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FOR ANIMAL RESOURCES



REGIONAL FRAMEWORK ON ENVIRONMENTAL MANAGEMENT FOR SUSTAINABLE AQUACULTURE DEVELOPMENT IN AFRICA -

Eastern Africa and the Great Lakes Region

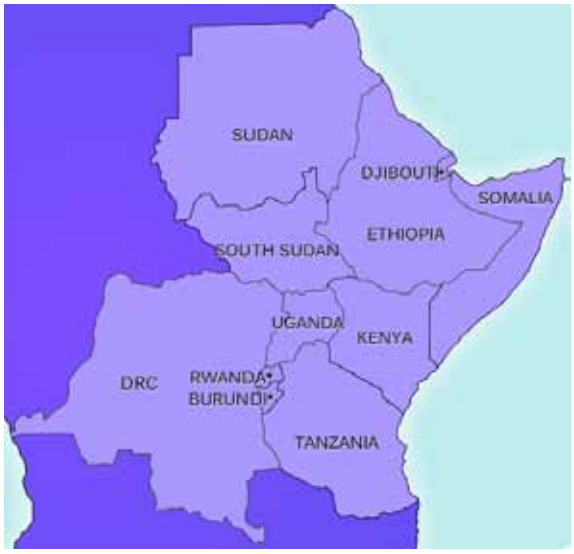


Figure 1. Member States in Eastern Africa and the Great Lakes Region



Figure 2. Water Basins of Africa

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ACRONYMS AND ABBREVIATIONS

AU	African Union
AUC	African Union Commission
AU-IBAR	African Union-Inter African Bureau for Animal Resources
AU MS	African Union Member States
BCC	Benguela Current Commission
BMP	Better Management Practices
CAADP	Comprehensive Africa Agriculture Development Programme
CAMFA	Conference of African Ministers of Fisheries and Aquaculture
CBI	Community-Based Initiative
CBO	Community-Based Organization
CCA	Climate-Change Adaptation
CCLME	Canary Current Large Marine Ecosystem
CCRF	FAO's (2011a) Code of Conduct for Responsible Fisheries
CSO	Civil Society Organization
DFID	United Kingdom International Development Agency
DRC	Democratic Republic of Congo
EAA	Ecosystem Approach to Aquaculture
EAC	The East African Community is an institution that comprises of Burundi, Kenya, Rwanda, the United Republic of Tanzania, and the Republic of Uganda as members
EAF	Ecosystem Approach to Fisheries
EC	European Commission
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration of the United States
GIASI	Global Invasive Alien Species Information Partnership
GIS	Geographic Information Systems
HACCP	Hazard Analysis and Critical Control Points
IGAD	Djibouti, Ethiopia, Kenya, Somalia, Sudan and Uganda are members of the Inter-Governmental Authority on Development
IUCN	International Union for Conservation of Nature and Natural Resources
MCS	Monitoring, Control and Surveillance
NASO	National Aquaculture Sector Overview
NEPAD	New Partnership for Africa's Development
NGO	Non-Governmental Organization
OECD	Organisation for Economic Co-operation and Development
PPPs	Public and Private Partnerships
REC	Regional Economic Community
RFB	Regional Fishery Body
RFO	Regional Fisheries Organization
RFMB	Regional Fisheries Management Body
RFMO	Regional Fisheries Management Organization
PFRS	Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa
R&D	Research and Development
SME	Small and Medium-Sized Enterprises
US	United States
WHO	World Health Organization
WTO	World Trade Organization
WWF	World-wide Fund for Nature

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FOREWARD

Aquatic ecosystems provide several goods and services including for fisheries and aquaculture production. Aquatic ecosystems are also the ultimate recipients of pollution from human activity, including from aquatic production practices. The productivity of aquatic production systems, aquaculture not withstanding depends on the status of aquatic resources. Aquatic resources are generally considered renewable. However, even while this might be so, they are not infinite. They need to be properly managed if their contribution to nutrition, economic and social well-being of the growing world's population is to be sustained. Irresponsible aquatic production practices can have significant adverse environmental and social impacts.

Africa's continental fisheries and development strategy, The Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (PFRS) consequently advocates for the sustainable management of aquatic resources for sustainable fisheries and aquaculture development. The FAO Code of Conduct for Responsible Fisheries encompasses this approach. The paradigm of this is enshrined in the Ecosystem Approach to Aquaculture. The ecosystem approach to aquaculture (EAA) is a strategy for the integration of aquaculture within the wider ecosystem to ensure sustainable development, equity and resilience of interlinked social-ecological systems.

In line with these, several African Member States require Environmental Impact Assessments as part of the requirements for the approval of large commercial aquaculture projects. However, it is the Continent's overall objective to expand commercial aquaculture to the level whereby aquaculture becomes a major contributor to fish production, rural employment, income as well as food and nutrition security. This infers that the number and size of operations as well as technologies employed shall increase and become more diversified.

Sustainable aquaculture development at such a scale entails that the application of strategic sectoral environment management approaches that do not just focus at the farm but also factor in the wider environment. This is because in practice, aquaculture is dependent upon the entire ecosystem. For example, at geographical level, clusters of farms that share a common waterbody or watershed need coordinated management to ensure sustainable utilisation and biosecurity. Cultured species are sensitive to water quality and are therefore extremely vulnerable to the damage inflicted by other users of the waterbody or watershed. Furthermore, while disease incidences can be controlled at farm level, their effects occur at the watershed level and often do require control, management and mitigation at the watershed level. Likewise, exotic fish that escape from fish farms often impacts on biodiversity across the entire watershed. External drivers of aquaculture such as population growth and development, trade and climate change also affect entire ecosystem. Watershed boundaries, trade and climate change transcend national boundaries.

Sustainable aquaculture development founded on the principles of EAA therefore requires transboundary initiatives. Common, coherent and practical regional frameworks and policies that promote sustainable development and responsible practice of aquaculture within watershed resource limits are inevitable necessary if the Continent's sustainable commercial aquaculture development goals are to be achieved. Given the importance, this Regional Framework was thus developed as a result of a consultative process that involved a **Consultative Regional Workshops on Aquaculture Environmental Management** to draft the framework that drew participants from the public and private sector involved in producers and other sector actors, environmental management agencies and aquaculture managers. The draft was circulated to Member States and Regional Economic Communities for review prior to validation.

Having frameworks for Environmental Management for Sustainable Aquaculture Development shall strengthen the capacity of Member States to make more realistic and appropriate aquaculture development plans, approve appropriate projects and institute environmental management assessments more effectively.

Additionally the adoption and mainstreaming of the Regional Frameworks into National Aquaculture Development Plans and Strategies shall facilitate the development and implementation of BMPs for all stakeholders, lower costs for undertaking Environmental Impact Assessments for practitioners, make it easier to implement labelling and certification of products and zone areas for aquaculture.

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EXECUTIVE SUMMARY

The Regional Framework on Environmental Management for Sustainable Aquaculture Development in Eastern Africa and the Great Lakes Region is based on principles of FAO's Ecosystem Approach to Aquaculture (EAA) and Code of Conduct for Responsible Fisheries. It adapts these concepts to the Comprehensive Africa Agriculture Development Program (CAADP) and the AUC Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (PFRS).

This regional framework has consequently been developed to ensure aquaculture development in the region conforms to the principles that promote responsible use of natural resources to ensure sustainability and equitable benefits for stakeholders and citizens of Eastern Africa and the Great Lakes Region.

In conformity to this, this framework is built upon six core principles, notably: Profitable – improve the productivity, incomes and potential to generate wealth from sustainable aquaculture practice; Inclusive – accommodate and meaningful engagement of communities, disadvantaged groups as well as other sectoral actors.; Healthy – supports nutritional well-being of society as well as ecosystem health; Smart – expands opportunities for the region's people to succeed nurturing them through to life-long learning, ensuring higher and more widely shared achievements by ensuring the best use of technology and training for aquaculture; and Green – safeguarding environmental goods and services for the future generations by developing the sector within parameters of the regions environmental carrying capacity and thus building capacity for responsible use of natural resources for aquaculture development

The desired outcomes from the implementation of this regional framework are sustainable commercial aquaculture development in the region characterized by (PEIWST): P = Increasing fisheries and aquaculture productivity, E = Improving profitability of fish enterprises, I = Enhancing inclusive sustainability, W = Wealth generation, S = Social welfare, nutrition and food security, T = Trans-boundary collaborative management to sustain aquatic ecosystem health.

The key themes reflect the main challenges facing the industry. To achieve this, the framework sets objectives, indicators, mitigation measures, monitoring and performance standards, as the starting point for responsible and sustainable sectoral development. The framework provides the foundation to support sustainable commercial aquaculture development in the region.

The document is divided into the following chapters:
Chapter One: Provides a situation analysis of aquaculture and its prospects in the region. These provide the justification of the framework

Chapter Two: Describes the outcomes of the consultative process as well as the status of environmental management for aquaculture in the region. It additionally details sustainable aquaculture development raised by stakeholders. It also suggests implementation roles for different the different agencies.

Chapter Three: Discusses the objectives, policy background and perceived outcomes from the framework

Chapter Four: Identifies the tools that can be applied to achieve the objectives of the framework to support sustainable commercial aquaculture development in the region. The environmental management tools are geared to meet both the legislative re¬quirements and ensure responsible use and management of aquatic resources for aquaculture

Chapter Five: Proposes institutional arrangements and roles of the different agencies in implementing this framework.

Chapter Six discusses stakeholder involvement.

Finally, the framework sets out the approach for delivery that will guide aquaculture policy in the region. It provides the platform needed to ensure a thriving and resilient aquaculture sector in Eastern Africa and the Great Lakes Region.

1.0. SITUATION ANALYSIS

1.1. Socio-Economic Overview of the Region

The Eastern African and the Great Lakes Region comprises Tanzania, Kenya, Uganda, Rwanda, Burundi, Eastern Democratic Republic of Congo, South Sudan, Sudan, Somalia, Ethiopia and Djibouti. The region has an estimated population of 325 million with a regional average growth rate of about 4% (World Bank 2015). The countries in the region are Low Income Developing Countries whose economies for whom agriculture is among the principle economic activities. The average Gross National Income of the region is USD 624 (IMF 2014).

1.2. Aquatic Resources

The collective freshwater and marine aquatic resources between these countries are vast. The main freshwater catchments in the Region include the Nile River Basin, The Jubba Basin, the Turkana, Basin and the Shabella Basin. The estimated regional surface area of these freshwater basins that are home to about 237 fish species (out of which 43 are indigenous) is 3,321,723 km2 (WRI 2012). The countries to the East border the Indian Ocean and western part of the Red Sea (see figure 1 above). Collectively, the total exclusive economic zones between these countries represent a marine resource covering up to 1,500,000 m^2 (FAO, 2015).

The aquatic resources provide a huge potential including in terms of potential genetic resources to sustain aquaculture development in the region. However, to achieve such levels of production, the rational utilisation of the aquatic and other natural resources is essential. This calls for the sustainable management of these transboundary aquatic ecosystems.

1.3. Status of Aquaculture

According to FAO statistics, the Eastern African Region produces about 24% of the continents capture fishery production estimated at 4.9 million tons and 9% of Africa's total aquaculture production estimated at about 681,000 tons (FAO, 2011, FAO, 2012 and FAO, 2014[a]).

The increase in capture fishery production over the last 10 years within the region was about 10%. Aquaculture on the other hand registered an increase in production of over 800%. These changes are a reflection of the production potential of the capture fisheries and aquaculture. The freshwater fisheries produce most of the regions fish. However, this resource has attained its limits. The largely unexploited fish production resources are aquaculture and high sea marine fishing. However, despite the growth in aquaculture, aquaculture contributed to only 11% of the regions total fish production in 2014. In 2014, the estimated regional aquaculture production was 149,273 tons out of the regions total fish production of 1,860,183 tons (FAO, 2014 a).

Eastern Africa's aquaculture is largely freshwater aquaculture from ponds on smallholder farms. The major aquaculture producing countries in the region are Uganda (74%), Kenya (16%) and Tanzania (7%) (FAO 2014[a]). The major species farmed are the tilapias (mostly *Oreochromis niloticus*), the African catfish (*Clarias gariepinus*) and the mirror carp (*Cyrpinus carpio*) and to a lesser extent Trout (*Oncorhynchus mykiss*) in the highlands Kenya and Tanzania. Milkfish (*Chanos chanos*), fresh water prawns (*Macrobrachium rosenbergii*), shrimp (*Paenaus sp.*) and Octopus (*Ocotpus sp.*) are also farmed to a lesser extent at artisanal level in the coastal regions.

1.4. Fish Supply and Trade in the Region

The countries in the region are among the Low-Income Food Deficit countries (LIFDC). Global per capita fish consumption has risen to above 20 kilograms a year, thanks to stronger aquaculture supply and firm demand, record hauls for some key species and reduced wastage, according to a new FAO report published today. However, population and production data indicate that in 2014 region's average per capita fish supply is about 4 kg per capita/year and actually declined by 6% between 2005 and 2014 (FAO 2014a, FAO 2016, World Bank 2016).

It is not surprising therefore that more food fish increasingly being imported into the region. While total exports are five times the value of imports, over the last four years, the value of fish imports into the region increased by 72% while exports increased by a margin of 16%. By value, the fish trade flows are to the European Union (40%), Eastern Africa (16%), Southern Africa (13%) and China (8%) (FAO 2014a). The trends show the regional demand and market potential for fish arising from the regions food and nutritional needs.

1.5. Climate Change

The status of the environment and the climate change phenomenon provides additional challenges for the sustainability aquaculture development in the region. The current major threats to aquatic environmental sustainability in the region arise from changes to land use patterns as a result of anthropological changes and demographic pressure as well as pollution. Notable among these are poverty, rapid population growth, land use and tenure systems, mass movement e.g. of refugees, and limited energy alternatives for the majority of the population. Consequently, the ensuing environment deterioration and reduction of ecosystem goods and services characterized by loss of habitat due to land degradation, deforestation to clear agriculture, industrialisation, urbanisation and other uses with the consequent pollution have had effects on water supply and quality. The effects on aquatic productivity and ecosystem health subsequently limit the prospects for sustainable aquaculture development (AU-IBAR 2016a, Cheche 2015).

The predicted climate change for region include unpredictable seasonal weather patterns, increased flood frequency, droughts, increases in sea levels, higher ambient temperatures, elevated levels of atmospheric carbon-dioxide as well as unprecedented extreme events. Consequently a rise in water tables, changes in sediment budgets, water scarcity, and changes in aquatic productivity due to increases in water temperature, acidification of waters, higher siltation and evaporation levels are expected. Within the marine ecosystems, a rise in sea levels with the associated consequences, coastal erosion, warmer waters, loss of coastal ecosystems (including fishes and seaweeds), inundation of low-lying areas and saline intrusion is envisaged.

The environmental and predicted climate change effects on marine and inland ecosystems described above shall clearly have an effect on water availability, water flows and physico-chemical characteristics (quality) of water. Aquatic species, unlike terrestrial animals, are poikilothermic. Their body temperatures and their biological functioning vary directly with water temperature and prevailing water quality characteristics. Environmental and climate change induced variations on water volume and quality shall therefore have a more immediate and stronger impact on aquatic animal production compared to that of terrestrial animals.

For aquaculture, the greatest risks arise from environmental pollution and habitat destruction which may have a negative effect on water supply and quality for production, aquatic animal health and product safety. Droughts are likely to result in reduced water supply for ponds and dams where cage culture is practiced. Floods will on the other hand result in siltation and potentially destruction of ponds. Changes in sea level and salinity levels also affect the opportunities for marine aquaculture. These dynamics will likely result in

economic loss for farmers particularly isolated smallholders whose ability to harness and control water flows for an entire production cycle are limited. The status of the aquatic environment not only affects the levels of production but also product safety.

It should also be noted that there are other users of this key resource whose interests need to be safeguarded. Potential negative impacts from aquaculture include habitat destruction, collection of juveniles as stocking material from the wild, species introductions, aquatic animal disease and pollution as a result of production inputs need to be mitigated against.

In consideration of the above, harnessing the full potential of the regions aquatic resources for sustainable aquaculture development entail healthy aquatic ecosystems. However, the status of aquatic resources, as well as the impacts of environmental and climate change on aquatic ecosystems health, do not abide by political boundaries. Therefore, cooperation and collaboration between the Member States in managing these resources collectively for the common good is a pre-requisite to ensuring sustainable growth in the sector within the region.

2.0. HOW WE GOT HERE

2.1. The Process

The process used to develop the framework was an all-inclusive consultative and collaborative process between both public and private sector stakeholders from national, regional and international arenas. The broad consultative culminated into a regional consultative workshop held in Kampala, Uganda in 2015 that involving all Member States within the region, the Regional Economic Communities and Regional Fisheries Bodies in Kampala Uganda. These included representatives from East African Community (EAC) represented by the Lake Victoria Management Organisation (LVFO), and Inter-Governmental Authority on Development (IGAD) members. These countries that participated in this consultative process were Burundi, Djibouti, the Democratic Republic of Congo (DRC), Eritrea, Ethiopia, Kenya, Rwanda, Somalia, South Sudan, Sudan, Tanzania and Uganda. There was also representation from FAO and private sector stakeholders in the region.

2.2. The Status of Environmental Management for Aquaculture in the Region

At the regional level, the regional communities have taken steps to support transboundary natural resource management based upon International Policy and Best Practices on Environmental Management. The specificities for aquaculture as an emerging and rapidly growing sector are yet to be comprehensively addressed. IGAD, however, is presently working on a regional framework for aquaculture-specific EIAs to overcome coordination problems amongst its member countries' shared water bodies.

At the national level, 82% of the 11 countries in the region had either national aquaculture specific or generic environmental policies or laws that sufficiently supported the regular utilisation of Environmental Impact Assessments (EIAs) (see table 1 below). Of these, only four countries stated that these instruments were satisfactorily being implemented. Limited capacity and weak effective mechanisms were found key identified constraints in the implementation of EIA's for aquaculture. Notable among the causes for the latter were lack of legal and institutional arrangements for effective coordination and communication between regional and sectoral offices at (AU-IBAR, 2015c). Implementation and coordination amongst numerous actors is a common problem that public administrations face worldwide (Hill and Hupe, 2010; Pressman and Wildavsky, 1973).

Table 1: *The status of EIA implementation for aquaculture in the region*

Country	Policy/framework established	Policy/framework implemented	Regulations established	Process applied and enforced
Burundi	+	-	-	±
Djibouti	n/a	n/a	n/a	n/a
DRC	+	+	+	+
Ethiopia	+	±	+	+
Kenya	+	+	+	+
Rwanda	+	+	+	+
Somalia	+	n/a	n/a	n/a
S. Sudan	-	-	-	-
Sudan	+	±	n/a	n/a
Tanzania	+	+	+	+
Uganda	+	±	+	±

The grading is based upon the August 2015 reports presented by MS pa participants. (-) indicates no or minimal progress; (±) in the process of development; (+) developed and are being implemented; (n/a) could not be established.

Specific steps are yet to be undertaken to develop harmonised guidelines on Environmental Management for Commercial Aquaculture (AU-IBAR, 2016a). The overlap arising from Member States belonging to more than one Regional Economic Communities also entails harmonisation of policy between the RECs where aquatic resources are shared.

2.3. Outcomes of the Consultative Process

Commercial aquaculture value chains entail the utilization of natural resources for production, harvesting, processing, marketing and utilization of wastes. This places qualitative and quantitative demands on land, water and other ecosystem resources for inputs and the assimilation of wastes. Further to this, these resources have multiple functions and users. The needs of these and the impact of aquaculture on other uses and users need to be taken into account.

In addition access to and the rational utilisation of suitable environmental goods and services notably land and water for production and inputs derived from natural resources notably seed and feed in the right quantities shall be required. The potential consequences of having increasingly more independent smallholder concentrated in an area independently managing aquatic resources for production in close proximity was also raised. Other concerns were the need to ensure biosecurity, food-safety, and occupational health as well as mitigate against pollution, genetic intrusion and alterations to biodiversity, land and aquatic ecosystem degradation as a result of growth in aquaculture.

To address these concerns the capacities to collect and utilise eenvironment and natural resource data and information, undertake transboundary water basin management and environmental assessments for aquaculture, domesticate multilateral environmental agreements, create awareness, address knowledge gaps and co-opt the participation of all stakeholders was key.

The above issues make it imperative that for sustainability, aquaculture practice in the region should encompass resilience, be smart, productivity and be all inclusive (table 2). The critical elements to support for an enabling environment in the region to support the sustainable development and growth of equitable commercial aquaculture include were:

1. Creation of awareness on environmental impact assessment in aquaculture systems
2. Broadening participants understanding of the EAA and its relevance to sectoral planning.
3. Identification of the main ecosystems and bio-security issues likely to arise as commercial aquaculture sector expands within the Eastern Africa and the Great Lakes Region
4. Identification of socio-economic issues (including policy and governance) relevant to aquaculture environmental management within Eastern Africa and the Great Lakes Region
5. Development of draft guidelines for environmental management framework for suitable aquaculture development Eastern Africa and the Great Lakes Region.

Table 2: *The envisaged outcomes of regional framework for aquaculture*

Theme	Description
Resilient	Prepare for the effects of climate change and ensure fisheries operate within the carrying capacity of the environment, with an especial focus on minimising the industry's ecological footprint.
Smarter	Optimise productions and increase profitability by applying tools and technology to inform planning and decision-making in situations of complex trans-boundary and multi-dimensional governance.
Productive	Promote and enhance the yield of high-quality farmed fish and shellfish in order to satisfactorily supply goods that meet: (1) the needs of locals in safeguarding food security and livelihoods; and (2) the demands of markets, thereby boosting regional economies.
Inclusive	Collaborate with stakeholders to fairly manage regional resources.

3.0. THE FRAMEWORK

From the above it is evident that there is a need to increase fish production within the region both for food and nutrition security as well as socio-economic reasons. However, given dynamic the nature of aquatic resources the sustainability of these resources for aquaculture as for any other use is best done at the watershed level. Watershed level sustainability for aquaculture should aim to sustain ecosystem health and biodiversity, food supply and community benefits. The regions watersheds (figure 1) are transboundary.

Optimizing the region's potential for aquaculture while at the same time ensuring that each Member State's territorial aquatic resources can sustainably produce aquatic animals for the benefit of its citizens, requires regional cooperation and collaboration for the common good. Comprehensive policies that encompass regulatory frameworks, institutional arrangements and ecosystem monitoring focused at mitigating the impacts of aquaculture production systems and managing risk at both the ecosystem and farm level within the context of overall national, regional and continental development goals consequently become critical elements for success.

3.1. Purpose and Objectives of the Framework

The purpose of this regional framework is to provide the principles and guidance for the responsible utilisation of the regions aquatic resources for sustainable aquaculture development resilient to climate change while at the same time maintaining ecosystem integrity and the supply of other essential aquatic goods and services.

The overall objective of this approach to ensure the sustainability and growth of aquaculture as an economic activity that contributes towards poverty eradication in the region. Specifically the region envisages that aquaculture practiced within this framework shall result in the specific objectives listed in line with the continental and global Sustainable Development Goals. The regions specific objective for adopting this approach for sustainable aquaculture development is to transform aquaculture in the region into (AU-IBAR, 2016[a]):

a. A source of social security (employment, income generation etc.)
b. A source of nutrition and food security
c. Increase aquaculture production and productivity
d. An activity that is based upon rationale and sustainable use of shared water bodies.

The framework therefor provides the foundational basis, guiding principles and tools that could be used to promote the harmonised and coherent planning, development and practice of commercial aquaculture within local ecological carrying capacities to ensure sustainability and ecosystem integrity. In addition to promoting biosecurity, such an approach also facilitates the assurance of food-safety and market access for the regions aquaculture products.

Additional benefits the implementation of this framework shall provide for practitioners in the sector include the improvements in the feasibility of undertaking Environmental Impact Assessments for Aquaculture (EIAAs), development and implementation of appropriate Best Management Practices (BMPs), zonation for aquaculture and reduced conflicts arising as a result of aquaculture.

3.2. Policy Background and Principles of the Framework

In addition to addressing the needs of the region, this framework is anchored upon the following global and continental policies. At the global level it integrates the sustainable Development Goals (SDGs) (UNDP,

2015), the FAO Code of Conduct for Responsible Fisheries (FAO, 1995), FAO's Ecosystem Approach to Aquaculture Development (FAO, 2010).

At the continental level it is coherent with the Comprehensive Africa Agriculture Development Programme (CAADP) that was endorsed at the African Union Heads of State Summit as a New Partnership for Africa's Development (NEPAD) program in July 2003 (AUC, 2003). It is additionally coherent with the Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa that was endorsed by African Heads of State and Government at Malabo in 2014 (AUC-NEPAD, 2014).

The core principles of the framework consequently are:

1. **Sustainable Growth:** The aquaculture industry is ambitious to grow but growth must be sustainable and equitable. Growth must be within the carrying capacity of the aquatic environment and balanced against the needs of others.
2. **Economic principle:** Aquaculture industries should be able to fulfil their ambitions for growth, be market-led with a focus on quality leading to improved economic returns for the industry and greater market stability.
3. **Environmental principle:** Aquaculture industries should act as a good neighbour by minimising risks to biodiversity and impact on the environment and other aquatic activities. Growth should be within the carrying capacity of the environment.
4. **Social and Equity principle:** Aquaculture industries should underpin strong local communities and provide benefits to those communities.

The output of the consultative process further suggested the following themes that consequently become key parameters for the development and application of the framework

3.3. Users of the Framework

It is proposed that this framework be adopted and implemented by all stakeholders in the aquaculture value-chain. The primary stakeholders for whom this framework is intended are:

1. Member States in the Region.
2. Regional Economic Communities and Resource Management Entities
3. Sector Participants
4. Consumers
5. The Broader Public

4.0. THE REGIONAL FRAMEWORK ON ENVIRONMENTAL MANAGEMENT FOR SUSTAINABLE AQUACULTURE

4.1. Thematic Overview of the Regional Environment Management Framework for Sustainable Aquaculture Development in the Eastern Africa and Great Lakes Region

Table 3 describes the key regional themes for the framework along with a description of the desired outcomes under the key parameters.

Table 3: *Thematic Overview of the Regional Environmental management Framework for Sustainable Aquaculture Development in the Eastern Africa and Great Lakes Region*

KEY REGIONAL THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					Desired Outcomes
	PROFITABLE	INCLUSIVE	HEALTHY	SMART	GREEN	
Increasing fisheries and aquaculture productivity (P)	Maximising profitability by promoting a positive image of the industry, making best use of the region's quality brands to secure markets home and abroad and retain and attract the best people and innovators	Protecting valuable assets by high standards of husbandry and bio-security to benefit all sectors and surrounding communities	Producing healthy high quality, safe farmed fish and shellfish backed by a modern effective food safety regime	Develop plans and spatial zoning to make optimal use of the space available to grow fish and shellfish through open and transparent processes	Sites located to ensure optimum production of high quality, safe farmed fish and shellfish	Grow Aquaculture to supply the additional animal protein needed by 2050, employ millions more people than today and generate billions of dollars in additional income
Improving profitability of fish enterprises (E)	Strong industry with a strong brand through well-established markets and developing new markets for higher value and niche products and retaining stock within farm premises to increase profitability whilst preventing conflict with others' interests	Solving these multi-layered problems through a viable approach that begins with tailoring these schemes to the needs of important stakeholders especially smallholders who potentially have the most to gain	Promoting the health and nutritional benefits of farmed fish and shellfish	Ensure favourable conditions for both commodity and niche market production, better integration with transport and processing infrastructure and improved staff training and development	Enhancing the industry's reputation for respecting the environment through adoption of best practice and greener technologies and reducing the impact on wild fisheries by increasing use of alternative feed sources and minimising the pressure on wild stocks	Maximised profitability for commodity and niche market producers by promotion of a positive image of the industry and making best use of national and regional quality brands to secure markets at home, regionally and abroad and provide sustainable employment opportunities

KEY REGIONAL THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					Desired Outcomes
	PROFITABLE	INCLUSIVE	HEALTHY	SMART	GREEN	
Enhancing inclusive sustainability (I)	Develop a climate to improve investor confidence, supporting and underpinning the long-term future and competitiveness of the sector	The different member states and markets have their own unique strengths and weaknesses, and each will require a hybrid governance model that embraces both the private and public sectors to deliver the objectives and make things work.	Developing both species-specific and generic multi-species unified certification standards. Avail government oversight and scope so that take all of the externalities of their activities into account when applying for sustainable certification	Establish standards that cover many species, and take the farmers themselves into account and facilitate best use of technology and resources to make aquaculture attractive to investors	All major schemes consider the environmental costs of production, transportation and distribution.	Development programs that fully incorporate women and marginalized groups into program design and implementation. Strong broader government regulation since no single unified scheme will ever fully satisfy the needs of all stakeholders, but that doesn't mean that a unified approach to tackling these related issues couldn't work
Wealth generation (W)	Ensure favourable conditions for both commodity and niche market production, better integration with transport and processing infrastructure and improved staff training and development	Break language barriers, cost, and time constraints for farmers that are often unable to participate in most of programs. Ensure deplorable working conditions that sometimes prevail on these farms are addressed by the standards. Certainty and clarity going forward, underpinning downstream activities and benefits to local and upstream communities	Protecting valuable assets by high standards of husbandry and bio-security to benefit all sectors	Ensure large stakeholders and smallholders are equally comply with strict national food and safety standards, and ensure that they are in a prime position to take advantage of the schemes already in place.	Enhancing the industry's reputation for respecting the environment through adoption of best practice and greener technologies and reducing the impact on wild fisheries by increasing use of alternative feed sources	Market-led aquaculture investments operating in all member states

KEY REGIONAL THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					Desired Outcomes
	PROFITABLE	INCLUSIVE	HEALTHY	SMART	GREEN	
Social welfare, nutrition and food security (S)	Develop schemes that take into considerations the working conditions of farmers and protect valuable assets by high standards of husbandry and bio-security to benefit all sectors	Break language barriers, cost, and time constraints for farmers that are often unable to participate in most of programs. Ensure the deplorable working conditions that sometimes prevail on these farms are addressed by the standards	Promoting the health and nutritional benefits of aquaculture products and producing healthy high quality, safe farmed fish and shellfish backed by a modern effective food safety regime	Continual development of control strategies and making best use of available medicines as well as research and development into emerging diseases	Good strategies to help minimise discharge of medicine residues to the environment and the appropriate disposal of mortalities to limit disease spread	A secure long-term future for the industry by protecting the asset through adoption of disease and parasite-control strategies which also contribute to minimising impacts on the environment
Trans-boundary collaborative management (T)	Securing finance to support the long-term stability and development of the industry	Establish public consultation for multi-site certification methodology where stakeholders are invited to have their say during public comment periods that then feed into the regional forum and global decision and position on aquaculture	Adopt a scheme for accredited Certifiers and monitoring by an independent accreditation organisation for fish farms and fish product suppliers	Ensures the region's programs are robust, credible and meet best practice guidelines for standard-setting organizations as set out by FAO	Development of the right sites in the right places through transparent, streamlined and proportionate regulation and processes to minimise adverse impacts on other users of the marine and freshwater environment	strengthening south-south cooperation as well as the "African Voice" on international policy dialogue with implications for African fisheries governance Transform aquaculture towards environmental sustainability and social responsibility using efficient market mechanisms that create value across the value chain.

4.2. Strategies to Address Key Issues for Sustainable Aquaculture Development within the Thematic Context of the Framework

This section gives a more detailed outline of each of the six key themes identified by stakeholders and five objectives of the Aquaculture Framework. The issues, as identified by stakeholders from member states, are highlighted within each theme as well as how they relate to other themes and the strategic objectives of the Eastern Africa and Great Lakes Region's Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa.

4.2.1. Increasing Fisheries and Aquaculture Productivity (P)

Desired Outcome: Grow Aquaculture to supply the additional animal protein needed to employ millions of more people than today and generate billions of dollars in additional income.

ISSUES IDENTIFIED BY STAKEHOLDERS	LINKS TO OTHER KEY THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					DESIRED OUTCOME
		P	I	H	S	G	
Quality of seeds and fertilisers used	P, E, W	√		√	√	√	Invest in technological innovation and transfer, specifically breeding and hatchery technology, disease control, feeds and nutrition, and development of low-impact production systems
Improved containment							
Land ownership competition with other land and water uses Land and water use conflict	P, I, S, T	√	√	√	√	√	Facilitate land availability for specific enterprises Mapping of suitability areas Carry out Strategic Environmental Assessment (SEA) Develop Land-use Master Plans Zonation of water-based practices
Trans-boundary issues and land and water use conflict	S, I, T		√	√	√	√	Aquaculture plans, in the context of marine plans and river basin management plans, which provide a clear indication of where aquaculture development may take place for production of shellfish, finfish and other species
Disease management	P, E, W, S	√		√	√	√	Effective control strategies for fish and shellfish diseases including efficient identification of emerging diseases and compliance with an industry code which is evolving to reflect current best practice, Quarantine, Capacity building to end users, and Certification of the enterprises
Escape to the wild	P, S, I, T	√		√	√	√	Stringent measures to avoid escape and encourage research on surveillance of escaped organisms - knowledge is needed concerning the quantitative and qualitative effects of escapes on local populations.

ISSUES IDENTIFIED BY STAKEHOLDERS	LINKS TO OTHER KEY THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					DESIRED OUTCOME
		P	I	H	S	G	
Waste management	P, I, T	√	√	√	√	√	Robust and bio-secure arrangements for the satisfactory disposal of waste and mortalities – both routine and for mass mortality events or emergency culling
Feed sustainability	P, E, W	√		√	√	√	Feed derived from sustainable sources and understood as such

***P** = Increasing fisheries and aquaculture productivity, **E** = Improving profitability of fish enterprises, **I** = Enhancing inclusive sustainability, **W** = Wealth generation, **S** = Social welfare, nutrition and food security,) **T** = Trans-boundary collaborative management*

4.2.2. Improving Profitability of Fish Enterprises (E)

Desired Outcome: Maximised profitability for aquaculture commodity and niche market producers by promotion of a positive image of the industry and making best use of the Eastern Africa and the Great Lakes Region's quality brand to secure markets at home, within the region and abroad and to provide sustainable employment opportunities.

ISSUES IDENTIFIED BY STAKEHOLDERS	LINKS TO OTHER KEY THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					DESIRED OUTCOME
		P	I	H	S	G	
Aquaculture as a viable career	P, I, S, W, E	√		√	√		Aquaculture recognised as a rewarding career which attracts, retains, educates and trains talented and innovative people
Structure the industry and adopt a value- chain approach		√		√	√	√	Planned processing, access to markets and overseas
Diversification in aquaculture, new species and new markets	P, E, S,	√	√	√	√	√	Strategy in place to support diversification and innovation through development of new species production with good market prospects, informed by developments in technology
Health benefits of eating fish and other aquaculture products	E, W, S	√		√	√		Promotion of health benefits of fish and other aquaculture products by clear linkage of aquaculture to the region's food policy
Feed sustainability	P, E, W	√		√	√	√	Feed derived from sustainable sources and understood as such
Reduced waste and appropriate utilisation of by-products	P, E, W	√	√	√	√	√	Create and use environmental grants to develop measures to minimise waste products and utilise by-products

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4.2.3. Enhancing Inclusive Sustainability (I)

Desired outcome: Strengthen broader government regulation with a unified approach that respects the needs of all stakeholders. Establish investment climate which supports and underpins the long-term future and competitiveness of the sector with investment in best practice and new technologies. Development programs that fully incorporate women and marginalised groups into program design and implementation are more effective than those that don't (USAID, 2013). Men, women, and children all play a role in maintaining healthy fisheries and aquaculture enterprises. For this reason, it is important that both genders be considered and consulted within the fisheries and aquaculture planning, policy, and decision-making processes leading to reform. This starts with breaking down what, until recently, have been some long-held misperceptions about men, women, and even youths' roles in these sectors - the misperception that livelihoods in fishing and aquaculture are male-only occupations, and women are only involved in post-harvest activities. Recent research (USAID, 2013), however, estimates that at least 50 million women in developing countries, often with children at their side, work in the fishing and aquaculture industries, performing a wide range of activities from harvest to post-harvest.

ISSUES IDENTIFIED BY STAKEHOLDERS	LINKS TO OTHER KEY THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					DESIRED OUTCOME
		P	I	H	S	G	
Lack of public sector funding	P, E, I	√	√	√	√	√	Best use of available public funding for the benefit of the whole industry including research grants
Lack of private sector funding	W, E, T	√	√	√	√	√	More private sector funding available, encouraged by government and investor confidence
Competitiveness of Eastern Africa and the Great Lakes Region's aquaculture with aquaculture in other countries	P, E, W	√		√	√	√	The aquaculture industry is competitive within each market area
Lack of standards that cover many species, and take the farmers themselves into account and facilitate best use of technology and resources to make aquaculture attractive to investors	P, I, S, T	√	√	√	√	√	Standards established that take into account all stakeholders including farmers
Gender and marginalised groups	E, I, W, S		√		√		No barriers to both gender's and youth participation, access to resources (e.g., land, credit), and voice in decision making Development programs that fully incorporate, men women and marginalized groups into program design and implementation

***P** = Increasing fisheries and aquaculture productivity, **E** = Improving profitability of fish enterprises, **I** = Enhancing inclusive sustainability, **W** = Wealth generation, **S** = Social welfare, nutrition and food security,) **T** = Trans-boundary collaborative management*

4.2.4. Wealth Generation (W)

Desired Outcome: Market-led aquaculture investments operating in all member states and correct the impression of aquaculture being a high risk enterprise.

ISSUES IDENTIFIED BY STAKEHOLDERS	LINKS TO OTHER KEY THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					DESIRED OUTCOME
		P	I	H	S	G	
Poor quality inputs (Seed and Feed) coupled with increasing prices	P, E, W, I, S	√		√	√	√	Provision of inputs (feeds and seeds)
Small scale farms with uncoordinated production	P, E, W, I	√	√	√	√	√	Regulations and licensing in place
Short term business outlook by farmers	E, W	√		√	√	√	Provision of support services e.g. Veterinary
Undiversified aquaculture species and markets	P, I, E	√	√	√	√	√	Strategy in place to support diversification and innovation through development of new species production with good market prospects, informed by developments in technology
Aquaculture is a high risk enterprise	I, E	√		√	√		Aquaculture recognised as a viable and rewarding career which attracts, retains, educates and trains talented and innovative people
Engagement with Africa and wider international stage	T, E	√	√		√		The region is proactive and effectively engaged with other countries on aquaculture issues including implementation of the aquaculture strategy, sharing best practice and as a major contributor to international cooperation on research
Employment from the Fisheries and Aquaculture	W, E,		√	√			Direct Employment and Credit facilities development

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4.2.5. Social Welfare, Nutrition and Food Security (S)

Desired Outcome: Aquaculture in the region uniquely important to livelihoods, food security, and poverty alleviation and programs in place that engage the public-private sector while applying value-chain approaches. Programs promote marketing of sustainably sourced, socially responsible.

ISSUES IDENTIFIED BY STAKEHOLDERS	LINKS TO OTHER KEY THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					DESIRED OUTCOME
		P	I	H	S	G	
Healthier fish and shellfish	S, E	√		√	√	√	Producing healthy high quality, safe farmed fish, seaweed and shellfish backed by a modern effective food safety regime

ISSUES IDENTIFIED BY STAKEHOLDERS	LINKS TO OTHER KEY THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					DESIRED OUTCOME
		P	I	H	S	G	
Licensing, Certification, Control and Surveillance	I, S, T	√		√	√	√	Improved systems for licensing aquaculture developments
Operational Transparency	I, S, T			√	√	√	Development of the right sites in the right places through transparent, streamlined and proportionate regulation and processes to minimise adverse impacts on other users of the marine and freshwater environment
Social and economic inclusion	S, I		√	√	√	√	Certainty and clarity going forward, underpinning downstream activities and benefits to local communities
Hatcheries/production of disease-free smolts, eggs and spat	S, P, I		√		√		Secure retention of viable finfish and shellfish hatcheries
Shellfish quality and public health	S, T, I	√		√	√	√	Establishment of improved controls and testing mechanisms
Fish and shellfish disease control including emerging diseases	S, T, I	√		√	√	√	Effective control strategies for fish and shellfish diseases including efficient identification of emerging diseases and compliance with an industry code which is evolving to reflect current best practice
Impact of aquaculture on other users	I, S, T	√		√	√	√	Impact of aquaculture on wild fisheries, biodiversity and wider environment minimised through robust and appropriate planning and licensing systems
Conflict of resource users	I, T		√	√		√	Zonation/ mapping of aquaculture sites Develop awareness creation programme Develop conflict resolution mechanism Capacity building programmes
Inadequate data and information on socio-economic issues regarding environment and aquaculture development and contribution	S, I, P		√	√	√	√	Evidence based policy and programmes Conduct surveys and studies including indigenous species Documentation and dissemination of results Documentation and dissemination of results Conduct exchange visits/ study tours
Institutional arrangement	T, I, S		√		√	√	Develop institutional arrangements for enhancing collaboration and partnership
Access rights to land and water	T, I, S		√	√	√		Cross border collaboration and legal framework

4.2.6. Trans-boundary Collaborative Management (T)

Desired Outcome: Win-win- solutions that strengthen South-South cooperation as well as the "African Voice" on international policy dialogue with implications for African fisheries governance and transform the region's aquaculture towards environmental sustainability and social responsibility using efficient market mechanisms that create value across the value chain. Establish a legal framework to address issues, conflicts and financing.

ISSUES IDENTIFIED BY STAKEHOLDERS	LINKS TO OTHER KEY THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					DESIRED OUTCOME
		P	I	H	S	G	
Engagement within the region, Africa and the wider international stage	I, E, T		√	√	√	√	Eastern Africa and the Great Lakes Region proactive and effectively engaged with other countries on aquaculture issues including implementation of the aquaculture strategy, sharing best practice and as a major contributor to international cooperation on research
Market-led aquaculture development approaches to accelerate aquaculture growth	W, E, I	√	√	√	√	√	Strong strategic and implementation plans, privatised services and laws and regulations that protect investor and farmer investments Governments political will to support the aquaculture sector Market, governance and investment conditions are conducive for economic growth
Management Regime	T, I		√	√		√	A forum to support discussion among trans-boundary nations with the aim of developing joint agreements, plans, and cost/benefit sharing arrangements. different actors such as governments, nongovernmental organizations, scientists, and policy makers
Legal Frameworks	T,I		√	√	√	√	A legal framework or structure in place within all riparian nations and might involve international agreements (binding or non binding) to address issues
Dispute resolution mechanisms	T, I		√		√	√	Principles of equitable and reasonable utilisation, which can include clauses on thresholds of allowable harm, minimum allocation for vital human needs, and minimum required levels of water for proper functioning of lake and rivers ecosystems

ISSUES IDENTIFIED BY STAKEHOLDERS	LINKS TO OTHER KEY THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					DESIRED OUTCOME
		P	I	H	S	G	
Common environmental management	I, S,T			√	√	√	Policy that is holistic, encompassing the health, agriculture, education, fisheries, into policy making, and, in all likelihood, is based on an integrated water resources management approach
Information Management System for sharing data and information among the riparian countries	T, I, S	√	√	√	√	√	Joint monitoring programs; Joint training and capacity building exercises to promote use of common language, common parameters in data collection and data analysis, and use of a common data base; Use of remote sensing, real time monitoring or other technologies to collect data from sensitive areas; Access to degree programs and training programs to build capacities in nationals of all the riparian countries
A financing system for trans-boundary basin management	E, W, T	√	√		√		Protection of public goods e.g. floods protection measures and nutrient management; Regulating public goods e.g. enforcing fisheries quotas; Producing market good e.g. hydropower; Maintaining commissions Interventionist approaches can be applied by governments to jump-start commercial aquaculture development provided that this approach is supported by strong strategic and implementation plans
Win-win-solutions	E, W, T	√	√			√	Cooperation among riparian countries sharing the lake with trust among participating countries. This is a difficult task but can be achieved by first working on technical projects together, slowly evolving a political infrastructure, and building in mechanisms for financial compensations if a win-win solution cannot be reached (so the party losing can be financially compensated)

ISSUES IDENTIFIED BY STAKEHOLDERS	LINKS TO OTHER KEY THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					DESIRED OUTCOME
		P	I	H	S	G	
Linking of water quantity, water quality, fisheries, land use and watershed issues	I, P, T, E	√	√	√	√	√	A holistic/integrated approach: to address all the critical issues discussed above an integrated approach to deal with the trans-boundary water issues is important, attempting to address one issue at a time might complicate other issues
Information exchange, joint monitoring and assessment mechanisms	I, T		√	√	√	√	Common terminology among riparian nations Harmonised or comparable methodology for collecting data and information Uniform reporting procedures Targets for planning purposes across the riparian nations
International policy dialogue with implications for African aquaculture governance	S, I, T		√	√	√	√	A strong political will and commitment for better trans-boundary lake basin management
Financial and technical capacity building	P, E,		√		√		International community commitment in terms of financial, technical and human capacity building
Operational Framework	I, S		√		√	√	Successful operational four Levels of resources: Technical; Science/research; Regulatory instruments; and Communications channels
Resources management plans	T, I		√	√	√	√	Strong monitoring and enforcement of regulations and restrictions
Upstream-downstream linkages	T, P, I, S	√	√	√		√	People educated about linkages between healthy lakes/rivers, sustainable aquaculture, their own health, and the actions of the aquaculture famers around lakes, and other water bodies

ISSUES IDENTIFIED BY STAKEHOLDERS	LINKS TO OTHER KEY THEMES	The Eastern Africa and Great Lakes Regional Framework on Environmental Management for Sustainable Aquaculture Objectives					DESIRED OUTCOME
		P	I	H	S	G	
Trans-boundary governance tools and challenges	T, I		√			√	Benefit sharing: A trans-boundary water system is a common pool of resources, which means that if one riparian nation uses it the benefits available to other riparian countries decrease Non-binding trans-boundary agreements on environmental issues benefit from a strong mandate. Agreements such as the Great Lakes Water Quality Twinning: as a way for two or more organizations to enter into a well structured relationship that allows commissioners, scientists, politicians, and others affiliated with the organizations to exchange knowledge and experiences. Twinning bridges organizations and fosters collaboration among a wide range of professionals and stakeholders

***P** = Increasing fisheries and aquaculture productivity, **E** = Improving profitability of fish enterprises, **I** = Enhancing inclusive sustainability, **W** = Wealth generation, **S** = Social welfare, nutrition and food security,) **T** = Trans-boundary collaborative management*

5.0. TOOLS AND RESOURCES FOR SUSTAINABLE DEVELOPMENT AND MANAGEMENT

5.1. Applicable tools and resources

5.2. Applying aquaculture tools and resources – the general context

Figure 3 sets out the full scope of issues, interactions and considerations this framework adapts that need to be taken into account by policy-makers (FAO, 2013).

The tools consequently recommended are:

i. **Ecosystem Approach to Aquaculture (EAA).** This approach sets out useful planning and management tools/resources that can help address these key issues. It draws upon tools and resources that have been successfully used in freshwater and marine aquaculture operations as well as environmental management across the globe. Appendices 1 and 2 also set out in more detail, the types of tools that can be applied at both national and trans-boundary regional levels to manage aquaculture operations from an environmental and sustainability point of view. Member States can apply these tools within their national jurisdictions or can jointly agree to develop joint country frameworks to apply the more regionally focused elements of these tools. Tables 1 and 2 provide a general framework within which the more specific tools can be applied by Member States at the appropriate level and scale.

ii. **Zonation for Aquaculture.** Zonation is put forward as among the principal tools for the rational utilisation and management of natural resources to enable equitable commercial aquaculture development at the regional scale required to sustainably provide the additional tonnage of fish the region needs. The identification and zoning of suitable freshwater and marine areas for aquaculture is necessary as a tool to support and expand development based upon ecosystem constraints, rational and equitable management and utilisation of natural resources for aquaculture, ensure biosecurity, safeguard aquatic resources for other users and future generations. Additional benefits that would accrue from zonation include facilitate rational registration and permitting systems, help concentrate areas of production thus support the development of commercial aquaculture value-chains, improve capacity to implement appropriate environmental management tools for aquaculture, improve the viability of investments and improve access to markets.

   Zoning and the development of aquaculture zones as an approach would greatly support the clustering smallholder producers, improve their access to natural resources for aquaculture as well as help streamline support to enable smallholders mitigate against environmental risks associated with aquaculture and establish resilience mechanisms against climate change.

   The application of GIS tools for spatial assessment and strategic planning recommended for the zonation process based upon the recommendation of FAO, (2013) as illustrated in similar areas where this has been applied (Puniwai et al, 2014).

iii. **Environmental Assessments and Monitoring Tools.** The use of Best Practices approaches would greatly enhance the capacities to achieve regional aquaculture goals.

   a. **Regional Strategic Environmental Resource Assessments (SEA) for sustainable Aquaculture Development** was recommended as a tool to support the formulation and assessment of regional and national policies, plans and program development. This tool shall invaluable to support rational and equitable utilisation and management transboundary aquatic resources between Member States in the region.

b. Environmental Impact Assessments and Monitoring for Aquaculture (EIAA) for application to specific projects. The EIAA's shall to:

i. To inform a consenting or licensing decision;
ii. To identify mitigation measures that will minimize any possible environmental impact, and often social impact;
iii. o generate a monitoring system and follow up mechanisms.
iv. The approaches to this should be harmonised in tandem with the outcomes of the SEAs.
v. Stakeholder participation. The participation of both primary and secondary stakeholders at all stages of the development process including planning and decision making is imperative.
vi. Public Awareness. Increasing the level of awareness and promoting aquaculture best practice based upon environmental soundness is among essential tools for success implementation.

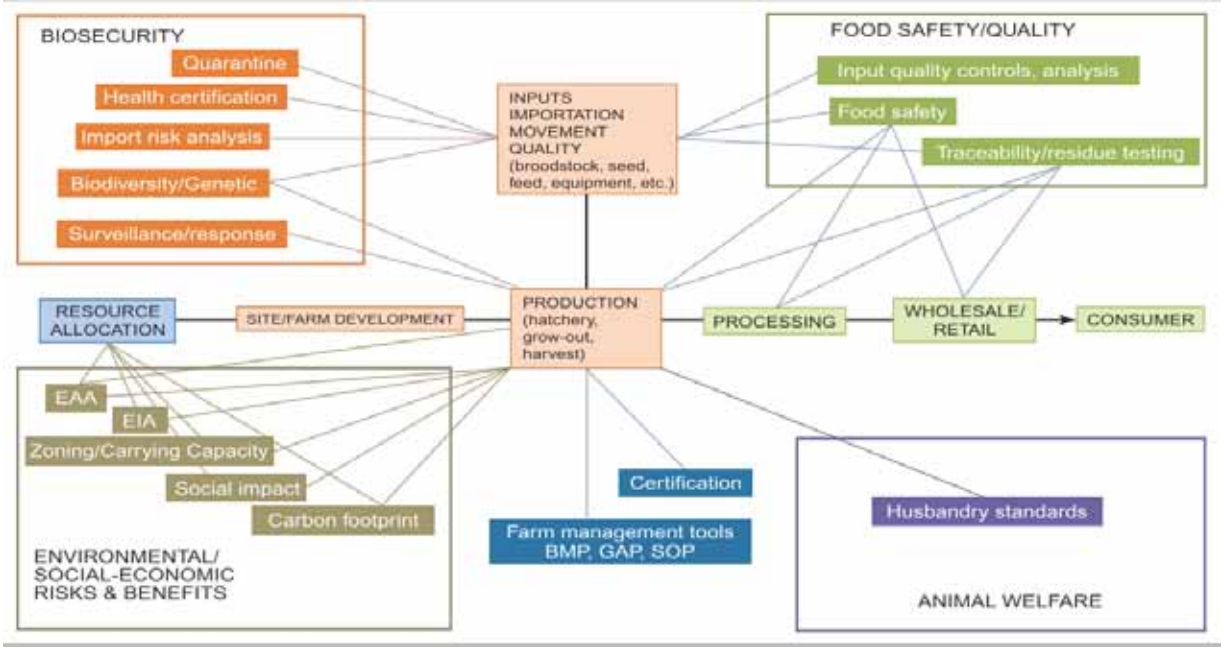


Figure 3: *FAO's (2013a: 5) proposed implementation tools framework for an aquaculture supply chain*

Table 4: *Key trans-boundary aquaculture issues*

Area	Key issues
Planning	**Development** Export production Import substitution Registration and licensing Site locations Zoning Indigenous species and limited fry inputs Industry investments
	Impact assessments and risk analyses: Environmental impacts Social impacts Vulnerability assessments Market research
Management	**Regulations** Food safety (Residue testing, disease monitoring and controls) Oversupply Farm stock escape into the wild
	Support Organisation of aquaculture business operators Research and knowledge sharing platform

5.3. Governance instruments and controls over marine and land use

Data and information derived from the application of the above tools shall form the technical basis for the formulation, implementation and monitoring of policy and actions as well as impacts of sustainable commercial aquaculture. The instruments shall address:

5.3.1. Adoption of regional harmonised guidelines to support the identification and zoning of suitable production areas and appropriate production systems and capacities.

The region has the potential for a range of aquaculture production systems ranging from extensive to intensive land and water-based systems in both fresh-water and marine environments. Pond, tank and cage culture can be sustainable practiced in the region as long as this is done within the environmental carrying capacity limits with correct quality of inputs. Socio-economic factors such as local and regional markets are also favourable. Adaptation of potential systems to the socio-economic sensitivities of the region notably the need to address poverty and provide meaningful livelihood alternatives particularly for the youth and disadvantaged segments of society would make tangible impact on the regions achievement towards the SDGs.

Coherent and harmonised multi-sectoral national and regional legislature and guidelines to protect biodiversity against genetic introgression in the respective watershed, control outbreaks of aquatic animal disease, sustain water supply and quality, prevent land degradation and ensure food-safety of products produced through aquaculture from transboundary natural resources shall facilitate this.

Integrating Environmental and Commercial Considerations into this shall be necessary. Guidelines and legislature to support investment and the management of aquaculture management areas (AMA's) whereby producers are clustered or utilise shared water resources within zones shall build confidence in the sector and guide investments into these zones. This support would enhance the formation of 'clusters' as 'aqua-businesses', for the purpose of reducing service costs, meeting certification requirements and attracting better markets as a co-operative (figures 4 and 5).



Figure 4: *A FAO and World Bank (2015: 3) schematic of an aquaculture zone (striped blue) in an estuary between a river outlet and coastal area. In total, there are 20 individual farms ('F'). The various colours of the farm labels indicate different ownership*

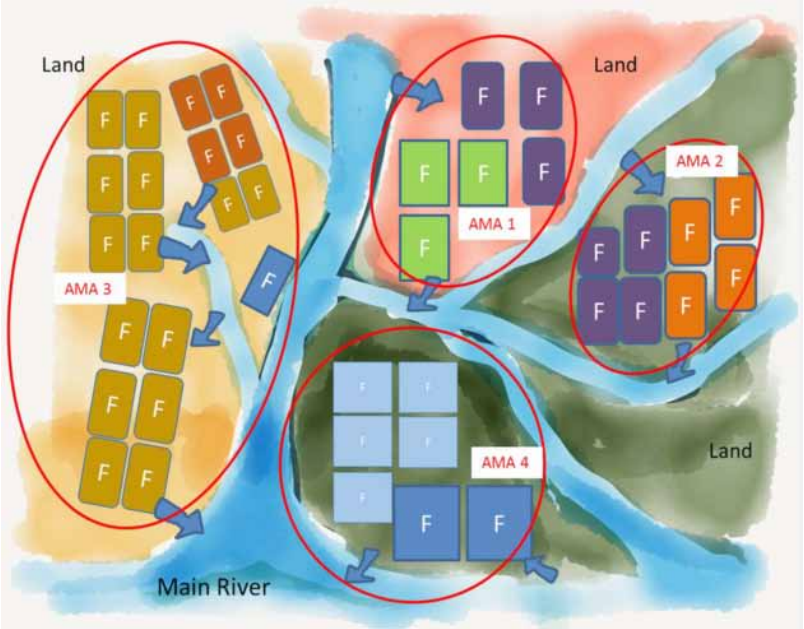


Figure 5: *A FAO and World Bank (2015: 3) schematic of a zone with four neighbouring land-based AMAs of catfish ponds. The arrows in the schematic show water flow, and the varied colours within an AMA indicate different owners of the sites*

5.3.2. Regionally harmonised registration and licensing processes for commercial aquaculture

Registration and licensing to regulate access, utilization and disposal of resources from the various individual establishments and zones is recommended to safeguard the supply of environmental goods and services for aquaculture and other uses. Information accruing to these shall comprise among the databases used for sustainable utilization and monitoring of the regions resources for aquaculture. These must be harmonized and streamlined into national government systems if transboundary facets of the sector are to be promoted and appropriately managed (See appendix .. for more details Appendices 1 and 2).

5.3.3. Regionally Harmonised of Environmental Management Approaches and Protocals

International best practice for environmental management in aquaculture includes the adoption of the EAA and Environmental Impacts Assessments for Aquaculture (EIAAs). The need to develop and implement harmonising and developing minimum standards for EIAA in the region that support transformation of the aquaculture sector and its value chains into an all-inclusive vibrant, profitable and environmentally sector cannot be underrated. It is particularly important for the region that aquaculture offers tangible livelihood opportunities for smallholder semi-subsistence farmers, marginalised groups including and artisanal fisher-folk whose unlimited access to the fisheries is increasingly being limited for the sustainable management of the regions fishery resources. The benefits of EIAAs should therefore be accessible to all. Currently the major challenge associated with the implementation EIAAs are the high costs. These is often as a result of the data investors are required to obtain, limited number of credited personnel to undertake these and costs of monitoring. Guidelines and application of SEAs to support national planning, collection and sharing of data and information as well as appropriately tailored EIAAs in line international standards for the different stakeholders along the value-chain that are recognised across the region would facilitate private-sector and public partnerships in implementation, reduce costs and improve applicability and public attitudes towards the same.

Social impacts

The systematic analysis of socio-economic and cultural impacts of aquaculture interventions through tools such as Social Impact Assessments (SIAs) figures prominently on the FishGov agenda. SIAs generally involve the development and collection of baseline indicators/data; the monitoring and evaluation of indicators over a period of time; and the preparation of recommendations to reduce negative impacts or augment

positive benefits. The purpose of pre-project SIAs is to predict social outcomes and either minimise the possible adverse or maximise the potential benefits of aquaculture operations, whereas post-project SIAs assess what has occurred (FAO, 2013[a]).

The FAO (2013[a]) notes that 'no specific regulatory requirements have been established for SIA in aquaculture'. It nevertheless is considered a complementary part of the EIA process. In general, SIAs should be conducted by trained social scientists (FAO, 2011[c]) who have experience with collecting and analysing data about the negative and positive effects of social policy and engineering projects. The World Bank (world Bank, 2003 and 2007) published two tool guides that also consider poverty concerns in social impact analyses. FishGov participants might also find three complementary guides on the application of social analysis from the Investment Centre at FAO (2011[c]) helpful. The first of the three Social analysis for agriculture and rural investment projects guides addresses the project managers' and team leaders' perspective of recruiting appropriate staff to conduct social analyses. The second guide for practitioners discusses various frameworks and social analysis tools that can be employed in projects. The last guide addresses fieldwork aspects of incorporating social analysis into a mission, such as integrating qualitative data collection into project activities.

Climate change and vulnerability issues

Changes in climate will likely have a massive impact on the productivity of aquatic habitats in coming years. There hence has been a big industry push to assess future threats and vulnerabilities, and build resilience by planning and implementing adaptation measures that will help fish farmers cope with changes. FAO (FAO, 2012) has published a logical framework that could serve as a template for setting-up such aquaculture and climate change programmes. FAO (2015[a]) also recently published a relevant technical paper for aquaculture professionals who are interested in adapting present practices in the face of climate change. Entitled Assessing climate change vulnerability in fisheries and aquaculture: Available methodologies and their relevance for the sector, FAO (2015[a]) advises sector professionals to consider the following to 'improve the targeting and effectiveness of adaptation actions':

- Who (as in people, species and/or production systems) is vulnerable and how can their vulnerability be reduced?
- Where are the vulnerable ecosystems and can resource management support any adaptive capacity measures?
- Who is most vulnerable to economic and social consequences and what can be done to minimise those effects?
- Where will climate change create new opportunities and for whom can it benefit? How can it be used as an opportunity to improve human well-being?

Further information about climate change vulnerability assessment methodologies for the aquaculture sector can found in Barsley et al. (2013) annotated bibliography.

5.3.4. The movement of aquaculture produce and products

Regional instruments to safeguard the environment during the distribution of aquaculture inputs, produce and product to the various local, regional and international markets without hindering but rather promoting access to markets and trade shall be necessary. The figure elow illustrate what the key elements for consideration in this regard are (Kirema-Mukasa, 2013, FAO, 2013[e]).

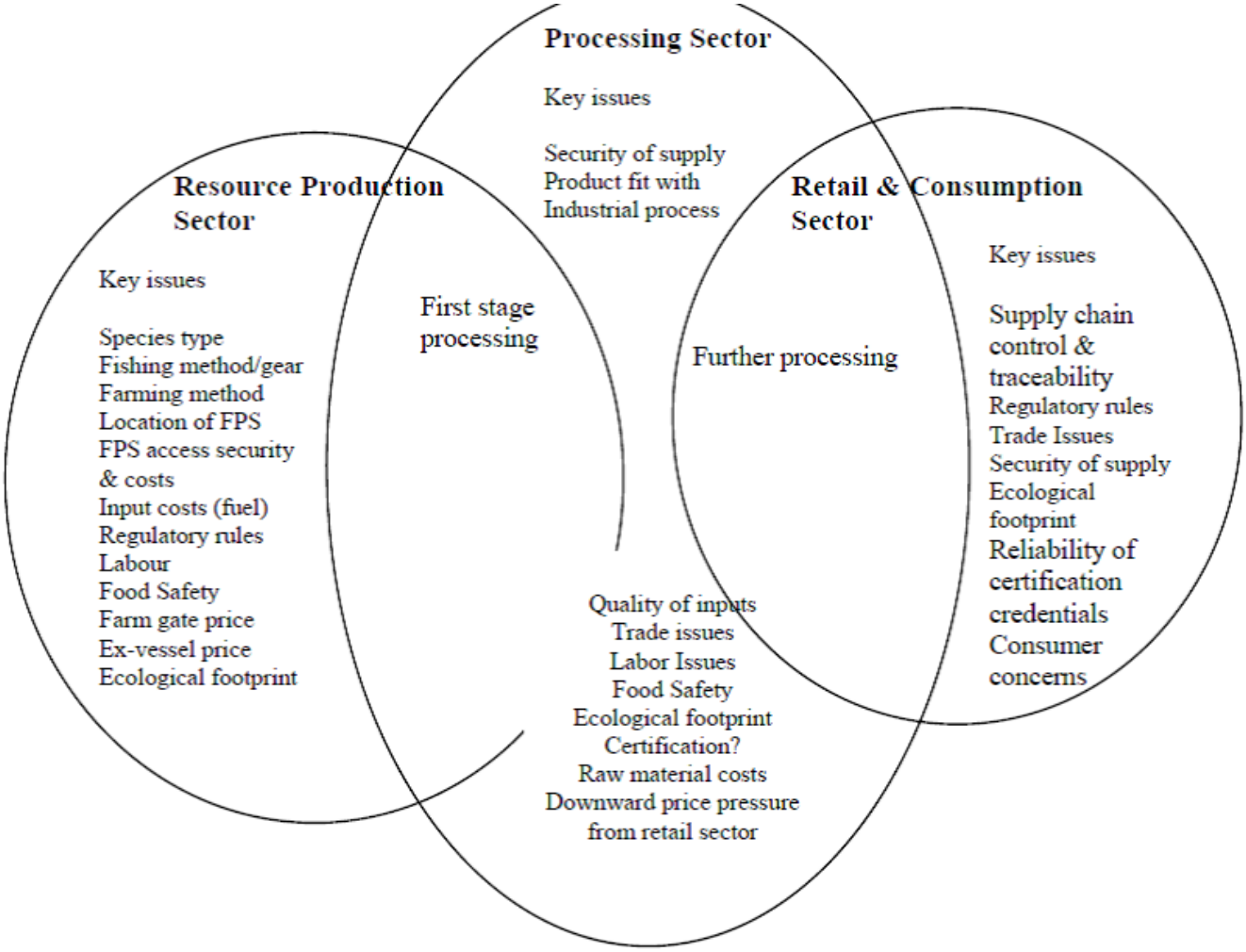


Figure 6. *Supply chain aspects*

5.3.5. Food Safety and Bios-Security Considerations

Already in place are East African Standards and Code of Practice to synchronise fish handling, processing and distribution throughout the region (EAC, 2000). These as well as, HACCP for aquaculture should be adopted (Bagumire et al. ,2010) Other Sector Specific Instruments.

Guidelines to support the establishment of biosecurity in line with international guidelines notably conserving biodiversity, preventing escapes and disease control are particularly important to sustain aquatic ecosystem integrity. (FAO, 2011) Chenje and Mohamed-Katerere (2006). Harmonised guidelines and procedures to handle non-native species identification, undertake risk analysis, build capacity, management and legislative tools are important (http://giasipartnership.myspecies.info/en).

5.3.6. General considerations

Encouraging and supporting the private-sector adopt Best Management Practices in their operations and subsequently being involved in the development and application of harmonised Standard Operating Procedures. This includes support and utilisation of research and sharing of knowledge.

6.0. THE DELIVERY AND STAKEHOLDER ARRANGEMENT

The implementation of the aquaculture framework requires dedicated management, monitoring and inspection capacity within the Eastern Africa and Great Lakes Region, cooperative multi-sectoral public and private-sector governance arrangements as well as intergovernmental fora for interacting with representatives of the aquaculture industry.

In this section prospective areas of coordination between governmental departments and key stakeholders are identified, and their prospective respective roles and responsibilities discussed.

6.1. Ministerial Groups on Aquaculture (MGAs)

This Regional Framework on Environmental Management for Sustainable Aquaculture Development in Eastern Africa and the Great Lakes Region will adopt an approach in which a Ministerial Group on Aquaculture (MGA) from each member state drives the progress on the priorities and outcomes contained in this document, rather than simply being a body which reviews and tracks progress. They will generate flexible lists of priority actions that remain current and country specific, are regularly reviewed and re-prioritised as being appropriate and draw action plans.

Work-streams will flow through the six identified key themes and be directed by the MGAs. The Groups will be guided by this overarching framework document in the identification of short and long-term priorities as well as agree actions within each theme.

Each theme will have a "Theme Leader" who sits on the main group and will have responsibility for ensuring that agreed actions within their theme are effectively implemented. The themes will include sub-groups, and possibly the use of task-specific committees which can co-opt specialists/experts and stakeholders with relevant interests. Care will be taken to involve all key stakeholder interests, as appropriate, either through the MGAs, focused sub-groups and work-streams or the Regional Aquaculture Forum. It is proposed that MGAs will meet biannually to review, revise and agree action plans with a scope to review, add and change membership as appropriate or as need arises.

The MGAs shall report back to the Aquaculture Forum on progress at every meeting.

6.2. The Eastern Africa and Great Lakes Region's Aquaculture Forum

This Framework calls for the composition of a consultation forum to address the value chain issues for the aquaculture sector through "a wider Regional Aquaculture Forum". The Forum will have the following features:

- Wide-ranging membership from all active stakeholders,
- It will be chaired rotationally among the member states,
- It will feed into framework theme action plans and receive feedback on progress from the member states Ministerial Groups,
- It will be tasked with specific pieces of work to inform themes or specific issues. Members/Forum representatives could be co-opted onto task specific groups as appropriate,
- It will act as a breeding ground for new policy initiatives and provide opportunities to inform policy and respond to wider, relevant inter-government consultations on aquaculture in the region.
- It will generate key questions for the MGAs to be dealt with through the relevant sub-group, and
- It will as appropriate, allow for stakeholders input to ensure that the actions remain relevant and accommodate new issues of concern which may arise or when there is a lack of progress.

- There shall meet at least once annually to review, revise and agree on action plans.
- There shall be scope to review, add and change membership as appropriate.

6.3. Coordination Structures

The following structures (figure 7) will be used to coordinate implementation of the Framework;

a. The Ministerial Group on Aquaculture (MGA) which will deal with issues arising from the Regional Forum requiring coordination within the region and between the region, stakeholders and industry. This is primarily an operational platform within the region that is able to consult with other stakeholders as required.
b. The Regional Intergovernmental Forum is the where the high level policy issues or inter-departmental issues will be dealt with thematically as described above.
c. The following committees shall serve as under the forum as illustrated in figure 7.

1. Committee on Scientific Advisory (CoSA) on:

i. Statistics and Information
ii. Economics and Social Sciences
iii. Aquatic Environment and Ecosystems
iv. Marketing of Aquaculture Products and Value Chain Approach Sustainability and Inclusion in Aquaculture
v. Spatial Planning, Site Selection and Carrying Capacity
vi. Trans-boundary Governance and Twinning

2. Committee on Regulations and Compliance (CoRC)

i. Certification, Monitoring and Surveillance
ii. Consumer Safety
iii. Environmental Protection

3. Committee on Administration and Finance (CoAF)

This will handle the financial and administrative matters of the entire structure.

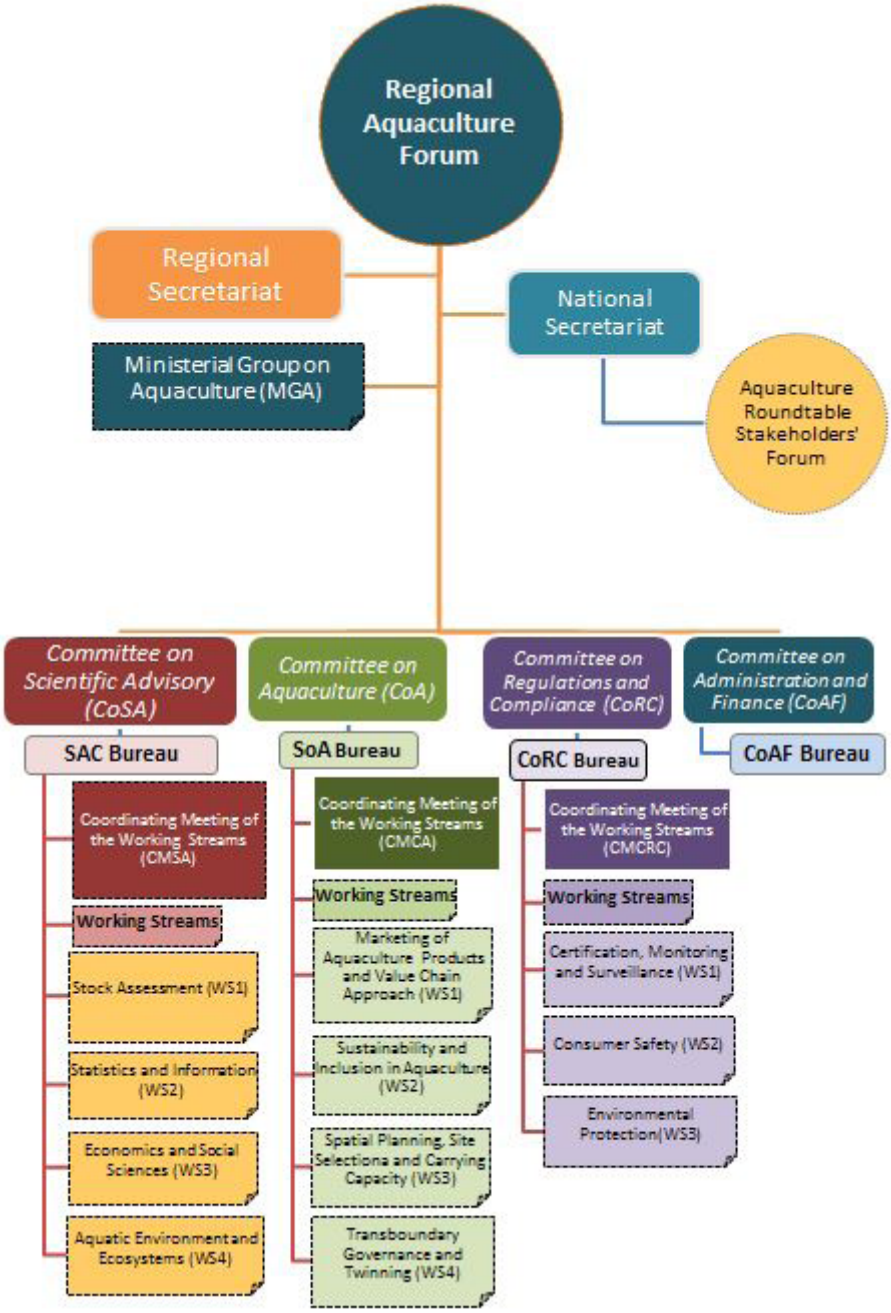


Figure 7: *Eastern Africa and Great Lakes Regional Aquaculture Coordination Structure*

The proposed procedure of attaining environmental aquaculture certification is elaborated in figure 11 showing clear steps from the application through the local government stage, municipal, sectoral level and the national appeals process before certification.

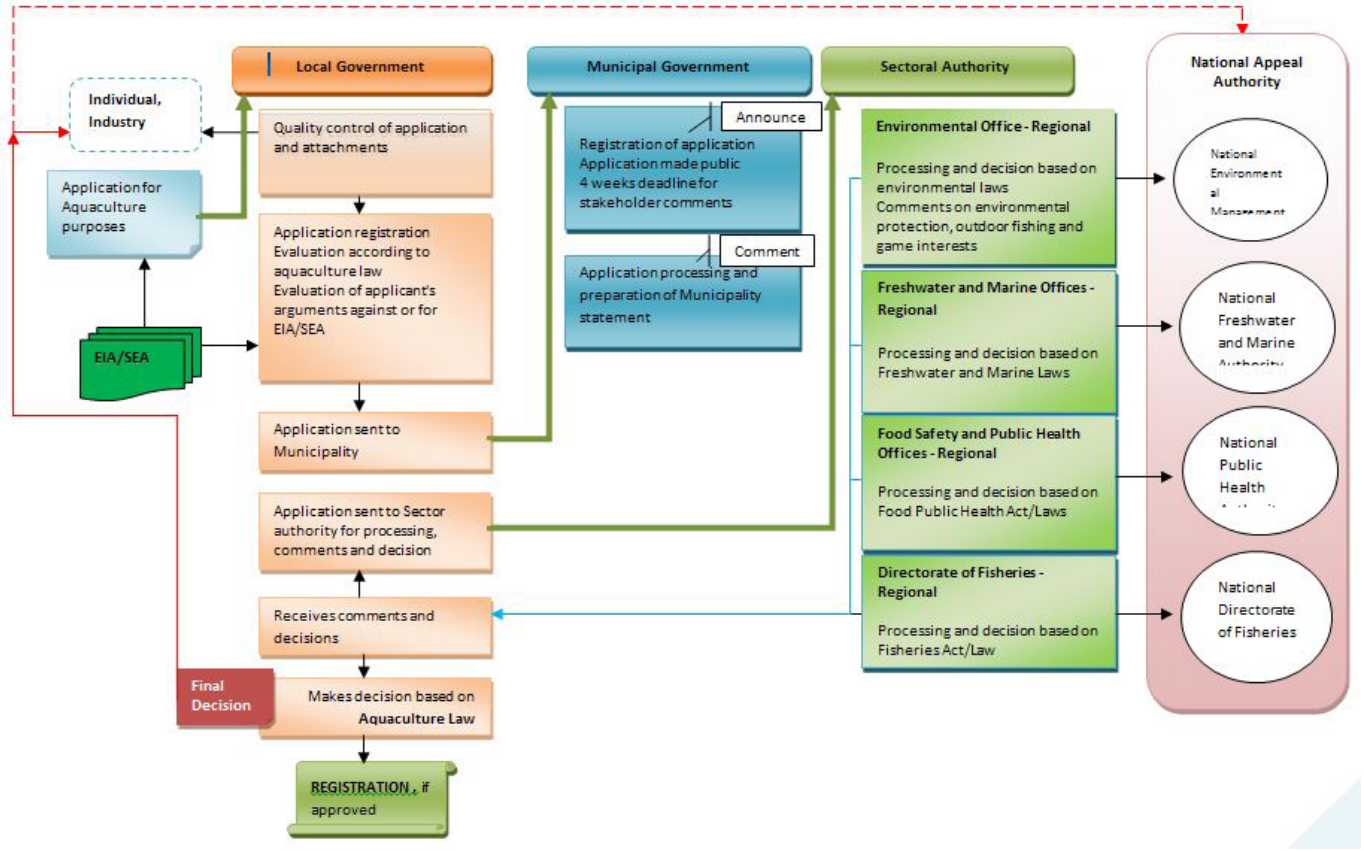


Figure 8: *Aquaculture Certification Process*

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APPENDIX 1:TOOLS/INSTRUMENTS FOR ALLOCATION OF AQUACULTURE USE RIGHTS & MANAGEMENT OF CONFLICTS

TOOLS/INSTRUMENTS FOR ALLOCATION OF AQUACULTURE USE RIGHTS AND MANAGEMENT OF USE CONFLICTS

INSTRUMENT	EXPLANATION	ADVANTAGES	DISADVANTAGES
REGULATORY INSTRUMENTS			
Zoning	• Division of marine area into zones for different uses with rules including multiple use frameworks	• Can preserve and protect environmentally fragile areas • Can exclude certain uses altogether • Can restrict development in ecologically fragile areas • Can preserve integrity of historic areas and structures	• Can result in inefficient use of marine zone • Restricts supply of resources • May prevent innovation • Requires supplementary controls, well-trained bureaucracy, and adequate enforcement capacity • Cannot ensure long-term protection • May exclude the poor and is biased against newcomers • Vulnerable to political and market pressures
Ecosystem-based Plans	• For instance a Regional Marine Plan for a cluster of ecosystems in a catchment area	• Manages on an ecosystem basis • Potential to integrate what needs to be integrated	• Costly in terms of information and transaction costs across political jurisdictions • Absence of clear lines of authority can lead to problems not being addressed
Industry and Use Based Management Plans	• Plans for resource management built on co-operation between users and regulatory authorities – provides a framework for the use of zones and all other instruments mentioned below • May be passed as legislation or as delegated legislation	• Based on user and stakeholder participation and provides predictability for users • Based on reality in the sector or industry	• Can be captured by sectoral interests • Can be comprehensively ignored
Codes of practice – mandatory; negotiated voluntary	• Industry develops adopt, codes which limit or precludes key negative ecological and social impacts	• Can reduce losses associated with specific natural hazards	• Can raise operational costs

INSTRUMENT	EXPLANATION	ADVANTAGES	DISADVANTAGES
Moratoria and interim development regulations	• Temporary development bans designed to restrain development until a protection plan can be developed or implemented or until public facilities related to an environmental problem can be constructed or upgraded.	• Can restrain development in sensitive areas or with respect to sensitive resources • Supports Precautionary Principle	• May impede economic development
Permits under command and control regimes	• National, state or local permits to use marine resources under specified terms and conditons	• Enforces regulatory system and well known and well understood by all participants and rest of society	• Require political commitment and effective enforcement capacity
Shoreline exclusions or restrictions	• Prohibit or significantly limit certain uses within a strip or band in the coastal zone.	• Can protect environmental sensitive resources and can prevent shoreline erosion and blockages of public access.	• Requires strong political support and complementary land or coastal management programs.
Critical area protection – marine reserves etc.	• Restricts development and use. May include buffer zones surrounding the resource area or special environmental assessments	• Can protect particular types of sensitive environments or natural areas,	• Requires strong political support and complementary land management programs and regulations
Historic preservation rules	• Establish a process for designating historic properties and for the review of alterations to or demolitions of designated historic properties	• Can protect cultural resources	• Require clear institution responsibilities and effective enforcement capacity
Permits	• Issuance of permits or license is required prior to construction or implementation of proposed development	• Can be granted or withheld according to how an entity meets certain conditions • Can control specific issues and behaviour and therefore reduce vulnerability of natural resources	• Requires strong enforcement capacity. • Does not mobilize the internal capabilities of license holder effectively unless coupled with other incentives
Mandatory policies for critical areas or issues e. g. New Zealand Coastal Policy	• Requirements or guiding principles for managing sensitive areas and other resources	• Provide framework for issuing permits or preparing special area plans	• Tends to be vague on how resources in specific geographical locations will be affected
Technology based instruments and rules	• Prohibited gear and technologies (drift-nets and mesh sizes) as well as mandated gear and technologies (by-catch excluder devices)	• Based on real effects of fishing	• May be costly to implement

INSTRUMENT	EXPLANATION	ADVANTAGES	DISADVANTAGES
ECONOMIC INSTRUMENTS			
Transferable use rights	• Right to transfer use rights – fisheries etc.	• Can help market support ecological objectives	• Involves complex implementation
Capital gain taxes on valuable property rights – eg. Fisheries quota	• Type of capital gains tax applied to increases in value of resources between the time of initial purchase and subsequent sale or exchange of resource	• Revenues can be used to purchase sensitive areas	• Political factors can undermine effectiveness • Can impede operation of markets
Ecological Impact and betterment fees	• One-time payments made by developers or industry at the time of development approval, calculated to be proportionate to the cost of providing physical infrastructure and environmental services to increase carrying capacity while protecting the environment	• Can be used to compensate for values that will be lost as a result of the developments and also to support, environmental monitoring and clean up • Shifts burden of financing public infrastructure to private developers	• Require effective collection procedures
Environmental performance bonds	• Sum of money as insurance against specific event • Likely to be used in biodiversity protection and used in some fisheries access agreements and also offshore oil and gas	• Provide incentive to not damage habitat or marine ecosystem	• May be costly to generate bonds for some sector participants
Tourism taxes and user charges	• Taxes or charges assessed on transport, hotels, restaurants, or other facilities	• Provide funds to support historic preservation	• Require willingness to pay
Grants and low interest loans	• National government provide grants or low interest loans to state and local governments or private entities	• Provide funds for ecological protection, historic preservation, industrial relocation, and hazard mitigation	• National grant and loan programs are subject to fiscal constraints
Insurance against catastrophic events	• Insurance against catastrophic events	• Provides support to marginal or vulnerable local communities to local communities	• Encourages marginal sectors and communities

INSTRUMENT	EXPLANATION	ADVANTAGES	DISADVANTAGES
GRANT OF OWNERSHIP RIGHTS			
Full ownership of rights in the marine zone equivalent to land-based rights but taking into account unique characteristics of marine zone - can be granted to individuals, companies, community groups or NGOs	• Government establishes or improves system for clarifying ownership and boundaries and provides secure long-term tenure to users of particular areas • Ecological commitments can be made a condition of full ownership	• Rights holders can gain access to formal credit sources so they can invest in improvements to withstand certain hazards and implement ecological improvement plans • Incentives for investment in relevant resources • Helps with locating offenders and assigning responsibility for violations of the law	• Requires political will at national level and adequate funds and expertise to introduce or improve titling procedures • Provision of tenure may encourage invasion of hazard-prone areas.
INTERVENTION IN MARITIME MARKETS AND USES BY GOVERNMENT			
Voluntary acquisition of associated land-based rights and areas by government to limit use of marine areas	• Acquisition of land as reserves, natural parks etc. where land area is integral or a pre-condition to marine uses – main focus of regulation is marine uses not the land itself	• Allows permanent protection and can re-shape use patterns	• Can be costly • Can involve high costs for management and monitoring
Purchase and sellback (or leaseback)	• Government agencies can purchase land next to a marine zone in fee, attach restrictions to the deed, and then resell or lease the restricted land	• Retains in government ownership only those rights needed to meet protection or other use management objectives	• Cannot meet all management objectives • Requires appropriate land/marine relationship
Expropriation of established marine use rights by declaration of no-take or no-use zone	• Government pre-empts marine use A(commercial fishing) and substitutes no use or Marine Use B (recreational purposes) • Government may or may not pay compensation	• Allows government to acquire marine zone for protecting sensitive resources if other acquisition techniques are not feasible	• Requires supplementary management programme not just the taking over of the resource • Involves high acquisition costs • May involve expensive and time consuming litigation
Purchase of marine use rights in established market – say quota markets	• Governments purchase rights permanently, temporarily or upon a particular trigger to shape market behaviour or outcomes to achieve ecological objectives	• Ecological objectives are met	• Acquisition can be costly

INSTRUMENT	EXPLANATION	ADVANTAGES	DISADVANTAGES
Exchange of use areas	• Government agencies may facilitate exchange of use areas amongst conflicting groups or between government departments and claimant groups	• Provides opportunity to consolidate areas of similar or complementary uses	• May involve substantial administrative costs (ie appraisals, negotiations, resource inventories, impact assessment) to accomplish complicated and time-consuming transactions • May involve political obstacles or resistance by private groups
Exaction	• Requires dedication of area of marine zone to particular uses in exchange as a condition for obtaining zoning approvals or permits	• New users pay for controlling multiple use impacts p	• Involves difficulty in calculating fair share of costs
GOVERNMENT PROVISION OF INFRASTRUCTURE			
Providing basic infrastructure	• Targeting resources for infrastructure provision	• Can reduce vulnerability to natural hazards • Can guide development to environmentally appropriate ares	• Requires ability to mobilise adequate financial resources and adequate management capacity for construction, operations, and maintenance.
EDUCATION AND INFORMATION			
Remote sensing	• Process of recording information from sensors mounted either on aircraft or on satellites	• Supports all facts of disaster management • Can supply accurate and timely information at a low cost over large areas	• Requires specialised expertise to interpret data • Ground verification necessary where cloud cover obstructs satellite's view of hazard (ie earthquakes, landslides, floods)
Geographic information system (GIS)	• Systematic means of combining various data about a geographic area (i.e. nation, region, city)	• Provides critical data to support planning, hazard management and environmental assessment	• Requires technical skills to develop and maintain and repair system as well as commitment to update on a regular basis

INSTRUMENT	EXPLANATION	ADVANTAGES	DISADVANTAGES
Maritime and coastal information system (MIS)	• Data base containing spatially referenced data for a specific area or specific use as well as procedures and techniques for the systematic collection, updating, processing and distribution of the data	• Facilitates planning, resource allocation, ongoing management, provision of infrastructure, environmental assessment and property taxation • Can be self-financing • Principle of careful and informed decision-making • Precautionary Principle; User Pays and Polluter Pays Principle	• Requires political will at the national level • Can involve high costs • Requires expertise and commitment to properly interpret, update, and maintain data • May be subject to commercial confidentiality controls – for example data on fishing vessel trips and catch is highly valuable commercial data restrictions
Atlases and data banks	• Systematic compilations, interpretation, and display of data linked key issues	• Facilitate integrated and informed coastal zone management • Principle of careful and informed decision-making • Precautionary Principle; User Pays and Polluter Pays Principle	• Requires political will at the national level • Can involve high costs • Requires expertise and commitment to properly interpret, update, and maintain data • May be subject to commercial confidentiality controls – for example data on fishing vessel trips and catch is highly valuable commercial data restrictions
Hazard maps	• Tools for analysing vulnerability risk, especially when combined with critical facilities mapping	• Facilitates integrated and informed coastal zone management • Principle of careful and informed decision-making • Precautionary Principle; User Pays and Polluter Pays Principle; Ecological Integrity Principle	• Requires specialised expertise
Maps of ecologically critical/ fragile areas	• Provide geographical references that include information on the location, capacity, and service area of facilities which if destroyed or damaged can impose serious costs	• Supports ecological integrity principle • Supports management preparedness for emergencies	• Requires continuos updating and specialised expertise to interpret data

INSTRUMENT	EXPLANATION	ADVANTAGES	DISADVANTAGES
Natural hazards assessment	• Tool for determining the probable location and severity of dangerous natural phenomena and the likelihood of their occurring within a specific time period in a given area	• Supports management of areas prone to specific hazards & multiple use generally • Makes allocation of areas and use rights more rational and logical • Contributes to State of Environment Reporting	• Requires specialised expertise
Vulnerability assessment	• Tool for estimating the degree of loss or damage that would result from the occurrence of a natural phenomena of given severity	• Supports management of hazard-prone areas & multiple use generally • Contributes to State of Environment Reporting	• Requires specialised expertise
Environmental impact assessment	• Impact of proposed use on environment and other uses	• Supports management of ecological uses & multiple use generally • Makes allocation of areas and use rights more rational and logical • Contributes to State of Environment Reporting	• Requires specialised expertise
Critical habitat assessment	• Assesses state of critical habitat for fish stocks and other living resources	• Supports ecosystem approach and helps address cumulative impacts • Makes allocation of areas and use rights more rational and logical • Contributes to State of Environment Reporting	• Requires specialised expertise
Stock assessment	• Assesses state of stocks prior to, after and during fishing operations	• Supports ecosystem approach and responsible fishing approaches • Makes allocation of areas and use rights more rational and logical • Contributes to State of Environment Reporting	• Requires specialised expertise
Periodic valuations - priced and un-priced marine uses	• Tool providing accurate and timely data based on the operation of the market for marine uses in a given area	• Supports development planning, taxation and management • Makes allocation of areas and use rights more rational and logical • Contributes to State of Environment Reporting	• Requires specialised expertise and substantial cost
Advisory guidelines	• General directions for the project design and construction	• Provides a framework for issuing permits as well as preparing use or special area plans	• Adherence to guidelines is generally voluntary

INSTRUMENT	EXPLANATION	ADVANTAGES	DISADVANTAGES
Public education and participation	• Activities to educate the public about environmental and hazard related issues and to involve groups in planning and decision making	• Can ensure public support for and participation in management programs • Provides technical support and information for improving health and environmental conditions in specific areas	• Requires political commitment
Accreditation and Certification	• Industry by itself or with third parties (NGOS, Government) develops systems to reward best practice and certify such practices so it can earn a market premium – eg. Marine Stewardship Council, ISO 14001	• Market returns • Incentives to achieve beyond regulatory norm • innovation	• Market posturing and false representations are very possible • Unrealistic expectations on side or public and also industry • Market responsiveness may not last

APPENDIX 2:TOOLS /INSTRUMENTS FOR IDENTIFYING RESOURCE VALUES

Identifying Economic Values

TOOL	USE	STRENGTH	WEAKNESSES
Protocols for evaluating restoration / replacement costs	Assigns economic cost to environmental damages	Estimates costs directly related to the damaged resource	Some resources irreplaceable, ignores loss of use before replacement measures costs rather than values
Travel cost evaluations	Assigns economic value to resource based on visitation	Works well when distance to site is key for estimating benefits	Trips often have multiple objectives, confuses payments (expenditures) with value
Hedonic pricing protocols	Assigns economic worth to component of resource values	Can expand market prices to non-market environmental amenities	Difficult to identify contributions of various non-market factors: reflects market prices rather than values
Damage schedule questionnaires and protocols	Estimates the relative seriousness of adverse impacts	Facilitates quick response and saves transaction costs: reflects community concerns	Provides relative rather than absolute values: difficult to anticipate all types of possible losses

Identifying and Specifying Ecological Values

TOOL	USE	STRENGTH	WEAKNESSES
Scientific and technical ssessments of ecosystem health	Relates ecosystem quality to the performance of key indicators	Provides useful summary measures to gauge impacts of changes over time	Hard to link cause and effect in ecological relationships: choice of indicators may be controversial
Scientific and technical assessments of ecosystem integrity	Focuses on synergistic and system relationships	Recognises system-wide characteristics of complex ecosystems	Definitions can vary greatly across experts: human vs non-human factors problematic

TOOL	USE	STRENGTH	WEAKNESSES
Assessments of resource and ecosystems resilience	Assesses the long-term viability of a resource	Captures threats to future environmental quality based on past events and ecosystem response.	Difficult to measure: translation into comparable policy terms can be controversial
Carrying capacity assessments	Relates fundamental qualities of ecosystem to productivity	Tracks key threats to future resource use and availability	Relation of productivity to value may be contested: choice of impact baseline difficult

Source: Gregory, Identifying Environmental Values in Source: Dale and English, Tools to aid Environmental Decision-Making (1998), 38-39.

Tools for identifying environmental values
Identifying preferences on a broad scale

TOOL	USE	STRENGTH	WEAKNESSES
Attitudinal and opinion surveys	Gathers information about ecological understanding and support for policies	Viewed as egalitarian and democratic: can be closely targeted to issues or population	Subject to strategic and motivational biases: may encourage superficial responses
Contingent valuations	Places an economic value on a resource not sold in conventional markets	Derives numbers that can be compared to other economic valuations	Value estimates subject to biases: measures gains only confuses economic and other motives.
Constructed preference	Elicits values used in making decisions about environmental choices	Attempts to reflect actual division processes and the key tradeoffs of stakeholders	Responses may be difficult to integrate into cost-benefit framework
Image	Assesses effective and psychological reactions to scenarios or events	Incorporates perceptions and beliefs associated with a proposed action	Stimulus-response characteristics tough to anticipate high geographic variability in responses
Narrative and affect	Effects concerns of stakeholders through dialogue and conversation	Can yield compelling stories: methods grounded in familiar feelings and emotions	Subject to bias via small sample selection: coding of responses problematic
Referenda	Asks individuals to vote for or against a specific proposed action	Provides familiar method for gauging opinions of diverse stakeholders	Knowledge level of participants can vary widely: responses sensitive to framing of questions

Identifying preferences at a smaller scale

TOOL	USE	STRENGTH	WEAKNESSES
Focus group	Elicits response to proposed action through internal small group discussions	Inexpensive as directly targets question of concern: uses insights from diverse populations	Sessions can be dominated by one point of view: values remain implied and conflicts are difficult to address
Advisory committees	Develops a broad perspective on an issue: involves interested and knowledgable representatives	Allows for open discussion: can increase trust in agency and empower local citizens	Objectives and powers of committee may be unclear: diversity of viewpoints easily suppressed
Multi-attribute elicitations	Structures the objectives and tradeoffs of participants vis-à-vis policy alternatives	Structures problem and improves understanding of stakeholders' values: distinguishes ends and intermediate goals	May appear overly quantitative: difficult for participants opposed to problem decomposition

Source: Gregory, Identifyiing Environmental Values in Source: Dale and English, Tools to aid Environmental Decision-Making (1998), 38-39.



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