held. In addition, a desk review of literature and case studies was conducted to identify online data sources, including online databases. This involved the identification and digitization of major published documents and reports containing substantial data related to the aforementioned aspects. To enhance the continued relevance of identified data sources, a mechanism for regular updates was proposed.

2.4 Identifying gaps in data availability, data collection, storage, retrieval, and dissemination in fisheries, aquaculture, socio-economics, and environmental data

Leveraging on the data sources outlined in **Section 2.3**, NaFIRRI undertook an analysis of the capabilities and deficiencies in fisheries, socioeconomics, aquaculture, and environmental data. The assessment further enabled the evaluation of collection methods and their application for fisheries management and aquaculture development. The identified gaps relating to the presented variables in **Section 2.3** were established prior to consultations, thereby highlighting spatial and temporal knowledge gaps. Recommendations were formulated to address the identified gaps or to mitigate challenges associated with them.

2.5 Reviewing existing relevant regional, continental, and global databases and data collection, retrieval, and dissemination systems

NaFIRRI conducted a comprehensive review of pertinent regional, continental, and global databases, along with data collection, retrieval, and dissemination systems. The aim was to identify potential sources and dissemination mechanisms of fisheries and aquaculture data at a regional, continental, and global level to guide on appropriate utilisation in data management for fisheries management and aquaculture.

2.6 Developing proposals for a multidisciplinary approach to enhance fisheries strategies and programmatic investments.

NaFIRRI undertook a thorough review of existing literature on fisheries management aimed at enhancing fisheries management strategies and programmatic investments. This review encompassed interdisciplinary approaches across different fields, including biology, ecology, technology, legal, and socio-economics. Proposals were then formulated to strengthen the interdisciplinary approach in fisheries management.

2.7 Conducting an inventory of current and historical data on integrated fisheries surveys at regional and national levels

Using the data sources identified at both regional and national levels, as well as reviewed reports focussing on fisheries, aquaculture, socio-economics, and climate/environmental related data, an extensive inventory of current and historical data on integrated fisheries surveys for stock assessments and environmental data was conducted.

2.8 Elaborating the utilisation of data to enhance knowledge and governance of the sector

Recommendations were put forward to create non-expert dissemination packages derived from the data generated from this study. These dissemination materials included posters, position papers, brochures, and factsheets, which highlight key aspects of advocacy and address capacity development needs, fostering action and enhancing governance within the sector. The knowledge products generated were made available for online sharing and in printed forms at different events for physical dissemination. Additionally, opportunities leveraging compiled data sources to improve the Africa Fisheries and Aquaculture report were explored. Support for regional training workshops on database utilisation, inputting, retrieval, and dissemination was provided for major databases, in collaboration with AU-IBAR.

2.9 Data analysis and report writing

Thematic content analysis was used to analyse qualitative data sourced from literature reviews and consultations on fisheries data and statistics in East and Southern Africa. For quantitative data, including quantity of catch, effort, and value inputs, statistical methods such as determining means, frequencies, summations, and establishing relevant relationships were applied. The findings were used to draw conclusions and generate relevant research reports. Additionally, they informed the composition of reports focussing on fisheries, aquaculture, socio-economics, and environmental information derived from the research and statistics in that field.

3. RELEVANT AU POLICY INSTRUMENTS AND STRATEGIES

Extensive literature searches were performed by reviewing the relevant AU instruments and strategies on Fisheries and Aquaculture. The strategies and policies reviewed included; the Pan-African Strategy on Fisheries and Aquaculture Data Management; the Technical Guide to Harmonized Fisheries Data Collection, Management and Analysis for the African Union; the Policy Framework Reform Strategy (PFRS), the African Fisheries Reform Mechanism (AFRM) and the Africa Blue Economy Strategy.

3.1 Pan-African Strategy on Fisheries and Aquaculture Data Management; the Technical Guide to Harmonized Fisheries Data Collection, Management and Analysis for the African Union

The Pan-African Strategy aimed at establishing, revising, and improving national data collection systems in several African countries. This arises from the fact that the fisheries and aquaculture sector in several countries does not receive adequate support from policy makers and financial institutions due to poor collection, packaging, and dissemination of fisheries and aquaculture production and socio-economic data. Therefore, there is a need to address institutional and production challenges, for the private sector to seize market and investment opportunities to foster increased sectoral growth (AU-IBAR, 2016). Hence, the AU-MS need to develop a common strategy for data collection and analysis by reviewing the current methodologies to form a central data collection hub under the AU-IBAR, updated regularly with data from national and regional fisheries institutions. This will enable the AU-IBAR to:

i) incorporate national fisheries and aquaculture data collection, analysis, and dissemination into the NSS and NSDS;
ii) Update the statistical legal and regulatory framework;
iii) Strengthen the role of fisheries and aquaculture extension services in data collection;
iv) Assess and prioritize information user needs in data collection, packaging, and dissemination;
v) Enhance the statistical infrastructure, including human capacity development and strengthening institutions;
vi) Develop appropriate curricula on fisheries and aquaculture data collection and statistics, and establish national or regional training centers to develop capacity for all stakeholders in data collection;

vii) Develop archiving and disseminating tools which should include reporting channels system from national to regional, and continental to international institutions;
viii) Promote the use of modern technology in data collection, analysis, and dissemination - including GIS, Personal Digital Assistants, and mobile applications;
ix) Foster coordination, collaboration, and partnerships among stakeholders.

3.2 AU Policy Framework and Reform Strategy for fisheries and aquaculture in Africa (PFRS)

The Policy Framework and Reform Strategy (PFRS) is the blueprint for fisheries and aquaculture in the AU-MS envisioned to cause Accelerated Agricultural Growth and Transformation for shared prosperity and improved livelihoods in Africa. The PFRS is aimed at creating an enabling and conducive policy environment for the sector to create equitable social-economic development in Africa. It provides a paradigm shift in the management of the sector with an emphasis on productivity, profitability, sustainability, and participation in the governance of the sector. Specifically, the PFRS:

i) Elaborates and makes explicit guiding principles for good governance of Africa's fisheries and aquaculture for increased coherence and coordination of the sector.
ii) Assists AU Member States, RECs, and RFBs to develop realistic fisheries and aquaculture policies;
iii) Helps facilitate regional collaboration and integration in shared fisheries and aquaculture resources;
iv) Provides appropriate guidance on how to implement reforms for fisheries and aquaculture development.

The PFRS comprises seven policy arenas including; Conservation and Sustainable Resource Use, Small-scale Fisheries Development, Sustainable Aquaculture Development, Responsible and Equitable Fish Trade and Marketing, Strengthened Regional and Sub-regional Cooperation, Awareness enhancement and Human Capacity Development, High Seas Fisheries (**Figure 2)**. Furthermore, it considers crosscutting issues such as Strengthening Resilience and Reducing Vulnerabilities to Climate Change, Gender and Youth, Private Sector Investment, and Financing Mechanisms.

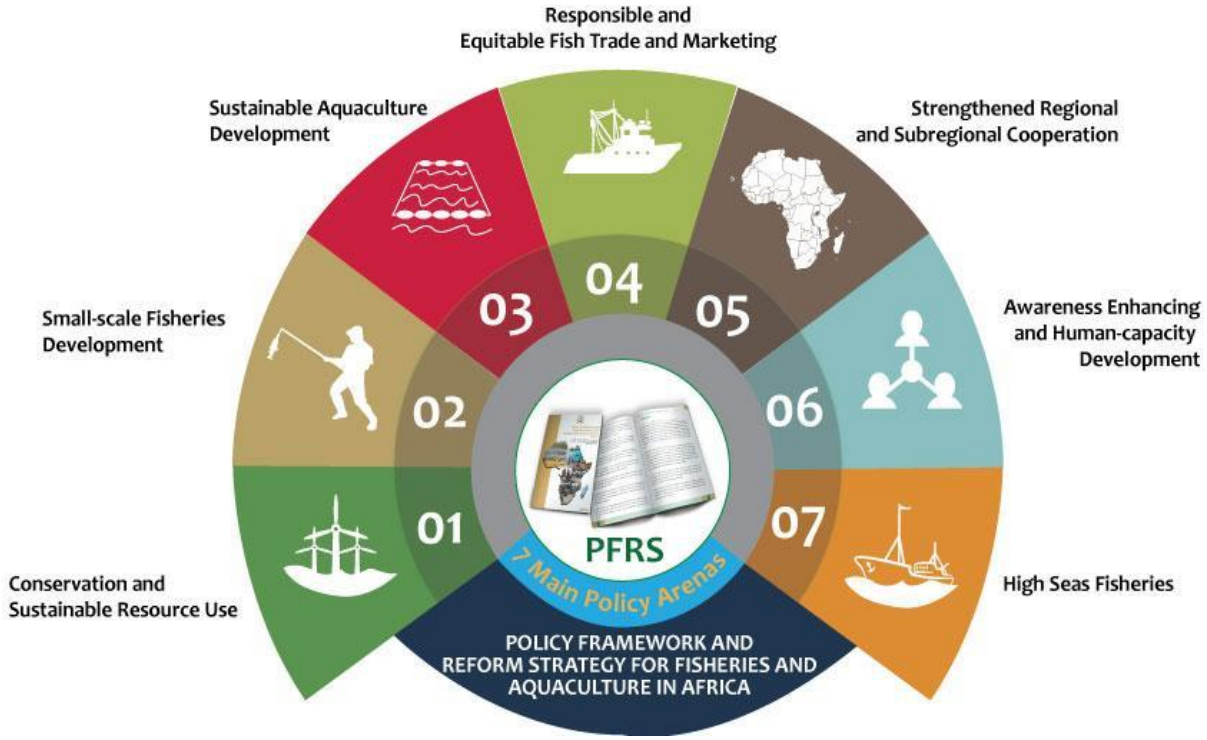

Figure 2: Policy Arenas in the Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa. (Adopted from World Organisation for Animal Health, 2023).

3.3 African Fisheries Reform Mechanism (AFRM)

This continental partnership coordination mechanism was established with the primary aim of facilitating coordination and coherence in the governance of the fisheries and aquaculture sector. The overarching objective of AFRM is to strengthen governance, and coherence, minimize duplication, and improve progress in the development of African Fisheries. It provides for coordination, information sharing, knowledge generation, advocacy for investment, promotion of partnerships, evidence-based policy formulation, resource mobilization for fisheries and aquaculture development in Africa, promotion of mainstreaming of the sector in the AU policy process, and strengthening the position of African fisheries and aquaculture in regional and global fora.

The AFRM has four Working Groups (*i.e.*, Policy, Governance and Institutions, Sustainable Aquaculture Development, Trade, and Enterprise Development, and Small-scale Fisheries Development) that identify key issues from the generated fisheries and aquaculture data and provide technical support to Think Tank (**Figure 3**). The Think Tank is an Executive Committee that directs, manages, and ensures policy recommendations and syntheses are provided to the Advisory Council (AC). The AC

submits the policy recommendations to the AUC which informs the Sectoral Committee on Fisheries and Aquaculture (CAMFA)

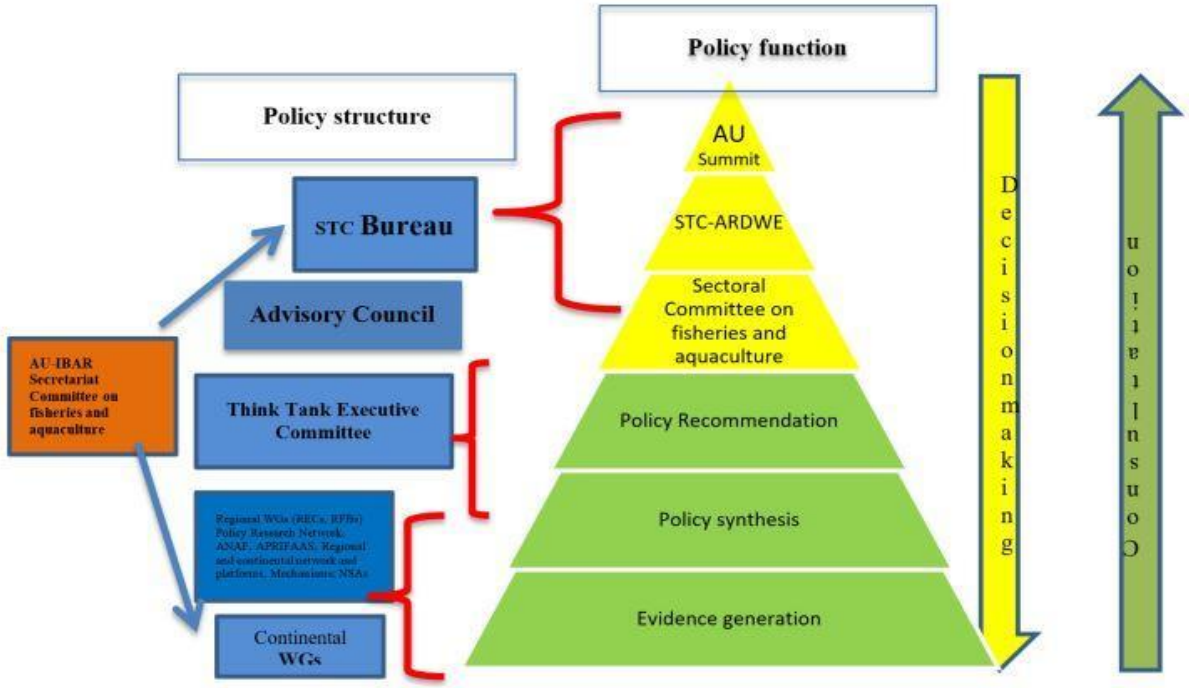

Figure 3: The African Fisheries Reform Mechanism. (Modified from NEPAD, 2014).

3.4 Africa Blue Economy Strategy (ABES)

The objective of ABES is to guide the development of an inclusive and sustainable blue economy that significantly contributes to continental transformation and growth, through advancing knowledge on marine and aquatic biotechnology, environmental sustainability, marine ecosystem utilization, conservation and carbon sequestration, growth of an Africa-wide shipping industry, development of sea, river and blue transport, management of fishing activities, and exploitation and beneficiation of deep-sea mineral and other marine resources. The ABES is based on five thematic technical areas:

i) Fisheries, aquaculture, conservation, and sustainable aquatic ecosystems.
ii) Shipping/transportation, trade, ports, maritime security, safety, and enforcement.
iii) Coastal and maritime tourism, climate change, resilience, environment, infrastructure.
iv) Sustainable energy and mineral resources and innovative industries.
v) Policies, institutional and governance, employment, job creation and poverty eradication, and innovative financing.

However, despite the benefits of ABES such as enhancing increased visibility of the Blue Economy, there is inadequate data and information on Blue Economy, which leads

to inefficiencies in policies, plans, and strategies to encourage participation in the Blue Economy Development Agenda.

4.0 DATA SOURCES AND MECHANISM FOR THEIR REGULAR UPDATE

Planning, development, and sustainable management of the fisheries and aquaculture resources depend heavily on timely and accurate data. Nonetheless, there is a dearth of readily available data and, in most cases, out-of-date, and not easily accessible to policy makers for informed decision-making. In some instances, the available data is poorly packaged and cannot be effectively utilised by the end users. Therefore, to identify gaps and provide recommendations for improving data collection, accessibility, and regular updating, we reviewed the types, and sources of fisheries, aquaculture, environment, and socioeconomic data.

4.1 Inventory of current and historical data on integrated fisheries resources at regional and national levels

Four common forms of fisheries resource data were identified by the inventory of current and historical data in Eastern and Southern Africa. The national fisheries and aquaculture research institutions, MDA, and regional RFBS are the primary hosts of this data. The common types of data are detailed in **Table 1** and they include;

i) Fish production (catch, catch per unit effort (CPUE) and economic revenue, fish biomass and distributions, fishing effort),
ii) Aquaculture production by species, and fish export.
iii) Water environment,
iv) Socioeconomic.

Table 1: Summary of an inventory of current and historical data on integrated fisheries resources at national and regional levels. Note: LVFO = Lake Victoria Fisheries Organisation, KMFRI = Kenya Marine and Freshwater Research Institute, TAFIRI = Tanzania Fisheries Research Institute, FAO = Food and Agricultural Organization of the United Nations.

Region	Country	Data type	Collection methods	Host institutions	Time series	Period
Eastern Africa	Uganda, Kenya, Tanzania	Commercial catch data (harvesting gears, catch by species, CPUE, economic value, consumption)	Catch Assessment Surveys (CASs)	LVFO, KMFRI, TAFIRI, NaFIRRI	Yes	2005-2021
	Uganda, Kenya, Tanzania	Fishing effort (boats, gears, fishers, facilities and infrastructure)	Frame Surveys (FSs)	LVFO, KMFRI, TAFIRI, NaFIRRI	Yes	2000-2020
	Uganda, Kenya, Tanzania	Species composition, abundance, distribution, biomass, water quality,	Hydroacoustic Surveys	LVFO, KMFRI, TAFIRI, NaFIRRI	Yes	1999-2022
	Uganda	Fish species occurrence, Catch, CPUE, biomass, fish	All	NaFIRRI, https://freshwaterbiod	Yes	1999-2023

Region	Country	Data type	Collection methods	Host institutions	Time series	Period
		occurrences, National Redlist of fishes, Water quality indicators		iversity.go.ug/		
	Somalia	Annual fish catches	CASs	Ministry of Livestock and Fishery development	No	2019
	Seychelles	Annual fish catches, fish value, fishing effort	CASs, FSs	Seychelles Fishing Authority	Yes	2021-2022
	Mauritius	Annual fish catches, fish value, fishing effort	CASs, FSs	Ministry of Blue Economy, Marine Resources, Fisheries and Shipping	No	2022
Southern Africa	South Africa	Annual fish catches, allowable catch, bycatch, fish value	CASs	International Commission for the Conservation of Atlantic Tunas (ICCAT)	Yes	2019
	South Africa	Fishing effort (boats, gears, fishers)	FSs	International Commission for the Conservation of Atlantic Tunas (ICCAT)	Yes	2019
	Namibia	Annual fish catches	CASs	FAO fishery country profile, Republic of Namibia; Ministry of Fisheries and Marine Resources		2021
	Madagascar	Annual fish catches, Length frequency data, fish mortalities	CAS, Biometric - Biological	https://www.fao.org/fishery/en/countrysector/naso_madagascar	No	1980- 2023
	Lesotho	Annual fish catches	CASs	https://www.ceicdata.com/en/lesotho/agricultural-production-and-consumptionand https://www.lndc.org.ls/content/aquaculture	Yes	Annually
	Botswana	Annual fish catches	CASs	National statistical bureau of Botswana	Yes	2018
	Zimbabwe	Annual fish catches	CASs	Zimbabwe Parks and Wildlife Management Authority (ZPWMA)	Yes	2002
	Mozambique	Annual fish catches, fish value, fishing effort	CASs, FSs	Mozambique Ministry of Sea, Inland Waters, and Fisheries	No	2017
	Zambia	Annual fish catches, fish value, fishing effort	CASs, FSs	Ministry of Fisheries and Livestock	No	2017

4.2 Identification of existing time series data and sources in fisheries, aquaculture, socioeconomic, and climate/ environmental related data

The bulk of the data that is currently available lacks trends. Socioeconomic and climate/environmental data are generally absent. However, records of capture fisheries

and aquaculture production in both the Southern African and Eastern African regions date back to the 1960s.

4.2.1 Southern African region

Records of capture fisheries and aquaculture production from South Africa and Botswana show that the sector has increased over time (**Figure 4 and 5**). There is however need, to promote sustainable utilization of these resources to avoid over-exploitation.

4.2.1.1 Botswana

The majority of the available data and information in Botswana is largely for aquaculture and freshwater production. Other datasets include the export and import volumes, number of fish farms and farmers, and quantity of fish produced. These records can be retrieved from the Department of Animal Production, Aquaculture division, Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA), and the National Statistical Bureau of Botswana fisheries (www.statsbots.org.bw).

4.2.1.2 Lesotho

Data types and information in Lesotho were mainly freshwater capture fisheries production including fish catch, catches per unit area, catch per household; fish consumption, fishing season, and import data. In addition, there is available data on Lesothos's national development indicators collected by the World Bank and FAO. The available data on aquaculture production between 1974 and 2015 from Global Economic Data Indicators, Charts and Forecasts (CEIC) (https://www.ceicdata.com/en).

4.2.1.3 Namibia

In Namibia, data exists on capture fisheries production, human consumption, and the proportion of fish for animal feeds. Additional information on marine fisheries, exports, marketing of fish and fish products, aquaculture and marine culture methods, type of fish cultured, and the culturing method are available from the Ministry of Fisheries and Marine Resources, FAO, and Directorate of Aquaculture.

4.2.1.4 South Africa

In South Africa, data is available on marine catches and effort, total production, freshwater and marine aquaculture, and employment. Additional information is on small inshore trawl, GDP Production, trade, marine imports and exports, value of fisheries imports and exports. This data was available from the International Commission for the Conservation of Atlantic Tunas (ICCAT), FAO reports on national

indicators and Ocean (Marine Fisheries), World Bank and Statistics South Africa (Republic of South Africa).

4.2.1.5 Eswatini

In Eswatini, the available data is on annual production imports and exports of fish, pollution levels, solid waste management, and sport fishing of mainly Largemouth bass (*Micropterus salmaides*), Rainbow trout (*Salmo giardeneri*) and Tiger fish (*Hydrocynus vittatus*) (FAO, 2008). These data are accessible from FAO and the National biodiversity strategy and action plan of Eswatini.

4.2.1.6 Zambia

Data sources for the Zambia fisheries include fish catches, fishing effort, fish consumption, contribution to the GDP, fish species composition, exports and imports, aquaculture production, and recreational fisheries. This data is available from the Ministry of Fisheries and Livestock, Zambia Aquaculture freshwater centre, Zambia Ministry of Trade and Commerce, Zambia Sport Fishing Association (ZSFA), and FAO reports on capture fisheries, aquaculture.

4.2.1.7 Zimbabwe

In Zimbabwe, the available data was freshwater annual catches from the Zimbabwe Parks and Wildlife Management Authority (ZPWMA), however, this data was not accessible online.

4.2.1.8 Mozambique

In Mozambique, available data is mainly on marine catches and from aquaculture. The data is available from the Mozambique Ministry of Sea, Department of Fisheries; Department of Aquaculture; and World fish Centre.

4.2.2 Eastern Africa region

The data types for this region included the inland and marine capture fisheries, aquaculture production, fish imports and exports, and environmental data (**Figures 4 and 5**). For fish and fish products especially the fish maw exports are only available for Uganda and Tanzania.

4.2.2.1 Kenya

In Kenya, the available data are on fish production both capture and aquaculture in the fresh and marine systems, imports and exports, fishing effort (boats, gears, and fishers), fish biomass, and distributions. This data is available from the Kenya Marine and

Fisheries Research Institute (KMFRI) and the Lake Victoria Fisheries Organization (LVFO), and online from http://www.seaaroundus.org/. One of the key main challenges in Kenya is the non-reporting of fish production e.g., between 1950 and 2017 over 3 million tons of fish catches are said to be unreported from the marine and freshwater waters. Thus, the a need for improved data collection systems.

4.2.2.3 United Republic of Tanzania

From the United Republic of Tanzania, the available data are on inland and marine capture fisheries production, fishing effort, fish catch value, aquaculture production, imports and exports, freshwater fish species occurrence records, and fish consumption records. This data is hosted at the Tanzania Ministry of Livestock and Fisheries, and regional data are hosted by LVFO. One key challenge is the irregular data collection that affects the trends in the available data.

4.2.2.4 Uganda

In Uganda, the available data is on inland capture fisheries production, fishing effort, imports and exports, fish species occurrences, and aquaculture production. This data are from the National Fisheries Resources Research Institute (NaFIRRI), the Directorate of Fisheries Resources (DiFR) of the Ministry of Agriculture Animal Industry and Fisheries (MAAIF), LVFO and online from https://freshwaterbiodiversity.go.ug/.

4.2.2.5 Mauritius

For Mauritius, the available data include inland and marine fisheries catches, values, aquaculture production, fish imports, and exports. This data can be obtained from the Ministry of Blue Economy, Marine Resources, Fisheries, and Shipping, Albion Fisheries Research Centre, and Ministry of Industry, Commerce and Consumer Protection (MICCP).

4.2.2.6 Madagascar

In Madagascar, available production records are on marine and freshwater aquaculture production, marine and inland small-scale capture fisheries catch, fishing effort, CPUE, and ecosystem variables (descriptive data). This data is available on request from the Ministry of Agriculture, Livestock and Fisheries (MAEP), and FAO.

4.2.2.7 Seychelles

For Seychelles, the available data is on marine fisheries and aquaculture production, Sea Cucumber production, fishing effort and licenses, biometric data, fish exports and imports, transportation records including marine accidents and records, and CPUE.

These data are available from the Seychelles Fishing Authority, the Indian Ocean Tuna Commission (IOTC), FAO, Ministry of Fisheries and Blue economy, Seychelles Conservation and Climate Adaptation Trust (SeyCCAT), Fisheries Transparency Initiative (FiTI), Seychelles Bureau of Standards (SBS), Seychelles Coast GuardSecurity water safety, and Ocean Data and Information Network For Africa (ODINAFRICA) (https://seyccat.org/wp-content/uploads/2018/04/Research-projects_2018.xlsx).

4.2.2.8 Rwanda

In Rwanda, the available data were freshwater catches, aquaculture production, imports and exports, and fishing efforts. The data is available from the Agriculture and Animal Resources Development Board (RAB).

4.2.2.9: Ethiopia

In Ethiopia, available data include inland fisheries catches, fishing efforts, and imports and exports. This data can be obtained from the Ethiopian Agricultural Research Organization, Fisheries and Aquatic Life Research Centre, and FAO.

4.2.2.10: Eritrea

In Eritrea, the only available data were on the fisheries and aquaculture production that is accessible from the WorldFish Centre.

4.2.2.10: Comoros

The available data from the Comoros capture fisheries production is from the state's islands (Ngazidja (Grande Comore), Ndzuwani (Anjouan) and Mwali (Mohéli)), value and the contribution of fisheries to the GDP. This data was available from FAO and online from http://comorespeche.org/index.php/statistics.

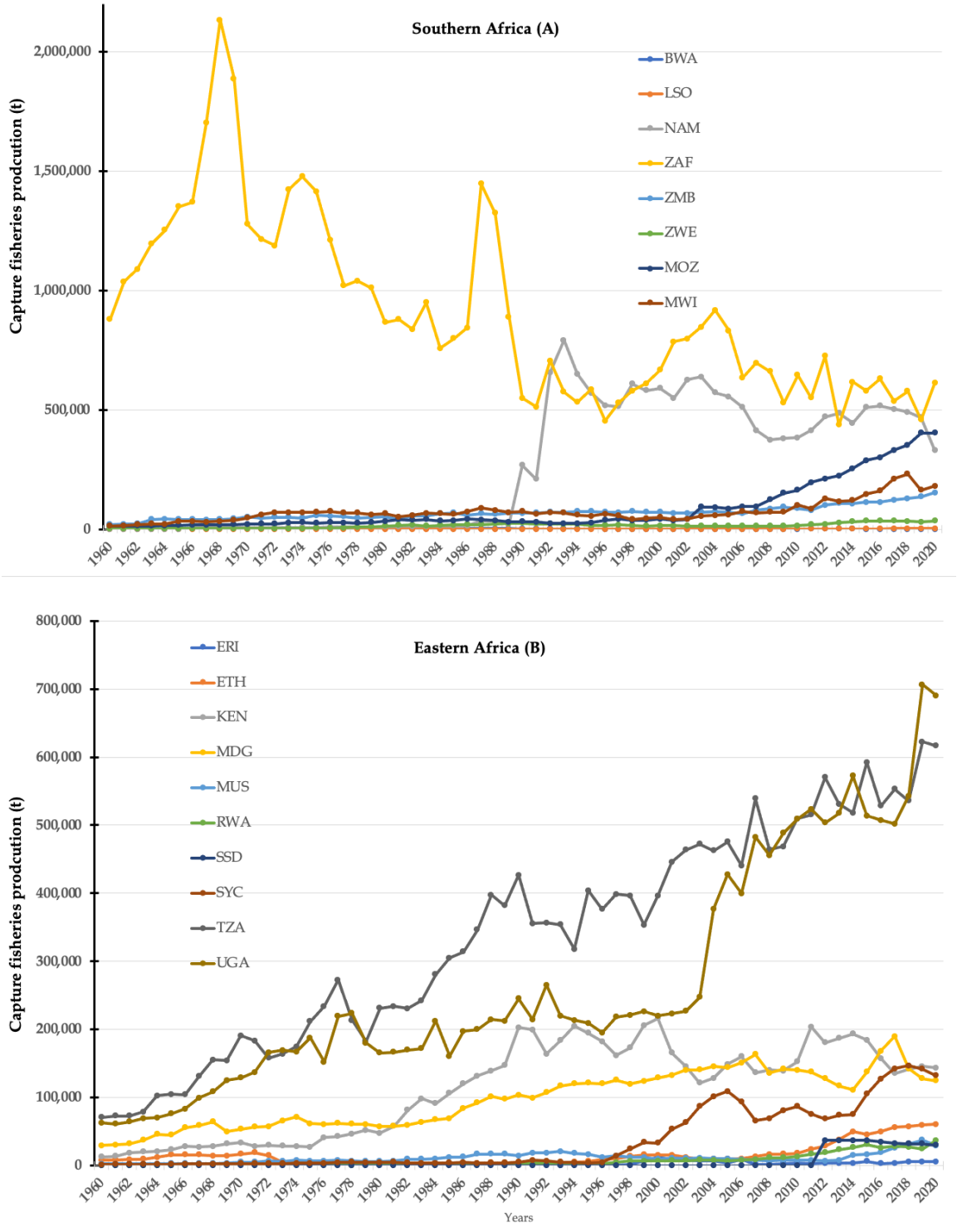

Figure 4: Summary of Capture fisheries production (tones) in Southern (A) and Eastern (B) (Source: OECD 2023). Note: BWA =Botswana; LSO = Lesotho; NAM = Namibia; ZAF = Zambia; ZMB = Zambia; ZWE = Zimbabwe; MOZ = Mozambique; MWI = Malawi; ERI =Eritrea; ETH = Ethiopia; KEN =Kenya; MDG = Madagascar; MUS =Mauritius; RWA= Rwanda; SSD = Southern Sudan; SYC = Seychelles; TZA =Tanzania and UGA = Uganda

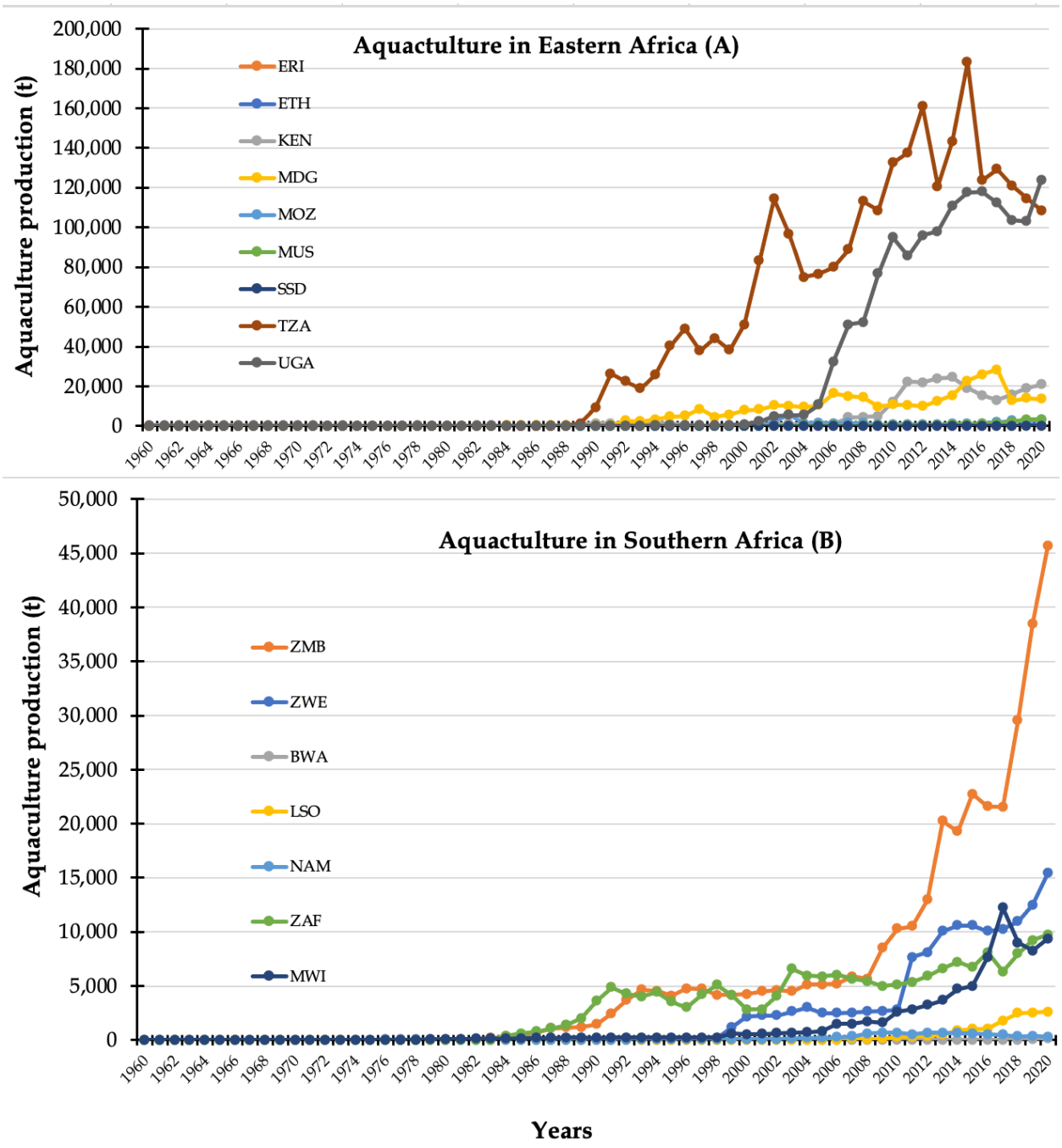

Figure 5: Summary of Aquaculture production (tones) in Southern (A) and Eastern (B) (Source: OECD 2023). *Note: BWA =Botswana; LSO = Lesotho; NAM = Namibia; ZAF = Zambia; ZMB = Zambia; ZWE = Zimbabwe; MOZ = Mozambique; MWI = Malawi; ERI =Eritrea; ETH = Ethiopia; KEN =Kenya; MDG = Madagascar; MUS =Mauritius; RWA= Rwanda; SSD = Southern Sudan; SYC = Seychelles; TZA =Tanzania and UGA = Uganda*

4.3 Gaps in data availability, data collection, storage, retrieval, and dissemination in fisheries, aquaculture, socioeconomics, and environmental data

The key data gaps in identified in the fisheries and aquaculture sector of the Eastern and Southern regions of Africa include, restricted access, inaccessibility, unreliability, lack of harmonized data collection protocals and methods, low adoption of ICT and next generation technicques in data collection and limited funding. For storage and retirval, there is no centralized databases for storage and archiving while dissemination is limted by funiding mechanisims and inadequate communication infrastructure. The details of these gaps in the diffrente thematic ares are summarized in Table 2 below.

Table 2: Summary of key/critical gaps identified in fisheries and aquaculture data avaiaalibity, collection, storage, retrival and dissemination in East and southern Africa.

Region	Thematic area	Data availability	Data collection	Data storage	Data retrieval	Dissemination
Southern and Eastern Africa	Aquaculture	1. Restricted access to data and in formats not easily accessible. 2. There is a general absence of reliable records. 3. Non-harmonized and conflicting data.	1. Absence of systematic data collection. 2. Limited range of data i.e. available records on production and culture species. 3. There are no standardized formats for data collection. 4. Low priority and limited funding because of its low production and national GDPs 5. Inadequate manpower to undertake comprehensive data collection 6. Low adoption of ICT digitized data collection.	Lack of centralized data storage and archiving systems.	1. Most data in technical reports which are not readily accessible 2. Data not centralized copy formats and scattered.	1. Data is not easily accessible to the public 2. There is limited funding for dissemination activities.
Southern and Eastern Africa	Capture fisheries	1. Most of the data and information are not readily accessible or require approvals to use. 2. Presence of strict data access and sharing policies in some countries. 3. There is a general	1. Absence of systematic data collection. 2. Limited range of data (catch, value, and fishing effort). 3. Non-harmonized and standardized data collection procedures on shared water bodies. 4. Inadequate skilled work force to	There are no centralized systems for data storage and archiving	1. Most data are not readily accessible. 2. Data retrieval is not easy as most of the data is in hard copy formats and scattered	1. Limited access to fisheries data to the public 2. Limited funding to support dissemination. 4. Inadequate

Region	Thematic area	Data availability	Data collection	Data storage	Data retrieval	Dissemination
		absence of reliable records. 4. Non-harmonized and conflicting data from the same country. 5. Lack of mechanisms for sharing of data among states on shared lakes. 6. Most of the information is available on commercial fish species with a large proportion of unclassified species. 7. Unwillingness by some respondents to share information. 8. Lack of funding to support ICT infrastructure and online data availability	undertake data collection. 5. Inadequate funding to capture fisheries research. 6. Low adoption of ICT digitized data collection. 7. Absence of independent fisheries authority or body responsible for fisheries data in some countries. 8. Low priority is given to fisheries data collection in some countries. 9. Lack of fisheries research infrastructure such as vessels. 10. Lack of strong collaborations and mechanisms for joint data collection on shared lakes.			streamlined policies on information dissemination. 5. Inadequate communication infrastructure
Southern and Eastern Africa	Environmental data (climate change)	1. Limited environmental data availability and accessibility in most countries.	1. Inconsistence in environmental data collection methods. 2. Less priority in environmental research. 3. Inadequate skills in the use of modern water assessment tools 4. Environmental data collection has largely prioritized large water systems.	1. No centralized accessible database for the storage of environmental data in most countries.	Most environmental data are scattered in different national departments and not readily accessible	1. The restricted access to environmental data impedes dissemination efforts 2. Lack of funding to support dissemination 3. Lack of streamlined policies on information dissemination. 4. Inadequate communication infrastructure
Southern and Eastern Africa	Socio-economics data	There is limited availability of fisheries socio-economics data	1. Limited data on fisheries value-chains in most countries.	No centralized database for the storage of socio-economics data.		Limited funding to fisheries socio-economics studies and hence inadequate information for

Region	Thematic area	Data availability	Data collection	Data storage	Data retrieval	Dissemination
						dissemination

Table 3: Summary of fisheries and aquaculture data types, sources, and the host institutions in East and Southern Africa

Region	Country	Data type	Collection methods	Host institutions (Data source)	Time series	Year
East Africa	Uganda, Kenya, Tanzania	Commercial catch data (harvesting gears, catch by species, economic value, consumption)	Catch Assessment Surveys (CASs)	LVFO, KMFRI, TaFIRI, NaFIRRI	Yes	LVFO, 2021
	Uganda, Kenya, Tanzania	Fishing effort (boats, gears, fishers, facilities)	Frame Surveys (FSs)	LVFO, KMFRI, TaFIRI, NaFIRRI	Yes	LVFO, 2020
	Uganda, Kenya, Tanzania	Species composition, abundance, distribution, biomass, water quality,	Hydroacoustic Surveys	LVFO, KMFRI, TaFIRI, NaFIRRI	Yes	LVFO, 2022
	Uganda	Fish species occurrence	Data mobilisation and corroboration	NaFIRRI(https://freshwaterbiodiversity.go.ug/)	NA	2023
Southen Africa	South Africa	Fish catch, allowable catch, bycatch, fish value	CASs	International Commission for the Conservation of Atlantic Tunas (ICCAT)	Yes	2019
	South Africa	Fishing effort (boats, gears, fishers)	FSs	International Commission for the Conservation of Atlantic Tunas (ICCAT)	Yes	2019
	Namibia	Fish production (catch)	CASs	FAO fishery country profile, Republic of Namibia; Ministry of Fisheries and Marine Resources		2021
	Madagascar	Catch landings, Length based data, fish mortalities		FAO, Fishery country profile (https://www.fao.org/fishery/en/countrysector/naso_madagascar)	No	FAO, 2023
	Lesotho	Capture fisheries production (catch)	CASs	https://www.ceicdata.com/en/lesotho/agricultural-production-and-consumption and https://www.lndc.org.ls/content/aquaculture	Yes	Annually
	Reunion	Catch production for large pelagic resources		https://www.europarl.europa.eu/RegData/etudes/IDAN/2015/563396/IPOL_IDA(2015)563396_EN.pdf (Table 1: Fish catches in Reunion)	Yes	2014
	Botswana	Annual fish catches	CASs	National statistical bureau of Botswana	Yes	2018
	Zimbabwe	Annual fish catches	CASs	Zimbabwe Parks and Wildlife Management Authority (ZPWMA)	Yes	
	Somalia	Annual fish catches	CASs	Ministry of Livestock and Fishery development	Yes	
	Seychelles	Annual fish catches, fish value, fishing fleets	CASs, FSs	Seychelles Fishing Authority	Yes	2021/2022
	Mauritius	Annual fish catches, fish value, fishing fleets	CASs, FSs	Ministry of Blue Economy, Marine Resources, Fisheries and Shipping	No	
	Mozambique	Annual fish catches, fish value, fishing fleets	CASs, FSs	Mozambique Ministry of Sea, Inland Waters, and Fisheries	No	
	Burundi	Annual fish catches, fish value, fishing fleets	CASs, FSs	Ministry of Environment, Agriculture and livestock (Fisheries and Aquaculture division)	No	
	Zambia	Annual fish catches, fish value,	CASs, FSs	Ministry of Fisheries and Livestock	No	

		fishing fleets				

4.4 Review existing relevant, regional, continental, and global databases and data collection, retrieval, and dissemination systems

The following are some of the existing databases in Eastern and Southern Africa that support data collection, retrieval, and dissemination systems that can be utilized for fisheries and aquaculture development and management (**Table 4**).

Table 4: Fisheries and Aquaculture databases in the Eastern and Southern African region

Database	Habitat category	Dissemination mode	Country of coverage	Accessibility	Category	Data source	Database owner	Capability	Gaps	References
Uganda freshwater biodiversity portal (UFBP)	Freshwater	Web-based	Uganda	Open access	Biodiversity conservation	Scientists Citizen science	NaFIRRI	1. Fish occurrences, and distribution, maps. 2. Fish stock indicators for the major commercial species. 3. Data is verified before being accessible.	No user guide for easy manoeuvrability.	https://freshwaterbiodiversity.go.ug/
Freshwater biodiversity information systems (FBIS)	Freshwater and marine	Web-based	Southern Africa	Signing up and login required; Open access	Biodiversity conservation	Scientists Citizen science initiative	Freshwater Research Centre (FRC)	Occurrence data on the freshwater data on taxa such as fish; provides distribution shapefiles..		https://freshwaterbiodiversity.org/
FishBase	Freshwater and marine	Web-based	Global	Open access	Biodiversity conservation	Scientist and citizen science	Online open access	Species description, occurrence; distribution, biology, and ecology	Some species are not described while information on others is insufficient.	https://www.fishbase.se/search.php
International Union for Conservation of Nature (IUCN)	Freshwater and marine	Web-based	Global	Open access	Biodiversity conservation	Scientists	IUCN Secretariat	Species description, threat status, occurrence; distribution, biology, and ecology	Assessments are sometimes conducted without using local knowledge.	https://www.iucnredlist.org/

Database	Habitat category	Dissemination mode	Country of coverage	Accessibility	Category	Data source	Database owner	Capability	Gaps	References
Global Biodiversity Information Facility (GBIF)	Freshwater and marine	Web-based	Global	Open access	Biodiversity conservation	Collated by scientists	GBIF Secretariat			https://www.gbif.org/
World Wide Fund for Nature (WWF)	Freshwater and marine	Web-based	Global	Open access	Biodiversity conservation	Collated by scientists	World Wildlife Fun			https://www.worldwildlife.org/
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Freshwater and marine	Web-based	Global	Open access	Biodiversity conservation and control of trade in endangered species	From government institutions on trade	CITES			https://cites.org/eng
Ramsar convention	Freshwater	Web-based	Global	Open access	Conservation of wetland resources	Government institutions on wetland management	Wetlands International			https://www.wetlands.org/wetlands/ramsar-convention/
Freshwater Biodiversity Data Portal	Freshwater	Web-based	Uganda, Tanzania, Democratic Republic of Congo, Kenya, Namibia, Zambia, Zimbabwe, and Burundi	Open access	Biodiversity conservation	Various sources and platforms including GBIF and scientists	BOKU			https://data.freshwaterbiodiversity.eu/

Database	Habitat category	Dissemination mode	Country of coverage	Accessibility	Category	Data source	Database owner	Capability	Gaps	References
East Africa data portal		Web-based	East African	Open access	General	From EA community research institution	EAC			https://eac.opendataforafrica.org/
Electronic Catch Assessment Survey app (e-CAS)	Freshwater	Mobile app and web-based	Uganda, Kenya, and Tanzania	Closed access	Fisheries stock assessment, water quality, and	From fishers, trained enumerators, and scientists	EAC	Collects data from the field and seamlessly archived in a central database; Different levels of access for the users	No detailed user manual for effective data collection	https://smartcas.net/login Google play store
Fisheries and Aquaculture Organization	Freshwater and marine	Web-based	Global	Open access	Fisheries (catch and effort data)	Government institutions in management and fisheries statistics	UN	The state of Fisheries and Aquaculture (SOFA)	The data is not synchronized with research fisheries institutions.	https://www.fao.org/fishery/en/statistics
HydroSheds	Freshwater	web-based	Global	Open access	GIS data for basins and subbasins	Remote sensing	World Wildlife Fund	HydroRivers, HydroAtlas, HydroBasins, HydroLakes		https://www.hydrosheds.org/
WORLDCLIM	Freshwater and marine	Web-based	Global	Open access	Environmental raster data for conservation	Remote sensing	World Climate Research Programme (WCRP)	Climatic data for both present and future prediction	No detailed user manual.	https://www.worldclim.org/
The African Geoportal	Freshwater and Marine	Web-based	Africa	Open	GIS	ESRI	Remote sensing	Datasets for mapping.	Video-based user manual not provided	https://www.africageoportal.com/
Fisheries Global Information System (FIGIS)		Web-based	Global.	Open	Strategic	Within FAO, regional fisheries management organisat	FAO	Integrated knowledge base, Single point-of-access	Low third-party dependency	https://www.fao.org/fishery/en/figis

Database	Habitat category	Dissemination mode	Country of coverage	Accessibility	Category	Data source	Database owner	Capability	Gaps	References
						ions and national centers of excellence.				
The Malawi Library and Information Consortium (MALICO),	Aquaculture and fisheries sciences library and information center	Electronically accessed	Malawi	Restricted		Bunda College of Agriculture (BCA), Chancellor College (Chancoll), National Aquaculture Centre Library and Information Centre (NAC-LIC), Natural Resources College (NRC), Monkey Bay Fisheries Research Centre, Mzuzu University (Mzuni)	MALICO	Medium of data access to Electronic Information through a Library Consortium. ●	A few institutions and scientists produce and deposit their papers/work in libraries	https://www.malico.mw/about-us/

Database	Habitat category	Dissemination mode	Country of coverage	Accessibility	Category	Data source	Database owner	Capability	Gaps	References
						and Malawi Fisheries College (MFC).				
The fisheries resource information system and tools (FiRST)	Extant trawl surveys and generic socioeconomic data, as well as catch-and-effort statistic	Web-based	Africa (Egypt, Nigeria, Tanzania, Zambia); Asia (India, Cambodia, Bangladesh, Myanmar); and Pacific (Solomon Islands and Timor Leste)	Restricted	Environmental, fisheries, and Agricultural data		WorldFish Centre	Digitizing of local information		https://digitalarchive.worldfishcenter.org/handle/20.500.12348/2329
FishBase is the premier biodiversity information website	African fresh and brackish water species.	Web-based	A global species database covering more than 32,000 species	It is accessed online	premier biodiversity information website	updated by the FishBase for Africa Team of the Royal Museum for Central Africa (RMCA) in Tervuren Belgium)				https://guides.library.ucdavis.edu/fisheries-aquaculture/databases https://www.fishbase.se/search.php
Aquatic Sciences	Marine, freshwater,	Web-based	Global	Open access with a	Fisheries, Environmen		ProQuest LLC	There is access to Electronic		https://proquest.libguides.com/asfa/

Database	Habitat category	Dissemination mode	Country of coverage	Accessibility	Category	Data source	Database owner	Capability	Gaps	References
and Fisheries Abstracts (ASFA)	and brackish water environments and organisms			subscription	t, Earth, Atmospheric, & Aquatic Science Database, Natural Science Collection, and SciTech Premium Collection.			Information through a Library Consortium. Training through workshops and seminars		home
Fish, Fisheries & Aquatic Biodiversity Worldwide	All aquatic ecosystems	Web-based	Global		Fisheries and Aquaculture Research Guides		University of California			*https://guides.library.ucdavis.edu/fisheries-aquaculture/databases*
Electronic Catch Assessment Survey (e-CAS)	Freshwater and Marine	Web-based and Smart phone App	Uganda, Kenya, Tanzania	Restricted access	Fish catch and fishing effort data	National and Regional CAS and FS working groups	LVFO	Real-time recording, transmission, archiving, and access to data. Unlimited cloud storage of data, ability to be expanded to accommodate different data sets, ability to customize data templates according to water body	The system has restricted access as a security measure,	*https://smartcas.net/login*

4.5 Proposed mechanisms for regular update of fisheries and aquaculture data and information.

Upon evaluation of existing data on fisheries, aquaculture, water environment, and socioeconomics, it became evident that there is a general deficiency in trend data and an imbalance in data distribution, with less emphasis on socioeconomics and environmental data compared to fisheries and aquaculture data. To address these challenges and enhance data availability and accessibility, the following mechanisms are proposed.

1. ***Development of standardized regional databases***: Establishing standardized regional databases will serve as a central repository for sharing and managing fisheries and aquaculture data and information.
2. ***Mobilization of scientists and stakeholders into regional working groups (RWGs)***: Forming strong and effective networks of RWGs composed of scientists handling different data sets (catch, fishing effort, water environment, aquaculture, and socio-economics data), will facilitate regular meetings for sharing, analyzing, and interpreting data, as well as disseminating findings to a wider stakeholder audience.
3. ***Development and adoption of customized online electronic data collection infrastructure***: Regional fisheries bodies should develop and adopt customized online electronic data collection infrastructure with centralised repositories to promote the remote collection and real-time submission of data. For example, systems akin to the online digital Catch Assessment Survey (e-CAS) developed by LVFO for transboundary Lake Victoria could be scaled up and adopted by other regional bodies to improve data acquisition, update, and sharing.
4. ***Strengthening partnerships and collaboration***: Strengthening partnerships and collaboration linkages among partners on transboundary resources and developing a Memoranda of Understanding (MOU) for joint collection and sharing of data will enhance data access, sharing, and cooperation.
5. ***Development of digitized integrated fisheries information management systems***: Implementing digitized integrated fisheries information management systems that accommodate different data sets on temporal scales will facilitate comprehensive data management.
6. ***Organize periodic regional, continental, and international symposia***: Organizing periodic symposia at regional, continental, and international levels and supporting technical staff to attend and share data and

information at these platforms will promote knowledge exchange and collaboration.

7. ***Capacity building for resource users:*** Developing capacity and infrastructure for resource users such as fishers and fish farmers, and providing training in data collection and record keeping, will enable the regular collection, submission, and updating of key fisheries statistics and records.
8. ***Development of national and regional policies***: Establishing national and regional policies that promote responsible data sharing among partner states on shared resources will ensure transparent and effective data management and sharing practices.

5 MULTI-DISCIPLINARY APPROACH FOR IMPROVED FISHERIES MANAGEMENT STRATEGIES AND PROGRAMMATIC INVESTMENTS

The multi-disciplinary approach for improved fisheries management strategies and programmatic investments is pivotal in achieving a comprehensive ecosystem-based approach within the fisheries sector. Through the adoption of this approach, critical issues such as food security, income generation, and community livelihood can be systematically addressed. Furthermore, it facilitates both regional and national integration in fisheries management, leading to the mitigation of challenges like Illegal, Unreported, and Unregulated (IUU) fishing, reduction of post-harvest losses, enhancement of fish quality for exports, increased fisheries production, and the promotion of sustainable aquatic utility and restoration across marine and the fresh waters ecosystems. This holistic approach ensures the sustainable utilization of aquatic resources and fosters ecosystem resilience.

5.1 Ecosystem Approach to fisheries and aquaculture

The importance of data and information as the foundation for effective fisheries and aquaculture management cannot be overlooked. The ecosystem approach to fisheries management, encompassing policy formulation, development of management plans, and evaluation of progress, represents a key component of a multi-disciplinary approach to enhancing fisheries management strategies and programmatic investments (FAO, 2003). In this approach, data and information needs are interconnected through various stages, each with distinct processes,

occurring on different time scales and requiring information at different levels of detail and aggregation. Additionally, the EAF necessitates the broadening of data, analyses, and information provision beyond traditional boundaries. Therefore, adopting a holistic approach to fisheries management such as EAF, allows for comprehensive consideration of various facets including biology, environment, fisheries and aquaculture, fisheries markets, export values, and socioeconomics within a project module. This integrated approach facilitates a more thorough understanding of the interconnected dynamics within aquatic ecosystems, thereby enabling more effective and sustainable management practices.

5.2 Transboundary approach to fisheries and aquaculture management

Facilitating transboundary cooperation is essential for the sustainable management of fisheries, aquaculture, environmental conservation, and socio-economic development, serving as a benchmark for the region. Numerous countries, including Indonesia, have successfully employed this approach to enhance the management of coastal and marine resources. Similarly, initiatives like the Lake Victoria Management plan have provided a platform for collaborative efforts among East African countries such as Tanzania, Uganda, and Kenya to address challenges within the Lake Victoria ecosystem. Additionally, institutions like the Lake Tanganyika Authority play a crucial role in promoting transboundary cooperation and ensuring the sustainable management of fisheries and aquaculture resources across borders on Lake Tanganyika. These collaborative endeavors underscore the importance of cross-border partnerships in achieving shared conservation and management goals within aquatic ecosystems.

5.3 Blue economy approach to fisheries

The blue economy approach to fisheries represents a contemporary framework capable of addressing multifaceted studies in fisheries and aquaculture, encompassing aspects of biology, socio-economics, and environmental variables across marine and freshwater ecosystems. The approach holds promise for initiatives such as mangrove restoration and conservation measures in marine ecosystems, as well as fostering sustainable practices within freshwater aquatic ecosystems through collaboration with stakeholders. Many countries in the East African region are increasingly focussing on these areas as intervention strategies to address key challenges within aquatic ecosystems. To this end, many meetings

and conferences have been convened to facilitate regional dialogue and ensure widespread adoption of the blue economy approach. These collaborative efforts underscore the recognition of the blue economy approach as a holistic and integrated framework for achieving sustainable fisheries management and socio-economic development in aquatic environments.

5.4 The Nile Basin Initiative (NBI) approach to fisheries

The Nile River traverses eleven countries (Burundi, DR. Congo, Egypt, Ethiopia, Eritrea, Kenya, Rwanda, South Sudan, Sudan, Tanzania, and Uganda). Therefore, implementing the Nile Basin initiative (NBI) approach to the fisheries and aquaculture, in collaboration with other stakeholders operating within this shared ecosystem, holds significant potential for addressing issues pertinent to these countries. By leveraging the collaborative framework provided by the NBI, countries within the Nile Basin can work collectively to tackle various challenges related to fisheries and aquaculture management. This approach fosters cross-border cooperation, knowledge sharing, and joint decision-making processes aimed at promoting sustainable fisheries practices and enhancing socioeconomic development within the region. Thus, the NBI approach serves as a valuable mechanism for advancing fisheries and aquaculture initiatives across the diverse and interconnected ecosystems of the Nile Basin.

5.5 The Marine Protected Areas (MPA)

The Marine protected area (MPA) approach serves as a vital tool for safeguarding both marine and freshwater aquatic resources across the African region. MPAs are designated areas that aim to protect marine biodiversity and ecosystems while allowing for sustainable human use. These areas often employ various management strategies, including fishing restrictions or bans, to control fisheries resource use, mitigate environmental degradation, and promote conservation efforts. MPAs are established in response to numerous threats facing the ocean, including overfishing, marine litter, pollution, and climate change, which have led to declines in marine biodiversity. By designating specific areas for protection, MPAs help to conserve critical habitats and provide refuge for vulnerable species. MPAs come in various forms and may be known by different names, such as marine parks, marine conservation zones, marine reserves, marine sanctuaries, and no-take zones. It is estimated that over 5000 MPAs have been established around the world, covering approximately 0.8 percent of the ocean. The protected areas can encompass a wide range of aquatic habitats, including Open Oceans, coastlines, estuaries, and freshwater

ecosystems like those found in the Great Lakes. By preserving these habitats, MPAs contribute to the overall health and resilience of marine and freshwater ecosystems, supporting biodiversity conservation and sustainable fisheries management efforts.

5.6. Intergovernmental Authority on Development (IGAD)

The Intergovernmental Authority on Development (IGAD) is a regional organization comprised of eight member states: Djibouti, Ethiopia, Kenya, Somalia, South Sudan, Sudan, Uganda, and Eritrea (currently active), with its headquarters based in Djibouti. Originally established in 1986 as the Intergovernmental Authority on Development (IGAD) in Eastern Africa, it was later reconstituted in 1996 to extend its scope. While initially focused on issues such as livestock and crop management, IGAD has since expanded its mandate to incorporate fisheries, recognizing the integral role of this sector in the region's economy and food security. This integration aligns with broader regional initiatives and partnerships, including those led by the African Union Inter-Africa Bureau for Animal Resources (AU-IBAR). Key areas of focus for IGAD include gender and power analysis; maritime security cooperation; regional integration in sectors such as fisheries, livestock, and crops; refugee protection, and the development of regional strategies.

Collaboration with other regional and international organisations such as UNESCO. FAO, SADAC, UNEP, and AU-IBAR, enhance the effectiveness of IGAD's efforts in promoting sustainable development and regional cooperation.
Incorporating a multi-disciplinary approach to fisheries management strategies and programmatic investments within IGAD's framework can leverage existing partnerships and resources to address pressing challenges and foster sustainable development in the region. This collaborative approach underscores the importance of coordinated efforts among key stakeholders to achieve shared goals and objectives. A detailed outline of the programmatic investment study is provided below.

Conceptual framework

Policy-oriented research refers to the systematic investigation aimed at identifying new or improved policies, regulations, or institutions (or their management) to enhance economic, social, and environmental welfare

The objective of this assignment was to document exemplary models or success stories of fisheries management that take into account various disciplines including biology, ecology, technology, legal, economics, and social sciences. These models would serve as guiding principles to inform and improve fisheries strategies across African Union (AU) Member States.

A successful model or success story of fisheries management holds the potential to attract investments, which may manifest in the form of loans, grants, or equity. This influx of investment capital signifies an opportunity for programmatic initiatives to play a pivotal role in leveraging private-sector investments.

By highlighting exemplary cases of effective approaches in fisheries and aquaculture investments, AU MS can be encouraged to adopt similar approaches, thereby unlocking several investment opportunities and fostering sustainable economic development in the fisheries sector.

5.7 Policy coherency in promoting multidisciplinary approaches for enhancing fisheries strategy and programmatic investments

A comprehensive analysis of both national and regional policies and frameworks was conducted to assess their alignment with improved fisheries and aquaculture strategies; and programmatic investment across the southern and eastern regions. Each policy was scrutinised based on key aspects or principles encompassing ecological-based approaches (biology, ecology, and environmental considerations), social-economic benefits, research and technological requirements for fisheries enhancement, legal frameworks, data management, and precautionary measures. Policies demonstrating responsiveness to these critical aspects were identified as potential contributors to the development of an ideal scenario model for fisheries management, embracing a multidisciplinary approach that integrates all disciplines including biology, ecology, technology, legal, and socio-economics. Such a model is conducive to fostering programmatic investments in the fisheries and aquaculture sector in Eastern and Southern Africa.

The review study followed a dual approach a) evaluating the extent of existing policies' alignment with multidisciplinary approaches in respective countries and regions; and b) identifying examples of the programmatic investments, their associated challenges, and how different regional policies have addressed these

investment opportunities. Based on these findings, recommendations, and proposals were formulated to enhance investments in fisheries and aquaculture sectors, aiming to promote suitable development and resource management.

5.8 Policy review: Multidisciplinary approaches to fisheries management and investment

5.8.1 National policies and multidisciplinary approaches to fisheries management and investment

Table 5 summarises the policy status, highlighting key aspects and investment strategies by the policy in individual countries. Preliminary information indicated that of 24 countries reviewed seven have clear and updated national sector fisheries and aquaculture policies. These countries include Kenya, Uganda, Tanzania, South Africa, Tanzania, Seychelles, Malawi and Namibia. However, other states have guidelines, partnership agreements, management/master plans, or policies embedded in other national sector policies, such as environment, agriculture, and wildlife that guide their fisheries and aquaculture management activities. For instance, Burundi, Rwanda, Djibouti, Ethiopia, and Eritrea have fisheries development and management interests embedded in their respective strategic management plans rather than formulated policies. Countries such as Reunion, Mauritius, and Madagascar lean towards EU policies and partnership Agreements for fisheries resources management. The Comoros and Botswana manage their fisheries sectors under other national sector policies, such as the environment and wildlife policies. Some countries under SADC aligned strongly with regional policies and protocols, such as the protocol on the fisheries of the Southern African development community. Additionally, some countries are in the continuous process of policy formulation and have yet to fully develop their national policies.

It is important to note that various perceptions and drivers influence individual countries' adoption of multidisciplinary approaches to fisheries management and investments, shaping how fisheries are managed. One key notable factor is the size of the sector and its contribution to national GDPs. A small contribution may indicate a lower interest in developing guidelines for fisheries management strategies and investments. Countries with greater access to water sources for sector development are more likely to emphasise dedicated or standalone policy development for fisheries management. However, other countries may face

hindrances such as political conflicts. Despite these challenges, there is clear evidence across all countries of a precautionary approach to fisheries resource management, with legal systems in place to regulate fishing activities, albeit with limitations in enforcement capacity.

Countries with policies demonstrated a clear commitment to responsible fisheries and aquaculture development, with responsiveness to ecological/environmental, social, economic, data management, and legal aspects of fisheries management strategies and investments, albeit to varying degrees. For instance, may not specify control measures for invasive weeds or the transfer of aquatic biological materials. Investment guidelines are given better priority in the national policies of Southern Africa, Tanzania, Kenya, Uganda, and Seychelles. Seychelles has the most detailed fisheries and aquaculture policy concerning multidisciplinary approaches and creating a conducive investment environment. Resources and human capital constraints, among other challenges, may constrain the management of fisheries activities in many countries. Nonetheless, it is imperative to have a fisheries sector policy guiding management strategies and investments rather than relying solely on master plans. Countries operating under policy guidelines prioritise fisheries research, technology development, and continuous data collection for monitoring fisheries and aquaculture activities and better planning purposes. A strong operational policy provides an enabling environment for multidisciplinary approaches to sector growth, which is strongly encouraged. In light of the rising demand for cheap protein sources from a growing African population, all countries should strive to develop inclusive multidisciplinary sector policies to support sustainable fisheries strategies and investments.

5.8.2 The role of regional policies in implementing multidisciplinary approaches to fisheries management strategies and investments

Regional policies play a crucial role in guiding the formulation of national policies. Key regional policies such as the East African policy, the Policy Framework Reform Strategy (PFRS), the African Fisheries Reform Mechanism (AFRM), and the Regional Agricultural Policy of SADC; provide strategic guidance for implementing sustainable structures for fisheries management and development. Additionally, protocols like the SADC Protocol on fisheries (2006) and the national fisheries and aquaculture policies for EAC and SADC member states, as well as trans-boundary fishing guidelines/laws, contribute significantly

to shaping fisheries management and investment strategies. These policies and frameworks are comprehensive, encompassing precautionary principles, an ecology-based approach to fisheries development, legal aspects, data collection and management for monitoring, social inclusion, economic benefits, fair trade, and investments in the fisheries sector. For example, the SADC protocol on fisheries promotes sustainable development and investment in the fisheries sector, encouraging member states to develop detailed policies tailored to their local context. However, some countries have yet to fully develop these policies despite the protocol's encouragement. For instance, the SADC protocol on fisheries encourages the promotion of joint ventures between foreign and national participants to increase capital in countries like Namibia. However, it explicitly states that the policy will not provide subsidies or loan guarantees for any trade or investment activities. In contrast, policies in Seychelles strongly support investments by offering fuel subsidies, access to soft loan schemes, promoting an integrated approach, and reducing the cost of investments and barriers.

Despite the protocol encouraging individuals' countries to develop more detailed policies to integrate further fisheries aspects to suit their local context some of the countries are yet to develop the policies. The protocol strongly encourages individual states to create an enabling policy for the promotion of investment in the fisheries sector. In some countries such as Namibia the fisheries sector policy on investments encourages the promotion of joint ventures between foreign and national participants -to increase capital. However, it categorically states that -the policy will not provide any subsidies and loan guarantees for any trade or investment activities. This is contrary to that of Seychelles for instance, which strongly supports investment; fuel subsidies; access to soft loan schemes; promotes an integrated approach; and reduces the cost of investments and barriers. The regional policies/frameworks may not provide all the details in the aspects of fisheries management and investment approaches but are a frame upon which national fisheries sector policies could be developed and then customised to the local country's socio-economic growth aspirations.

Table 5: Summary of the policy status highlighting key aspects of investment strategy by the policy in the respective country

Country	Policy	Ecological approach (biological ecological)	Social-economics	Legal aspects	Research & technology development	Data mgt mech.	Investment status	Recommendation (concerning investments)
Kenya	√	√	√	√	√	√	Inadequate	Policy briefs to improve investments required
Uganda	√	√	√	√	√	√	Inadequate	Policy briefs to improve investments required
Tanzania	√	√	√	√	√	√	Inadequate	Policy briefs to improve investments required
Burundi								Policy briefs to develop inclusive Fisheries policy
Comoros								Policy briefs to develop inclusive Fisheries policy
Djibouti								Policy briefs to develop inclusive Fisheries policy
Ethiopia								Policy briefs to develop inclusive Fisheries policy
Eritrea								Policy briefs to develop inclusive Fisheries policy
Malawi	√	√	√	√	√	√	Inadequate	Policy briefs to improve investments required
Madagascar								Policy briefs to develop inclusive Fisheries policy
Mauritius								Policy briefs to develop inclusive Fisheries policy
Mozambique								Policy briefs to develop inclusive Fisheries policy
Réunion								Policy briefs to develop inclusive Fisheries policy
Rwanda								
Seychelles	√	√	√	√	√	√	Good	Detailed policy on key/basic investment aspects

Country	Policy	Ecological approach (biological ecological)	Social-economics	Legal aspects	Research & technology development	Data mgt mech.	Investment status	Recommendation (concerning investments)
Somalia,								Policy briefs to develop inclusive Fisheries policy
Zambia,								
Somaliland,								Policy briefs to develop inclusive Fisheries policy
Zimbabwe								Policy briefs to develop inclusive Fisheries policy
South Africa	√	√	√	√	√	√	Inadequate	Policy briefs to improve investments
Botswana								Policy briefs to develop inclusive Fisheries policy
Lesotho								Policy briefs to develop inclusive Fisheries policy
Namibia	√	√	√	√	√	√	Inadequate	Policy briefs to improve investments
Swaziland								Policy briefs to develop inclusive Fisheries policy

Table 6: Regional policies on interdisciplinary Approaches in investments

Regional Policies	Ecologically based approach	Social economic	Legal aspects	Research & technology development	Data Management mechanism	Investment status/aspects
Fisheries and aquaculture policy for the East African community	√	√	√	√	√	Provides the framework for guidance (not details)
Protocol on the Fisheries of the Southern African development community	√	√	√	√	√	Provides a strong framework for investments in fisheries Encourages individual states to create an enabling policy for the promotion of investment in the fisheries sector.
African PFRS	√	√	√	√	√	Provides a framework for guidance (not details)

5.9 Programmatic investments

5.9.1 Overview of Programmatic investments

A pragmatic investment in the context of fisheries and aquaculture refers to an investment approach that prioritizes practicality, feasibility, and real-world effectiveness in achieving desired outcomes, rather than solely focusing on theoretical or idealistic considerations. Pragmatic investments in this sector often involve allocating resources towards initiatives or projects that have demonstrated tangible benefits, address immediate needs or challenges, and are likely to yield practical results within a reasonable timeframe. The most common types of programmatic investments in the fisheries and aquaculture sector in EAC and SADC member states include loans, equity interests, and grants. Other forms of financing in the fisheries sector include Savings and Credit Cooperative Organizations (SACCOs), revolving funds, subsidies, and Incentives. The proposed pragmatic investments in the fisheries and aquaculture sector in Eastern and Southern Africa include:

1. Infrastructure development: Investing in the construction of fish landing sites, cold storage facilities, processing plants, and aquaculture farms to improve the efficiency of fish handling, storage, and distribution. Constructing modern fish markets with adequate facilities for storage and processing can help reduce post-harvest losses and improve market access for fishers.

2. Technology adoption: Investing in the adoption of appropriate technology solutions such as GPS tracking systems for fishing vessels, and aquaculture automation systems to enhance productivity, efficiency, and sustainability.

3. Capacity building and training: Investing in training programs and capacity-building initiatives to enhance the skills and knowledge of fishers, aquaculturists, and fisheries managers. This may include training on sustainable fishing practices, aquaculture techniques, fish health management, and value-added processing. By equipping stakeholders with the necessary skills and knowledge, these investments contribute to improving the overall performance and sustainability of the fisheries and aquaculture sector.

4. Market development and value chain integration: Investing in initiatives aimed at strengthening market linkages, improving product quality, and promoting value addition along the fish value chain is paramount. This could involve supporting the establishment of cooperatives, investing in marketing campaigns, and facilitating access to finance for small-scale fishers and aquaculture producers. For example, providing microcredit loans to fishers for the purchase of appropriate fishing gear or to aquaculture farmers for the construction of fish production facilities could help increase productivity and income generation.

5. Research and innovation: Investing in research and innovation initiatives to address key challenges facing the fisheries and aquaculture sector, such as climate change, overfishing, and disease outbreaks. This may include funding research projects on sustainable fishing practices, development of new aquaculture technologies, and adaptation strategies for climate-resilient fisheries management. By supporting research and innovation, these investments will contribute to the long-term sustainability and resilience of the fisheries and aquaculture sector.

6. Increased funding through grants: Grants can be used to fund supplies or materials necessary for the program or in this case promote fish commodity value market chains for investment purposes. In some cases, program grants are eligible to support salaries for people involved. Grant-based funding is also key for market development to offset high real and perceived risks in the value market chain. The grants can catalyse market development, however, they not be sufficient to meet the long-term subsidy needs of the market.

Overall, these investments aim to achieve tangible and practical outcomes that contribute to the sustainable development and growth of the sector, while also addressing the immediate needs and challenges faced by stakeholders in Eastern and Southern Africa.

Programmatic funding is flexible financing for a program, company, organisation, group, or community with recurring revenue. It operates like a revolving line of credit where you can draw against annual recurring revenue. For the recipient, the primary benefit of a programmatic investment is access to capital, typically at more affordable terms than might otherwise be available. For the investor, the principal benefits are the achievement and sustainability of the mission-related program-the repayment of the borrowed money so that it can be used again for lending to others. Some lenders maintain formal programs that make programmatic investments/financing on an annual basis. Others make programmatic investments when the opportunity presents itself.

5.9.3 Description of the different forms of Programmatic investments

Programmatic Loans fall under three major categories. a) Entirely a loan receivable. i.e. an account in the general ledger of a lender, containing the current balance of all loans owed to it by borrowers. b) Entirely a loan contribution, i.e. the repayable Contribution to be provided by the lender under a Contribution Agreement/Arrangement. c) in part a contribution and in part a loan receivable. Loans are the most common programmatic investment. Stated interest rates on programmatic investments may be below market when compared to loans to entities of similar credit risk and often are set at very low-interest rates. Loan terms vary considerably, based both on the needs of the borrower, the type of

project, and the needs and expectations of the NFP investor. Terms can range from periods of a few months to more than a decade. Longer-term loans are typically associated with community development and infrastructural development projects.

Programmatic equity is a facility of capital/money delivered by an equity provider. It is typically referred to as shareholders' equity (or owners' equity for privately held enterprises/companies), and it is the amount of money that would be returned to a shareholder of an enterprise/ company if all of the assets were liquidated and all of the company's debt was paid off in the case of liquidation. With equity financing, there is no loan to repay. The business doesn't have to make a monthly loan payment, which is of benefit especially if the business doesn't initially generate a profit. This, in turn, gives the enterprise owner(s) the freedom to channel more money into your growing business. Equity capital facilities normally involve large sums of money.

Savings and Credit Cooperative Organization or Societies (SACCO) are voluntary associations whereby members voluntarily associate to promote their economic interests, regularly pool their savings, and subsequently obtain loans that they use for different purposes. Generally, SACCOS are also cooperatives but are financial. The idea behind the establishment of SACCOS is to promote savings and make credits available to the members. SACCOs have been demonstrated to be good /suitable for rural financing services, and financing small and medium scale enterprises.

Revolving funds are funds established specifically to give loans to members or to be expended or invested for a specific purpose with the condition that repayments benefits or income from the fund may be used again for these purposes only. The money is given to willing borrowers for their business or other uses, and this concept has been used by some non-profit making organisations to support fisheries entrepreneurs. The initial loan of revolving funds can also be from members of a revolving fund, donors, the Government, or a third party. Then this fund is collectively given to one of its members who need money where the fund establishment authority charges interest at a nominal rate or lower than the market rate. Those who had initial fund investments are also given interest on the money invested. Additionally, the fund can be invested in specific activities; or it may be expended for a particular purpose, which benefits the long run. The challenge has been defaulting paying back, with some fishers migrating to other fishing grounds. It is necessary for the fund establishment authority to acquire legal status for clear terms and conditions between the fund establishment authority and its members. In addition, legal status increases investors' faith that their money is in safe hands and cannot be misused. After establishing legal status, it is necessary to comply with the fund's statutory and other legal requirements.

Subsidies are a form of financial aid or support provided to enterprises/businesses in an economy by the government, often during recessions disasters, or other periods of low economic growth. This is done to promote economic and social policy. Subsidies increase production while investment increases productivity. In the fisheries and aquaculture sector of the EAC and SADC, subsidies have involved direct cash payments, discounts, tax waivers, and/or provision of essential inputs. In smallholder finance, subsidy plays a crucial role in accelerating the development of an inclusive market. Strategic subsidies encompass a wide array of activities designed to both develop the market's enabling environment and support individual service providers.

By providing money or other financial resources to businesses, the government helps businesses to continue operating and produce low-cost goods and services. Given that the products they produce will have a lower price, consumers in the economy can continue to purchase them. Increased consumer spending can sometimes bring an economy out of a recession or depression. These measures also ensure that citizens have access to the goods and services they need at an affordable cost. However, there is a tendency for the beneficiaries of subsidies to relax and forget about running the enterprise as a business to ensure its sustainability. Moreover, subsidies will not always be given.

Incentives for encouraging investment in the fisheries and aquaculture sector of EAC and SADC may take the form of Standard incentives for domestic and foreign investors. By increasing the level of investment, the level of employment and income can be increased. Standard incentives (stimulants for investment) that exist include:

Lowering the Rate of Interest would enhance the probability of investment so that investment in the private sector would be encouraged. Monetary authorities such as the central bank should be encouraged to consider a cheap money policy by lowering the bank rate.

Tax Reductions on personal and corporate taxes should be lowered so that the disposable income of the community increases. Again, a reduction in profit tax would increase corporate savings which may induce more investment.

Public Expenditure in the form of (i) pump-priming which is a deliberate public expenditure undertaken by the Government to initiate recovery of a depressed economy by injecting into circulation new money. The objective of Pump-priming is to stimulate private investment and not to supplement it. ii) Compensatory spending designed to compensate for the deficiency in private investment. It is public expenditure incurred to fill up the gap of private investment in the economy.

Price Policy to address instability in private sector investment is caused by price fluctuations which cause variations in the expected rate of profitability, i.e.,

marginal efficiency of capital. Thus, price stability is an essential condition for stimulating investment in the economy. Price stability does not imply price rigidity, rather it means relative price stability. Thus, the governments (EAC, SADC, and member states) in this direction must set a harmonized price policy henceforth.

Technological Change and Innovation **are necessary** when technological improvement takes place and the capital- output ratio tends to raise the demand for capital increases which induces more investment in the capital goods sector. There may be innovations like the introduction of new products, new methods of production, new markets, etc., from which investment is likely to increase in the economy.

5.9.4 Requirements for a good Programmatic investment

Some key requirements include:

I. Should be having a clear and realistic goal, expected results, and implementation plan/strategy
II. Should have the potential to generate returns and save funds periodically
III. Should be able to identify risks and implement mitigation measures
IV. Should ensure the safety of the generated products, the environment, and the persons developing the products.
V. Should be possible to monitor and evaluate the investment`s performance
VI. Should contribute to the growth of the fisheries and aquaculture sector/industry.
VII.

5.9.5 Key fisheries and aquaculture investments available in EAC and SADC member states

I. Fishing commercially important fish species e.g. in fresh waters: *Lates niloticus* (Nile perch), *Oreochromis niloticus* (Nile Tilapia), and *Rastrineobola argentea* (Dagaa) in East Africa. In the Marine waters: crustaceans, molluscs, demersal fish species, pelagic fish species, and tuna and tuna-like species.
II. Fish trade
III. Fish processing and fish by-product processing. These include artisanal and commercial processors e.g. factories exporting fish.
IV. Traders in fisheries and aquaculture-related equipment/inputs and storage infrastructure such as fishing nets, cooler transporters, processing equipment, packaging materials, etc
V. Commercial-oriented aquaculture – for food, ornamental, and other products e.g. pearls, sturgeon eggs, etc.
VI. Accredited testing laboratory services.

VII. Port/landing site operators/tenderer

5.9.6 A good policy responsive to the multidisciplinary approach to fisheries management strategy and programmatic investments

The review of various national sector policies revealed several gaps that need to be addressed to provide an enabling environment for appropriate management strategy and investments. Moreover, most of the countries are yet to develop fisheries and aquaculture policies to guide management and investments. Table sixteen (16) provides examples of potential fisheries investments, the challenges, and the policies addressing them. The emerging gaps are also highlighted, and these range from, quality of the fish products traded; issues related to improvement, protection of rare species, management of transboundary resources including crime prevention, limited private-public and international partnerships in Research & Development; harmonizing policy frameworks on protection of intellectual and property rights including indigenous knowledge systems; Policy/guidelines to manage /control emerging public health challenges from aquaculture activities and emerging aquatic infections/diseases attributed to climate change (Discipline: Public health). Furthermore, Strengthening policy on prevention/management of disasters in the aquaculture sector; Strengthening aquaculture policy on preventing antibiotic resistance; others include conditions that directly support investment environment e.g. subsidies; access to soft loan schemes; promotion of integrated approach; reduced cost of investments and barriers. These aspects represent the crucial approaches required for fisheries investment taking into consideration all the important precautionary, socio-economic, ecological, and legal approaches to sustainable fisheries management. The review affirms the urgent need to develop policies tailored to the regional policies and policy frameworks for guidance. From the study of regional and national policies; and protocols we determined that the SADC protocol on fisheries, the EA fisheries and aquaculture policy, and the National sector policies of Seychelles provided the best scenarios for a good and inclusive fisheries and investment strategy responsive to most of the multidisciplinary approaches examined in the current review.

5.9. Suggested proposals to improve the programmatic investments in fisheries and aquaculture sector in Eastern and Southern Africa

Policy development for countries in the process

Despite the existence of the legal instruments or approaches to regulate fisheries and aquaculture activities by most countries, and also the presence of National strategies/Master and developmental plans as well as other sector policies hosting fisheries aspects for most of the countries, it is evident that more than half of the countries in Eastern and Southern Africa either lack sector policies or

some are not updated. Policies are a prerequisite to the development of the fisheries and aquaculture strategy and programmatic investments because they guide the sector to focus on how to develop a system that is responsive not only to the precautionary approaches but also to socio-economic and ecological approaches. Therefore, countries are encouraged to continuously develop and update their respective policies to create an enabling environment for guided development and management of the fisheries sector and programmatic investments. For a policy to be effective in supporting an enabling environment for fisheries investments, the following specific areas should be considered as well.

Improve financial institutions' understanding of the fisheries and aquaculture markets and their capacity to assess business opportunities in the sector. This implies a shift towards a value chain approach, which considers the collective set of actors and processes over the entire value chain when making financing decisions. This approach would allow financial institutions to acquire knowledge from input providers, traders, processors, wholesalers, and other value chain actors as well as informal service providers who hold a unique informational advantage due to their direct business engagement within the value chain. Financial institutions can also take advantage of the current unprecedented availability of quantitative data to form market intelligence for fisheries and aquaculture finance, which enables significant cost savings before moving to the qualitative analysis of product design.

Diversify and adapt products and services for different actors of the value chain. Additional clients will be identified with their needs, capacities, and opportunities to offer additional services. This implies developing partnerships with other local actors, and better and cheaper ways to deliver a growing number of services. Each additional financial service offered in rural areas can bring increasing returns, facilitating the profitability of the rural portfolio.

Establish strategic partnerships with non-financial service providers, for transferring non-financial costs to specialized entities. Non-financial costs are mostly related to the technical assistance needed to strengthen the organization and coordination among several actors in the value chain. It includes capacity-building for farmers, cooperatives, and SMEs in different areas such as governance, financial management, and marketing. The public sector can play a leading role in creating an enabling environment for fisheries and aquaculture investments and new market opportunities for private investors.

Identify alternatives to guarantees based on physical collateral. Due to farmers' frequent lack of collateral, financial institutions tend to reject their business proposals regardless of the potential return on investment. Integrating farmers

into the financial system will require innovations not only in products but also in processes. Some successful experiences have shown that an effective way to reduce risks is to identify processes and indicators that give relatively minor weight to guarantees, focusing instead on performance indicators. New processes based on alternatives to collateral-based lending can also help reduce the time needed for approval and disbursement of loans, without restricting appraisal capacity.

Smallholder farms/farmers and small and medium enterprises (SMEs) are the backbone of the fisheries and aquaculture value chains in most developing countries. These agri-SMEs face many challenges: lack of capacities and poor quality of physical assets such as land and machinery, participation in poorly functioning value chains, and lack of access to the finance and investment needed to maintain or grow their businesses. Supply-side issues on the financial intermediary side, such as lack of adequate underwriting capacity, high transaction costs due to small size, limited access to relevant information, and often low literacy rate, and few people using banks, all add to factors resulting in a significant financial gap.

Table 7: Policy/strategic documents

Existing regional Policy/policy instrument	Purpose	Ecology	Technology	Legal	Economics	Social sciences	Data collection	Gap
Fisheries and Aquaculture policy 2018 - Uganda	To increase fisheries and aquaculture production to 1.7 million tonnes annually to contribute to food security, nutrition, and economic growth	Sustainable use of resources without degrading the environment	Research and Appropriate Technology Transfer	1.Operationalized by a legal instrument 2. Reorganize legal access to resources 3. Promotes legal and institutional frameworks	Promote trade & Marketing; commercialization of aquaculture	Promotes Principle of social equity and fairness	Promotes data collection	Not much on Investment in fisheries
National Oceans and Fisheries policy -Kenya	The goal is to ensure increased and sustainable fish production and utilization by properly managing the Ocean and other Kenya Fishery waters.	Promotion of an Ecosystem-based approach in the management of resources	Support research and development	Emphasis on improving the legislative framework	encourage joint investments in aquaculture; investment is mentioned; fiscal and monetary mechanisms are in place to facilitate access to investment funds	Promote co-management aspects; strong support for benefiting the local fisher communities	Data collection for monitoring emphasized	Not strong emphasis on biology, control of invasive species, diseases, etc.

Existing regional Policy/policy instrument	Purpose	Ecology	Technology	Legal	Economics	Social sciences	Data collection	Gap
National Fisheries policy of 2015-Tanzania	Poverty reduction through sustainable management and utilization of the fisheries resources.	Sustainable exploitation focussing on environmental protection is emphasized	Research and development are emphasized; promotion of aquaculture technologies	Emphasis on improving the legislative framework	PPP-investments are encouraged; support to finance and credit to fishers and farmers	Promotes Principle of social equity and fairness	Data gathering is emphasized	fiscal and monetary mechanisms in place to facilitate access to investment funds are not clear
Strategic Framework for Poverty Alleviation-Burundi								No explicit aspects of fisheries policy in the SFPA (Fisheries expected to contribute to Economic growth)
Growth and Transformation Plan (GTP)-Ethiopia								No evidence of fisheries policy
Fisheries Policy-Malawi	To promote sustainable fisheries resource utilisation and aquaculture development to contribute to food and nutrition security and	Strong emphasis on ecosystem approach	Research activities emphasised	Legislation is emphasized	Promote economic contribution	Emphasize social development and decent employment	The data-gathering mechanism is not stipulated	Investments and trade aspects are not explicit/clear

Existing regional Policy/policy instrument	Purpose	Ecology	Technology	Legal	Economics	Social sciences	Data collection	Gap
	economic growth of the country.							
National Environmental policy -Comoros								Mentions a few aspects of fisheries sustainability -no fisheries policy
Country Strategic Opportunities Programme-Eritrea								-no policy -the document emphasizes research in fisheries
MASTER PLAN FOR FISHERIES AND FISH FARMING IN RWANDA	The purpose of this plan is to identify high-priority options for strategic investment in fisheries and aquaculture and to lay out realistic and achievable targets	MP emphasizes safeguarding the environment & social risks	Technology is mentioned - to support increased production	Legal aspects are included	Contribute to economic development	MP emphasizes safeguarding the environment & social risks	To promote improved data collection	A clear mechanism/strategy for investment is lacking
Seychelles National Aquaculture Policy	Promote aquaculture	Responsive to environmental protection/aspects	The policy emphasises research and development	The Fisheries Act is present to regulate the sector	Emphasis on maximising the social-economic contribution of aquaculture	Supports involvement of the public in the benefits	No mention of the data collection mechanism	Investment is prioritized -but no clear actions to be taken are provided

Existing regional Policy/policy instrument	Purpose	Ecology	Technology	Legal	Economics	Social sciences	Data collection	Gap
		Strong emphasis on ecosystem approach						
SEYCHELLES FISHERIES SECTOR POLICY AND STRATEGY 2019	sustainable fisheries and aquaculture management and conservation s	Strong emphasis on ecosystem approach	Encourages creation and adoption of innovations to support sustainable management of resources	Clear regulation	Encourages strong economic contribution from the fisheries sector	Promotes equitable access to fisheries resources	Fishers are encouraged to provide georeferenced data; there is a strong emphasis on Data	Strong support in investment; fuel subsidies; access to soft loan schemes; promote integrated approach; reduce cost of investments & barriers It is a very detailed policy
Mauritius	No sectoral policy (embedded in government program)	Strong environmental policy	Challenges with information gathering	Available			Mot pronounced	
national freshwater (inland) wild capture fisheries policy for implementation -South Africa other many policies	Promote sustainable development of inland fisheries	Strong emphasis on ecosystem approach	Emphasises research and technology development	Promotes legal aspects	Encourages strong economic contribution from the fisheries sector	Promotes equitable access to fisheries resources by all	Data collection through research	Investment strategies not elaborated
Botswana				Have legal instrument				No policy

Existing regional Policy/policy instrument	Purpose	Ecology	Technology	Legal	Economics	Social sciences	Data collection	Gap
Swaziland								No policy
Namibia		Strong emphasis on ecosystem approach	Emphasises Research and development	Legislation to regulate marine fisheries	Facilitates fisheries' contribution to the economy	Promotes access to fisheries by all	Prioritise data collection	Promote joint ventures between foreign and national participants -to increase capital -policy not providing any subsidies and loan guarantees is maintained
Djibouti agricultural policy (no sector policy)								No policy
Mauritius -EU partnership agreement	to establish the terms and conditions under which vessels registered in and flying the flag of the EU may carry out tuna fishing in Mauritius waters		Promote scientific cooperation		Promotes economic cooperation -in the fisheries sector Conditional financial support if Mauritius permits			EU-partnerships Investment aspects not detailed
Reunion								-No internal policy

Existing regional Policy/policy instrument	Purpose	Ecology	Technology	Legal	Economics	Social sciences	Data collection	Gap
Common fisheries policy (CFP)								-Depends on the EU policy
Zambia Has draft policy				Fisheries act				
Somali Land				Fisheries act				

Table 8: Potential Fisheries investments and the policies addressing the identified gaps

Fisheries investments	Challenges faced	Key policies that govern operations of each fisheries investment	Interdisciplinary aspects addressed by the existing policies	Policy gaps in addressing the identified challenges to fisheries investment (state interdisciplinary ones as well)
Commercial-oriented Fishing	Increasing fishing pressure /overexploitation, illegal, unreported, and unregulated (IUU) fishing; high crime rate and piracy, high prevalence rate of some infectious diseases in fishing communities, pollution of the fisheries resources, and habitat change. Climate change is intensifying these pressures, posing very serious challenges and limiting livelihood opportunities. Sport/recreation fishing can be risky in that huge fish could drag away anglers. Landing sites have increasing human settlements/crowding	PFRS, AFRM, Regional agricultural policy-SADC; SADC Protocol on fisheries (2006); National Fisheries and aquaculture policies for EAC and SADC Member states, Trans-boundary fishing guidelines/laws.	- Research on fish biology and ecology for science-based evidence decision-making in the management of fish stocks & fisheries resources - Technology for sustainable exploitation & management of the fisheries and aquaculture resources - Strengthening policy for sustainable use and management of the sector (legal) - Economics: Promoting more private sector investment in the sector - Social sciences (gender and social inclusivity in the sector for more inclusive growth & community/stakeholder	- Protection of emerging threatened /endangered fish species. *(Discipline: fish biology & ecology)* - Cross-cutting issues like affirmative action to address infectious diseases that are rampant in fishing communities (*Discipline: Public health management*) - Controlling/preventing high crime rates and piracy, especially in tans-boundary water bodies (*Discipline: policy/legal affairs*) - There are limited private-public and international partnerships in Research & Development; - Harmonizing policy frameworks on the protection of intellectual and property rights Including indigenous knowledge systems.

Fisheries investments	Challenges faced	Key policies that govern operations of each fisheries investment	Interdisciplinary aspects addressed by the existing policies	Policy gaps in addressing the identified challenges to fisheries investment (state interdisciplinary ones as well)
	with poor hygiene conditions and sanitation, high rate of sexually transmitted diseases, high child-school drop-out rate, child labor, and early girl-child marriages,		engagements for collective planning & implementation of interventions). - Environmental management, e.g. interventions on adapting and mitigating climate change	
Fish trade including exporting and importing	Lack of access to financing, restricted market access (intra and inter), the need to ensure quality and safety of fish products, diseconomies of scale and not being able to add value to their catches, dis-jointed trade laws/legislature (intra and inter and internationally), several fees/taxes paid making it challenging to break-even (intra and inter and internationally), trade in threatened species	a) Harmonized East African Community guidelines for traders in fish, fishery, and aquaculture products and inputs in regional and international trade. b) E. African Standard Fish handling, processing, and distribution — Code of practice. Part 2: Code of hygiene for the handling, processing, storage, and placing of fish and fishery products c) SADC Protocol on fisheries (2006) d) The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) e) The International Union for Conservation of Nature (IUCN) guidelines on species for conservation f) National trade and investment policies /guidelines for each EAC and SADC Member state	- Enhanced economic growth - Public health (quality and safety of the products) - Enabling policy (legal aspects) - Conservation of endangered species (environmental aspect)	Enabling policy guidelines on fish trade during pandemics/epidemics (*Discipline: policy/legal affairs*) There is limited quality research-based data to guide decision-making to strengthen/improve fish trade initiatives (*Enhancing economics*). Strengthening policy on promoting programmatic investments in the fisheries sector, especially among artisanal fishers (rural localities), Small and Medium enterprises (SMEs), women, youth, and disabled (*Enhancing economics)* Need for harmonized national and regional financial inclusion policy (ies) / law (s), inclusive of the population that does use/ access conventional banking services.

Fisheries investments	Challenges faced	Key policies that govern operations of each fisheries investment	Interdisciplinary aspects addressed by the existing policies	Policy gaps in addressing the identified challenges to fisheries investment (state interdisciplinary ones as well)
		f) Intra-regional fish trade guidelines/laws		
Fish processing & fishery by-product processing	Poor product quality (insect infestation, mites, fungus, presence of sand, excess salt, rusting - brown discoloration, pink and yellow discoloration); inadequate facilities for preserving the products to increase their shelf-life; product quality not meeting market requirements; low returns on investment for some processed products	**a**) FAO and WHO (2009). Code of practice for fish and fishery products b) E. African Standard Fish handling, processing, and distribution — Code of practice. Part 2: Code of hygiene for the handling, processing, storage, and placing of fish and fishery products c) SADC Protocol on fisheries (2006) d) National fish processing policy guidelines for EAC and SADC Member states	- Public health management - Value addition enhancing incomes (enhancing economics) - Conservation of fish stocks as part of Environmental protection	- Guidelines on controlling new or emerging food spoilage or contaminating microbial communities *(Discipline: Public health management)* - Support artisanal fishing communities in programmatic investments to enhance their income. *(Discipline: Enhancing economics)*
Commercial-oriented Aquaculture	Poor access to - and reliable supply of quality, fish seed and feed, high cost of fish feeds, inadequate quality extension services, high investment costs, occurrence of fish diseases, low market price of farmed fish resulting into limited/not profits, limited financing of research to address sector-related challenges, the need to strengthen enabling policy on aquaculture	a) AU IBAR Aquaculture b) EAC aquaculture c) SADC aquaculture **d)** National aquaculture policies/laws for each EAC and SADC Member state	- Research to guide policy development - Contribution to the conservation of wild fish stocks - Technology generation & innovation - Enhancing income generation from aquaculture enterprises - Strengthening Extension services - Environmentally safe and sustainable aquaculture development - Climate change adaptation and mitigation	Policy/guidelines to manage /control emerging public health challenges from aquaculture activities and emerging aquatic infections/diseases attributed to climate change (*Discipline: Public health*) Strengthening policy on prevention/management of disasters in the aquaculture sector *(Discipline: legal aspect)* Strengthening aquaculture policy on preventing anti-biotic resistance (*Discipline: Public health*)
Trade in fisheries	High taxes; stringent	a) The African Union (AU)	- Promoting good product	

Fisheries investments	Challenges faced	Key policies that govern operations of each fisheries investment	Interdisciplinary aspects addressed by the existing policies	Policy gaps in addressing the identified challenges to fisheries investment (state interdisciplinary ones as well)
and aquaculture equipment, inputs and services	importation laws/restrictions and importation costs; products taking long on transit thereby affecting product quality; trade interruptions by epidemics/pandemics and emergencies like civil strife/wars; changing quality of items on the market and adulterated products.	Policy Framework and Reform Strategy on Fisheries and Aquaculture (2014). b) Regional agricultural policy-SADC; c) SADC Protocol on fisheries (2006) d) LVFO (2019). Harmonized EAC Guidelines for Traders in Fish, Fishery and Aquaculture Products and Inputs in Regional and International Trade. e) The EAC Protocol for the establishment of the Customs Union (2004) provides for streamlining of trade including trade in fish, fishery, and aquaculture products and inputs.	quality and safety (Public health)	
Accredited testing laboratory services	High operating costs versus returns on the investment, lack of accredited testing laboratories services in EAC MS. It is mainly done on SADC partially	Fish and fishery product quality assurance and monitoring (a public health intervention)	Enhancing economics	Regional and national policies for accredited testing & laboratory services are lacking in most member states of EAC and SADC. An updatable database of internationally accredited fish and fishery products testing **laboratories** lacking in AU MS to guide investors in quality assurance
Port/fish landing site operators	Oil pollution from engine-powered boats/ships; floods submerging infrastructure; receding water levels which cannot allow the big boat and	- Africa's blue economy - FAO Code of Conduct for Responsible Fisheries as a reference point. - SADC environmental		

Fisheries investments	Challenges faced	Key policies that govern operations of each fisheries investment	Interdisciplinary aspects addressed by the existing policies	Policy gaps in addressing the identified challenges to fisheries investment (state interdisciplinary ones as well)
	ship to dock at the ports/pierces with shallow water; sedimentation issues, Poor sanitation and hygiene (inadequate functional toilets and bathing facilities). Conflicts with other users of the fish landing sites/ports	legislation on the fisheries and aquaculture resources - SADC's Agreement on Port State Measures to Prevent, Deter, and Eliminate Illegal, Unreported and Unregulated Fishing (PSMA). It was adopted under the auspices of the FAO in 2009 and entered into force in 2016.		
Fish market operators/tenderers	Poor market infrastructure, in some instances products not meeting the required standards, traders defaulting on paying their dues to the market tenderers,	- SADC Fishery policy - SADC harmonized fish trading standards for member states to abide by within the free trade area - EAC Regional Trade Policy (2021) - EAC Rules of Origin (2015) -EAC Common Market Protocol	- Enhancing incomes from the fish trade - Promoting good quality and safety of products (a public health aspect)	

6. STAKEHOLDERS' VIEWS ON SOURCES OF FISHERIES, AQUACULTURE, SOCIO-ECONOMICS, AND ENVIRONMENTAL RELATED DATA (RESEARCH AND STATISTICS) IN EAST AND SOUTHERN AFRICA

A continetinel investigation was done on the the AU member states on Commission Studies on Identification of Sources of Fisheries, Aquaculture, Socioeconomics and Environmental Related Data (Research and Statistics) In East and Southern Africa. The study was geared at : i) Identify sources of fisheries, aquaculture, socioeconomics and environmental related data (research and statistics) in the East and Southern Regions of Africa and establish a mechanism for their regular updating. ii) Undertake studies to advance interdisciplinary approach in fisheries management to improve fisheries strategy and programmatic investments. The findings of the study were later presented to one big continental stakeholder workshop for validation of outcomes of the consultancy. The target respondents were the AU member states, Regional Economic Communities (RECs) and Regional Fisheries Bodies (RFBs), Regional Seas Conventions (RSC), water basin Commission, Partners, Non-State actors. The study looked at seven intervention areas. We revicied responses from Malawi and Uganda only and below were the key areas addressed.

6.0 Familiarization with AU policy instruments and strategies relevant to this consultancy area including the pan-African strategy on fisheries and aquaculture data management; the technical guide to harmonized fisheries data collection, management and analysis for the AFRICAN UNION; the PFRS and the AFRM

1. Many of our n**ational** institutions in the East and Southern Africa that are under AU: is your institution compliant with AU policy framework; Yes…….., No……
a. If NO what could be the causative effect leading to not being complaint? …
b. Is you institution ready to share data with other institutions in Africa; YES ……; NO……
c. If NO what could be problem…….

PART B: Questionnaire (R1:T3): Liaise with national and regional institutions (e.g., AU MS, RECs, RFBs) for identification of existing time series data and their sources in fisheries, aquaculture, socioeconomics and climate/ environmental related data (research and statistics) from relevant institutions in AU MS and establish a mechanism for regular updating; Identify sources of fisheries, aquaculture, socioeconomics and climate/environmental related data (research and statistics) from relevant institutions in AU MS and regional institutions and establish a mechanism for their regular updating.

2. What are the relevant **national** institutions in the East and Southern Africa that have time series data on:
d. Fisheries: Fisheries Department, Malawi – catch data……
e. Aquaculture: Fisheries Department, Malawi – fish harvest data……
f. Socio-economics: Fisheries Department, Malawi – frame survey data……
3. Climate/Environment: Department of Clime Change and Meteorological Services, Malawi……
4. What are the relevant **regional** institutions in the East and Southern Africa that have time series data on:
a. Fisheries: SADC, FAO Regional Office, AU-IBAR……
b. Aquaculture: SADC, FAO Regional Office, AU-IBAR ……
c. Socio-economics: SADC, FAO Regional Office, AU-IBAR ……

5. Climate/Environment:
   SADC……
   ……
   …
6. Is there a Policy Framework that governs access, regular updating and utilization of existing time series data among relevant institutions in the East and Southern Africa on?

a. Fisheries:
   No……
   ……
b. Aquaculture:
   No…….
   ……
c. Socio-economics:
   No…….
   ……
   ……
d. Climate/Environment:
   No……
   ……

7. What bottlenecks/challenges hinder regular update of time series data in the East and Southern Africa on:

a. Fisheries: Limited capacity – human resources and financial, priority differences
b. Aquaculture: As above……
c. Socio-economics: As above ……
d. Climate/Environment: As above ……

8. What mechanism(s) can be put in place to ensure that there is regular update of time series data in the East and Southern Africa regarding:

a. Fisheries: set up a data sharing centre/unit within RECs……
b. Aquaculture: as above……
c. Socio-economics: as above ……
d. Climate/Environment: This is being done……

9. What quality control mechanisms are in place by AU-IBAR to ensure time series data in the East and Southern Africa provide quality knowledge:

   ……
   ……
   ……

PART B: Questionnaire (R2&4: T4): Identify capacity in fisheries biostatistics and research data, socioeconomics, aquatic environmental data, data collection methods

1. Are there any efforts made by your institute/organization to collect data? in the area of:

Area	**Yes**	**No**
Fisheries biostatistics	Yes – by our research centres to a certain extent	
Research	Yes – by our research centres - to a certain extent	
Socio-economics	Yes – by our research centres to a certain extent	
Aquatic environment	Yes – by our research centres - to a certain extent	

2. Does your institute have capacity to collect the data referred to in (1) above?

If YES, please explain: to a certain extent manly for research that does not demand more financial resources like daily catch or harvest data, market data, annual frame surveys and fishing effort but for stock assessment surveys, these are not regularly done

If No, please explain: for activities like stock assessment surveys, these are not regularly done due to limited financial resources……

3. What methods are used in collecting data in the different areas?

Area	**Method used**
Fisheries biostatistics	Catch Assessment Survey (CAS) which is boat based and Malawi Traditional Fisheries (MTF) which is gear based for catch and effort data
Research	Several e.g. Sweeping Area Method
Socio-economics	Questionnaires
Aquatic environment	Biodiversity Index

PART C: Questionnaire (R4: T5): Review existing relevant regional, continental and global database and data collection, retrieval and dissemination systems.

1. What is the name of the database? FAOSTAT
2. Which habitat category is being addressed?
   a) Marine b) freshwater c) both
3. What is the dissemination mode?
   a) Web based b) mobile app c) both
4. What is the extent (regions country/countries) of coverage for data collection and dissemination? global
5. How is the data accessed from the database?
   a) Open-source b) subscription services c) login and access? d) any other
6. Which scientific domain is being addressed in the database or site?
   a) Biodiversity conservation b) aquaculture c) fisheries c) both
7. Based on the scientific domain in 6, what is the sub domain being addressed?
   a) Biodiversity conservation **b)** fisheries or aquaculture data collection **c)** environmental data GIS
8. What are/is the data sources into the system/system? Catch data
9. Who maintains/owns the database? FAO
10. What is the capability of the site/database? good
11. What are gaps that are prevalent for the system? Only for lack of submissions by some countries
12. What is reference material for the site? https://www.fao.org/fishery/en/collection/capture

PART D: Questionnaire (R3:T6):Conduct Policy-Oriented Studies Through Multidisciplinary Approach to Advance in Different Fields Including Biology, Ecology, Technology, Legal, Economics And Social Sciences, With The Purpose To Help Improving Fisheries Strategy And Programmatic Investments; Improve the fisheries and aquaculture through legal and other science related studies and technologies; Develop proposals to enhance interdisciplinary approach in fisheries management for improvement in fisheries strategy and programmatic investments.

(i) In your capacity what could be the fisheries strategy and program investments that could be used to improve fisheries and aquiculture?

Answer: training in data collection an archiving data……

PART E: Questionnaire (R1&2:T7): Conduct Inventory on Current And Historical Data On Integrated Fisheries Resources Survey (Or Fish Stock Assessments Data, Environmental Data) At Regional And National Level;: Identify sources of fisheries, aquaculture, socio-economics and climate/environmental related data (research and statistics) from relevant institutions in AU MS and regional institutions and establish a mechanism for their regular updating; Identify capacity and gaps in fisheries biostatistics and research data, socioeconomics, aquatic environmental data, data collection methods and their utilization for rational fisheries management and aquaculture development.

(i) What kind of data does your institution have? 1. Catch and harvest data on capture fisheries including aquarium trade and aquaculture and 2. Frame survey
(ii) For how long has you institution collected this data? Since 1970s
(iii) Can this data be accessed by any stakeholder including the regional and national institutions? Yes
(iv) Do you have data gaps in your data? Yes …… NO……
(v) If NO: What could be the problem that might have caused that data gaps. Financial issues

PART F: Questionnaire (R5: T8): Elaborate the utilization of data for production of knowledge products to enhance governance of the sector.; Contribute to the production of advocacy and position papers including the Africa Fisheries and Aquaculture report as well as enabling their dissemination.

1.Do you produce advocacy papers in your institution on Fisheries and Aquaculture?
Yes though not regularly prepared ……

2.If yes mention them

Poster papers b) Policy brief c) Brochure d) Fliers e) Factsheets

3.How do you disseminate information generated from your institution?

a) Email b) Seminars, c) workshops d) Baraza's e) Face to face f) Print media, g) Radios, h) TVs, i) Social media

4. If yes who do you disseminate information to?
General public, fisheries and fish farmers……..

a) Researchers b) Scientists c) General Public d) Students c) Policy Makers

……
……
5. Does your institution face challenges while disseminating information
no……
6. If yes, mention them
……...

7. What do you think can be done to overcome this challenge?
……..

7. UTILISATION OF DATA FOR THE PRODUCTION OF QUALITY KNOWLEDGE PRODUCTS TO ENHANCE GOVERNANCE OF THE SECTOR

Under this task, NaFIRRI is to develop an Advocacy position paper that would enhance, streamline, and harmonize data quality and nurture indigenous knowledge for sustainable growth of African Fisheries and Aquaculture through a shared vision and strategic framework that prioritise actions and strengthen the collaboration among East and Southern African governments. The paper is informed by months of stakeholders' consultations with national and regional Fisheries and Aquaculture

management institutions and the public on the kind of existing data that is collected and turned into knowledge products. To implement the Malabo Declaration, East and Southern African governments, the Fisheries and Aquaculture managers, fishing-related businesses and resource users need to work together to overcome difficulties experienced in current fisheries and aquaculture management efforts, work to improve on better strategies and promote programmatic investments. The paper outlines strategic recommendations for the AU to focus on the potential of fisheries and aquaculture management and development as far as knowledge generation and dissemination are concerned concerning the Malabo Declaration. The aforementioned advocacy position paper will cover the following format.

6.1 Position paper

- **Topic:** Unlocking the potential of fisheries and aquaculture **data and knowledge products to enhance governance of the sector in East and Southern Africa**
- 2. Introduce the topic with some basic background information. (Which existing mutual national data acquisitions, types, strategies and initiatives do East and Southern African countries have? Which country may have an edge in the way data is collected, and used over other countries? Can we use that to bench mark, streamline, and harmonize the data needs and, utility?
- 3. Introduce possible objections to your position. (how can data types, formats of key variables in Fisheries/Aquaculture sectors be streamlined and harmonised; how can participation of stakeholders in the fisheries and aquaculture value chains be supported and enabled; how can cultural and customary values/indigenous knowledge be nurtured?; how can opportunities as operating environment change be mapped out? and guide beneficiaries how to harness **knowledge products**)
- Support and acknowledge the opposing points.
- Explain why our position is still the best one, despite the strength of counter arguments.
- Summarise your argument and restate your position. End your paper focusing on your argument and avoid the counterarguments.
- When you write a position paper, write it with confidence and state your opinion with authority. After all, your goal is to demonstrate that your position is the correct one.
- Conclusion.
- The document will conclude by outlining selected strategic recommendations

6.2 Policy Brief

Then will have a policy brief format.

- Title. Streamlining and harmonisation of data needs, knowledge products for sustainable growth of fisheries and aquaculture sectors in East and Southern Africa or Sustainable fisheries and aquaculture: Expert knowledge from 24 countries in East and Southern Africa
- Executive summary.

  Ensuring productive and sustainable fisheries and aquaculture involves understanding the complex interactions between biology, environment, politics, management, and governance. This understanding is supported by evidence-based data (scientific knowledge) which should be linked with governance to sustainably manage fisheries and aquaculture resources. Utilising data gained from 24 African nations, we found that the main challenges perceived by fisheries experts were overfishing, habitat destruction, climate change, and a lack of political will. In this policy brief, we suggest data types and measures to address these challenges which do not require any radical change, including ecosystem-based fisheries data (gears, biodiversity data, MSY), environmental data, Socioeconomic data, and improved compliance, monitoring, and control data.
- Description of the problem. Jurisdictions in East and Southern Africa collect and share fisheries and aquaculture data, however, have limited collaborations amongst themselves to enable accurate and timely fisheries/aquaculture management decisions (including on socio-economic measures). The management of cross-jurisdictional fish stocks lacks streamlined and harmonised data acquisition, accessibility, and utility arrangements for a consistent operating environment at national, regional and continental levels. The datasets in some instances lack electronic data approaches and are not accessible to the public. Information on changing risk profiles associated with climate change that impinge on fishing and aquaculture enterprises needs to be collected and reported so as to anticipate and adapt to such risks. Overview of research.
- Current and proposed policies.

Current Policies	**Proposed policies**
1. National Fisheries and Aquaculture Policy, 2017 (UG)	
2. The Fisheries Act Cap. 378 of the Laws of Kenya	

3.The Fisheries Sector Master Plan (2021/22–2036/37)-TZ	
4. National Fisheries Policy, 2015-TZ	
5. National Plan of Action for Small Scale Fisheries (NPoA-SSF) Guidelines (2021)-TZ	
National Aquaculture Strategy (NADS) 2018–2025-TZ	
Fisheries Act No. 22 of 2003	
Tanzania Fisheries Research Institute (TAFIRI) Act No. 11 of 2016	

- Policy recommendations.
- Appendices and sources.

6.3 Details of the both the position paper and policy brief

- **Issue:** examine the issue you will be dealing with. Answer these questions: is the issue general or specific? How general/specific?
- **Audience:** Consider your primary audience. Your brief should be tailored to the needs of your audience. It makes a fundamental difference for how you must frame your analysis and your recommendation.
- **Actors:** identify the relevant actors for the issue you are dealing with. This is an essential step, since you will have to analyse their interests in order to make sensible and viable policy recommendations. Identifying the relevant actors is also essential to produce a good assessment of the context and of the interests that are plug into the issue.
- **Interests:** once you have identified the relevant actors, it is necessary to analyse their interests. What are the actors' interests? Which of the relevant actors have similar interests to your audience? Which ones have different interests? How different? This step is important both for the context part of your brief and for the critique of policy options/policy recommendations. Without a clear identification of the actors involved in the issue and their interests, your brief will result vague, and therefore not useful.
- **Recommendations:** your policy recommendations should reflect the above analysis. Remember that, according to the issue and the audience, your recommendation(s) might not suggest the best policy, but instead the most viable one. This should not limit your recommendation to just compromise policies. If you want to recommend radical change, you can; remember though that such radical action has to be implemented in some ways.
- The last step is to suggest to your audience the way to 'sell' the policy to its public (the public could be other members of the organizations, voters, other parties,

etc.). This last step helps your audience build support/consensus to implement the policy you recommended.

7: CONCLUSIONS AND RECOMMENDATIONS

7.1 Conclusions

The fisheries, aquaculture, socio economic and environmental sector holds significant potential in least developed countries (LDCs) for poverty reduction, employment generation, export diversification and structural transformation. Indications show that this sector remains underdeveloped and dominated by artisanal and/or traditional activities in the African region. Therefore, to have clear ways of data sources in this sector the following recommendations need to be addressed.

- Clear legal frameworks in the data collection and update in the whole African region.
- The involvements all the partner states both state and nonstate actors in this program approach would be pertinent for the success of the study program,
- The involvement of the regional blocks such as, FAO, SADC, UNEP, UNESCO in the data collection and regular update would be of value.
- Both regional and national personnel' in fisheries and other stakeholders need to be part and parcel in this program working in tandem with AU-IBAR.

In conclusion, regular data collection and updates in the fisheries, environment, at national and regional levels in Africa will be successful, once adherence to above mentioned recommendations is put in place at both national and regional levels on the African continent.

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