

## POLICY NOTE

# REGIONAL ENVIRONMENTAL AND BIOSECURITY FRAMEWORKS FOR SUSTAINABLE AQUACULTURE DEVELOPMENT FOR WEST AFRICA

### *Executive Summary*

West Africa has great opportunity for aquaculture due to availability of water resources, good water quality, suitable climate and the established production techniques in the region. However, poor aquaculture management practices among other challenges have affected production. Policies exist to guide the management of aquaculture but lack of coherence has restricted their impact. Based on Comprehensive African Agriculture Programme (CAADP) and Council for African Ministers in Agriculture (CAMFA), the Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa (PFRS) was developed to facilitate policy coherence for the sustainable management of fisheries and aquaculture resources in the member states of the African Union. This policy note has been developed from the West African regional framework which was developed out of consultations that were facilitated by AU-IBAR through the FishGov project. The policy note outlines strategies for managing shared resources, issues of health and safety, farm input use as well as site selection procedures

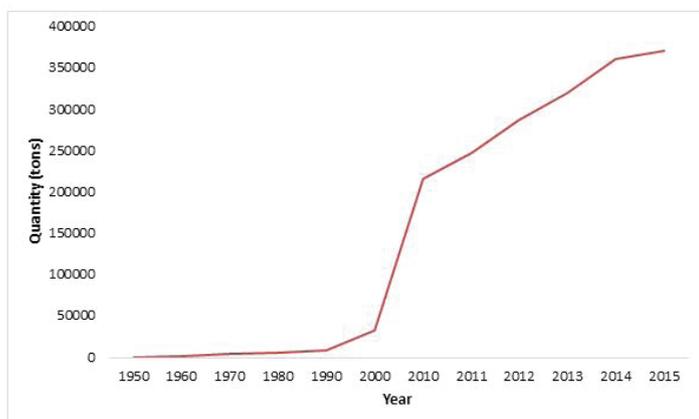
for aquaculture which has to consider flooding, land clearing, pollution and fish escape. As such considerations on water quality, environmental safety and health, climate, hydrography and social economics have been highlighted as key in ensuring increased production from sustainable aquaculture management.

### *Background And Introduction*

#### **An overview of Aquaculture in the West Africa**

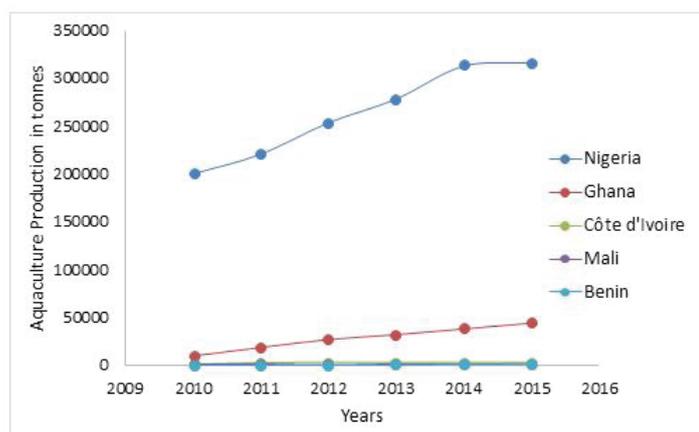
Aquaculture for most countries in the West African region started in the 1950s but has grown at varying paces. Production in the region is in both freshwater and marine environments employing both land-based and water-based facilities, with production in the freshwater dominating. Existing production systems include cages, pens, earthen ponds and concrete/fibre/plastic tanks. Development of aquaculture as a source of income and food has begun to be exploited recently. The region has registered increase in production since 1950 with a production of 371,057 tonnes in 2015 (FAO, 2017) (Figure 1).





**Figure 1:** The trend for Aquaculture production in West Africa

For countries like Ghana, Nigeria and Ivory Coast, the growth of aquaculture has been promising unlike other countries in the region, hence, Nigeria and Ghana are among the five African largest producers with an average production of 313 231 tonnes and 38 545 tonnes, respectively, in 2014 (FAO, 2015,



**Figure 2:** Aquaculture production for some individual countries in West Africa

Figure 2). Despite the growth of aquaculture in the region, production has not met the demand for the populace, registering a deficit in terms of supply. This calls for expansion of the sector which will consequently lead to more pressure on the environment. The region has tropical climate and rich natural water resources with 31 % and 9 % of the land area being suitable for small holder and commercial fish farming, respectively.

### **Environmental Laws and EIA regulations affecting aquaculture in West Africa**

Potential environmental impacts are restricting the development of the aquaculture industry. Recognizing the variation in potential environmental impacts from different types of aquaculture operations is a

necessary step in developing and implementing an efficient and effective environmental management regime for increased aquaculture production. Policies, regulations and governance measures are enacted to ensure environmental sustainability, without destroying entrepreneurial initiatives and social harmony. As a way of overcoming this challenge, aquaculture production is subjected to environmental laws and regulations. All the countries in the sub-region have some form of legislations that relate to aquaculture directly or indirectly. Aquaculture in West African countries is affected by EIA regulations of 1983, 1990, 1992, 1993, 1996, 1999, 2000, 2001, 2002, 2004, 2006, 2008 and 2012 and these are governed by different environmental Laws. Below is a summary of Environmental Laws and EIA regulations affecting aquaculture in the top 5 producing countries in the region.

### **SWOT analyses of aquaculture in West Africa**

Table 2 summarizes the strengths, weaknesses, opportunities and threats that relate to aquaculture for the region.

### **The Vision for West Africa region**

The vision for West Africa is to “have a sustainable production of cultured fish, expansion and growth of the aquaculture sector and enhanced social and economic benefits”.

### **The problems in relation environmental and biosecurity issues in sustainable aquaculture development**

Fish and fisheries resources generally contribute to socio-economic growth and development of West Africa among many other benefits. However, numerous challenges in the region have reduced prospects for increasing fisheries contribution to food security, poverty alleviation and wealth creation. Environmental factors both biotic and abiotic factors affect greatly the productivity from aquaculture. Issues of water pollution, diseases and alien species that escape into the natural water due to poor management practices are some of the factors that have reduced productivity from aquaculture in the region. Population growth and development, trade and climate change are also drivers of aquaculture that affect productivity. This policy

**Table 1: Summary of Environmental Laws and EIA regulations**

Country	Environmental Law	EIA regulations	Explicit mention of aquaculture in EIA	EIA oversight institution	Guidelines published for EIA: general/ aquaculture
Benin	1999 Framework Law on Environment 98-030	2001	Simplified EIA mandatory for aquaculture / fish culture	ABE/BEA	General guidelines
Côte d'Ivoire	1996 Code on the Environment	1996		BEI/MLCVE, ANDE	
Ghana	1994 Environment Protection Act 490/94	1999	EIA regulations: EIA mandatory for aquaculture Required to accompany any application for a licence for aquaculture; Fisheries Impact Assessments required for any activity impacting on a fishery (as well as EIA)	EPA	General guidelines
Mali	1991 Protection of Environment and Life Framework 91-47	1999	EIA required: for dams and other permanent installations intended to retain or to stock water	Ministry	General guidelines
Nigeria	Decree 58 of 1998 and Decree 86 of 1992	1992	EIA required: Land based aquaculture projects accompanied by clearing of mangrove swamp forests covering an area of 50 hectares or more; dams and man-made lakes and artificial enlargement of lakes > 200 ha	FEPA	General guidelines

**Table 2: SWOT analyses of aquaculture in West Africa**

Strengths	Weaknesses	Opportunities	Threats
<ul style="list-style-type: none"> <li>• Availability of water</li> <li>• Good water quality</li> <li>• Suitable climate</li> <li>• Sheltered bays for marine aquaculture production</li> <li>• Established production techniques</li> <li>• Technically advanced systems</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of quality inputs (poor quality brood stock, slow growing fingerlings and quality feed)</li> <li>• Insufficient investment in research and development</li> <li>• High cost of production</li> <li>• Bureaucracies and delays in aquaculture permitting process in some countries</li> <li>• Inadequate private investment</li> <li>• Poor management practices</li> <li>• Lack of support services and ancillary industries</li> <li>• Limited technical capabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Employment for rural and riparian communities</li> <li>• High demand for fish locally</li> <li>• Shortfall in domestic fish demand</li> <li>• Decline in capture fisheries</li> <li>• Land and sea based sheltered sites</li> <li>• Market demands not met</li> <li>• New species and niche products</li> </ul>	<ul style="list-style-type: none"> <li>• Fish diseases and parasites</li> <li>• Climatic change and variability</li> <li>• Lack of access to finance</li> <li>• Potential conflicts over water access</li> <li>• High costs of production</li> <li>• Impact on biodiversity from alien species</li> <li>• Pollution and poor sanitation</li> </ul>

note will serve as a guideline to Regional Agencies, Member States and stakeholders of the West African Region towards achieving sustainable aquaculture. It will contribute towards strengthening the capacity of Member States to make more realistic and appropriate aquaculture development plans, approve appropriate projects and institute environmental management assessments more effectively. It shall also facilitate the development and implementation of best management practices (BMP) for all stakeholders which in return promotes sustainability in the aquaculture sector in the region.

### *Policy Recommendations on Framework for Sustainable Aquaculture Development*

The recommendations seeks to addresses actions that can be taken before establishing and in the management of aquaculture taking into account environmental and biosecurity issues for sustainable aquaculture development in the West African Region.

#### **Site selection**

##### *Identification of suitable sites for aquaculture*

Selection of suitable sites needs to be carried out in accordance with sustainability and best practice guidelines (FAO/World Bank 2015; FAO 2010). The ecosystem approach to aquaculture (EAA) is one of

the benchmark guidelines designed for sustainable development of aquaculture and proposes three main considerations which ensures that sites selected for aquaculture fall within the ecosystem’s functional limits, are socially acceptable and are economically feasible. The considerations include ecological, socio-economic and governance. Considerations in aquaculture site selection should also be made on concept of carrying capacity

##### *Spatial planning*

The tools used include Geographic Information Systems (GIS), Tropomod, Dillon and Rigler model, remote sensing and mapping for data management, analysis, modelling and decision-making. Among the tools, GIS serves as a powerful analytic and decision-making tool in the selection of best site for aquaculture and should be adopted by countries in the region.

##### *Key considerations in aquaculture site selection*

Selection of sites for earthen pond construction and installation of cages is accompanied by several issues that relate to Flooding, land clearing, pollution and fish escape. Technical/environmental and social economic issues have therefore been identified and strategic actions have been put in place to ensure sustainable management of aquaculture production as highlighted in Table 3 below:

**Table 3:** Site selection issues and strategic actions

	<b>Identified issues</b>	<b>Strategic actions</b>
Environmental /Technical issues	<ul style="list-style-type: none"> <li>• Genetic introgression and biodiversity changes</li> <li>• Use of antibiotic and hormones</li> <li>• Cage net clogging</li> <li>• Predators</li> <li>• Water Current and depth</li> <li>• Use of anti-fouling agents to clean cages.</li> <li>• Fish seed</li> <li>• Materials for cage construction</li> <li>• Use of antibiotic and hormones</li> <li>• Climatic change and variability –flooding, water shortage</li> <li>• Flood-prone areas</li> <li>• Feed and feed management</li> <li>• Ecological and cultural sensitivity of site</li> <li>• Water availability to areas downstream of ponds</li> <li>• Sitting of ponds to obstruct reserves and socio-cultural sites</li> </ul>	<ul style="list-style-type: none"> <li>• Zonation to identify areas where certain genetic materials may be restricted to.</li> <li>• Exclude anti-fouling agent for cleaning cage nets</li> <li>• Develop predator exclusion devices (fencing, scaring off)</li> <li>• Limits for depth below the cages and current speed should be set to allow for dispersion of cage effluent and excess feed before they reach the floor of water.</li> <li>• Use of feed additives such as hormones, steroids and others should be regulated</li> <li>• Regulatory measures to ensure compliance to environmental quality standards</li> <li>• Provide guidelines to allow new genetic material into a regions</li> <li>• Develop guidelines to assist in traceability of genetic identity resources</li> <li>• Develop bio-security approaches to control fish escapes</li> </ul>

	Identified issues	Strategic actions
	<ul style="list-style-type: none"> <li>• Soil type changes and erosion</li> </ul>	<ul style="list-style-type: none"> <li>• Prescribe quality of netting materials for cages to limit escape of fish</li> <li>• Quality of feed with respect to floating period should be emphasized to give opportunity for fish to feed before it sinks</li> <li>• High digestibility of feed should be prescribed to allow most of feed to be used by fish to avoid pollution;</li> <li>• Enhance capacity fish farmers in feed management.</li> <li>• Regulate additives (steroids, hormones) in Prescribe quality of netting</li> <li>• Sitting of ponds should not adversely obstruct water to reserves and socio-cultural sites (sacred groves and forest reserves)</li> <li>• Avoid deforestation</li> <li>• Water budget – loss of water availability to areas downstream of ponds should be avoided</li> <li>• Flood-prone areas should be avoided as pond sites for fish culture</li> <li>• Improve health service delivery in related communities, and monitoring of impact of treatment by working on risk factors such as drainage, bush control and other aspects of environmental public health, etc.</li> <li>• Climate adaption strategies for aquaculture e.g. reduction of water tables</li> <li>• Use of aerosols and similar chemicals should be avoided</li> <li>• Land –use planning</li> <li>• Prescribe treatment of effluent before release into open waters</li> <li>• Pond water could be utilized for irrigation of crops in irrigated fields</li> <li>• Avoid construction of ponds in porous soils</li> </ul>
Socio-Economic Issues	<ul style="list-style-type: none"> <li>• Navigational rights of communities close to cage operations restricted</li> <li>• Proximity of cages to community water abstraction points lead to degradation of community portable water</li> <li>• Limited access to near shore areas by riparian</li> <li>• Loss of income by local fishermen</li> <li>• Vulnerability of community livelihood systems to climate change increased</li> <li>• Ponds pose risk of drowning to community members</li> <li>• Cage farms located near water intake point can lead to conflict between farm operators and water companies</li> <li>• Loss of land to alternative uses</li> <li>• Loss of income by local fishermen</li> </ul>	<ul style="list-style-type: none"> <li>• Cleaning agents should be regulated.</li> <li>• Regulatory system identifying certified hatcheries with periodic assessment of performance.</li> <li>• Introduction of new species of fish seed should be done cautiously.</li> <li>• Non-corrosive material to be used</li> <li>• Reasonable compensation for use of land for aquaculture should be requested and made.</li> <li>• Allocation of employment opportunities to community members in negotiations with prospective fish farmers</li> <li>• Negotiation for peaceful settlement</li> <li>• Public involvement guidelines</li> <li>• Establish water balance to ensure availability of water for downstream communities.</li> <li>• Efficient utilisation of water for aquaculture</li> <li>• Restriction of access of pond area to the general public.</li> </ul>

	Identified issues	Strategic actions
	<ul style="list-style-type: none"> <li>• Potential loss of rent and social status to land owners</li> <li>• Potential Conflict of water –use between downstream communities members aquaculture operator; particularly in water stressed areas – possibility of limited water supply for aquaculture</li> <li>• Escalation of communicable diseases and STDs as a result of aggregation of people for economic activity</li> <li>• Escalation of water-borne diseases</li> <li>• Drug resistant species</li> <li>• Habitat alteration and changes in micro environment results in loss of ecosystem services such as soil fertility as a result of soil erosion and soil water retention capacity and potential for cultivation of vegetables</li> <li>• Contamination of source of community water supply</li> <li>• Contamination of source of community water supply</li> <li>• Drug resistant species</li> <li>• Vulnerability of community livelihood systems to climate change increased</li> <li>• Loss of income by local fishermen</li> <li>• Drug resistant species</li> </ul>	<ul style="list-style-type: none"> <li>• Establish water balance to ensure availability of water for downstream communities.</li> <li>• Restriction of access of pond area to the general public.</li> <li>• Education and Awareness creation, Reduce stigmatization.</li> <li>• Education and Awareness creation, Reduce stigmatization</li> <li>• Social-responsibility of the enterprise be made clear to the community</li> <li>• Alternative commodities that withstand new micro environment should be promoted</li> <li>• Evidence of treatment of effluent before discharge demonstrated</li> <li>• Develop vulnerability adaptation strategies</li> <li>• Right of access to near shore areas of water bodies by communities should be guaranteed</li> <li>• Evidence of treatment of effluent before discharge demonstrated</li> <li>• Establish water balance to ensure availability</li> <li>• Social-responsibility of the enterprise be made clear to the community</li> <li>• Alternative commodities that withstand new micro environment should be promoted</li> <li>• Evidence of treatment of effluent before discharge demonstrated</li> <li>• Develop vulnerability adaptation strategies</li> <li>• Establish minimum distance from community water vpoints to minimize impact on community water quality</li> </ul>

**Farming inputs use issues and strategic actions**

Issues of farming inputs use have been listed below with strategic actions for addressing them (Table 4).

**Transboundary context for shared resources**

All transboundary water bodies create hydrological, social and economic interdependencies between societies. They are vital for economic development, reducing poverty and contributing to the attainment

of the Millennium Development Goals. The 1997 United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses is the only treaty governing shared freshwater resources that is of universal applicability (UN 2008). Issues and strategic guidelines for sustainable use of shared water bodies in relation to aquaculture are presented in Table 5.

**Table 4: Farming Inputs Use Issues and strategic actions**

	ELEMENTS	IDENTIFIED ISSUES		STRATEGIC ACTIONS	
		ENVIRONMENT/ TECHNICAL	SOCIO- ECONOMIC	ENVIRONMENTAL	SOCIO-ECONOMIC
I	INPUTS				
		<ul style="list-style-type: none"> <li>• Pollution and waste</li> <li>• Loss of biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Water pollution and use</li> <li>• Diseases</li> <li>• Low incomes</li> <li>• Livelihoods</li> </ul>	<ul style="list-style-type: none"> <li>• Capacity building of farmers in feed management and use.</li> <li>• Certification of feeds and quality assurance</li> <li>• Regulations and enforcement</li> <li>• Monitoring</li> </ul>	<ul style="list-style-type: none"> <li>• Alternative water sources</li> <li>• Alternative livelihoods</li> <li>• Health facility</li> </ul>
b.	Seed	Loss of Biodiversity	<ul style="list-style-type: none"> <li>• Loss of livelihoods</li> <li>• Social vices</li> </ul>	<ul style="list-style-type: none"> <li>• Use of indigenous species</li> <li>• Certification hatcheries</li> <li>• Legislations and enforcement</li> </ul>	<ul style="list-style-type: none"> <li>• Alternative livelihoods</li> </ul>
c.	Brood stock	Poor quality brood stock		<ul style="list-style-type: none"> <li>• Recruitment/ adoption of quality brood stocks, Capacity building of hatchery operators</li> <li>• Only certified brood stocks of approved fish should be used</li> <li>• Hatcheries should be certified</li> </ul>	
d.	Additives and probiotics	misuse of hormones and antibiotics which become available to non-target species	Conflict resulting from uncertainty of actions of different countries	Hormones, additives and probiotics should be approved materials and where they can be used should be guided.	Negotiations for agreement on type of additives to use.
e.	Organic and inorganic fertilizers in pond aquaculture	Unacceptable rate of application and contaminated animal droppings.	Social acceptance of different manures by different countries as source of conflict and delay of actions	Capacity building of farmers for appropriate use, Extension to farmers.	Negotiations for agreement on use of organic manure
2.	Nets and cage materials and pond liners	Poor quality liner material		Material quality should be prescribed and the rate of change determined	

**Table 5: Issues related to shared water bodies**

	Issues	Strategic Action
Shared water bodies	Availability of water in sufficient quantities for aquaculture activities as well as downstream requirements (Communities and ecosystems)	<ul style="list-style-type: none"> <li>• Collaboration in managing shared water resources</li> <li>• Negotiations to allocate abstraction quotas</li> </ul>
Water systems	Introduction of non-native species	<ul style="list-style-type: none"> <li>• Regulation to control movement of genetic material</li> </ul>
	Alteration of river flow	<ul style="list-style-type: none"> <li>• Catchment protection</li> </ul>
	Spread of invasive species	<ul style="list-style-type: none"> <li>• Develop integrated management approaches</li> </ul>

	Issues	Strategic Action
	Sediment and nutrient loading	<ul style="list-style-type: none"> <li>• Pollution control</li> </ul>
Public health issues	Increased incidence of communicable diseases and water borne diseases due to aggregation of population around water fish enterprise	<ul style="list-style-type: none"> <li>• Education and awareness creation</li> <li>• Improve health service delivery</li> <li>• Reduce stigmatization</li> </ul>

### **Environment safety and occupational health associated with aquaculture**

With the intensification of aquaculture, a number of aquaculture facilities across the world depend a lot on the input of formulated feeds and the application of agrochemicals, antibiotics and other inputs, resulting in the presence of many chemical and biological contaminants in aquaculture facilities. These can lead to high levels of antibiotic residues, antibiotic-resistant bacteria, persistent organic pollutants, metals, parasites and viruses in aquaculture finfish and shellfish. The occupational hazards, safety concerns, and risks to health in the aquaculture industry can vary considerably based on the types of operation, scale of production, and even the specific species of interest. The summarized five categories of hazards are as follows:

- Physiological (work design)
- Physical
- Chemical
- Biological
- Psychological

To mitigate these incidences, there is a need for the documentation of a health and safety plan which ensures that practical steps are taken to prevent an incident from occurring. A good health and safety plan would normally include the following: method of identifying hazard, safe work procedure, programme of training workers in safe work procedures, method of monitoring workers for safe work procedures, progressive disciplinary policy to ensure compliance with safety policies and a documentation of the steps of the health and safety plan as proof of due diligence.

### **Conclusion**

The policy note on regional Framework on Environmental Management for Sustainable Aquaculture Development in West Africa recommends employing an ecosystem approach to aquaculture (EAA) in

the whole aquaculture cycle, proper site selection procedures, strategic management and collaboration in managing shared water resources and documentation of a health and safety plan. Implementation of this policy note will give a platform needed to ensure a strong future for aquaculture in Eastern Africa and the Great Lakes Regions hence facilitating sustainable aquaculture development in the region.

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