
OPTIMISING THE FISHERIES RESOURCES OF THE ANAMBRA RIVER THROUGH EVOLVING STRATEGIES TOWARDS SUSTAINABLE FISHING

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ABSTRACT

This study explores the current state of fisheries resources in Anambra River and proposes evolving strategies to optimise and promote sustainable fishing practices. It emphasizes the urgent need for ecologically responsible, economically viable and socially equitable approaches to ensure the preservation of fish population of the river. Anambra River holds immense significance for local communities in terms of food security, livelihoods and cultural heritage. This study identifies key factors such as use of inappropriate fishing gears, harmful practices such as the use of poison and explosives, the lack of political will and commitment to enforce fishing regulations effectively as contributors to the decline of fish populations in the river. To address these challenges, comprehensive set of control measures proposed were provision of access to legal fishing gears, promoting alternative livelihood options, raising awareness among stakeholders, enforcing existing regulations, developing robust legislation and policies, and providing training to extension workers. Implementation of these measures will enable the Anambra River to sustainably support the well-being, economy, and cultural heritage of local communities while safeguarding its ecological integrity. In conclusion, this work emphasises the global significance of adopting sustainable fishing practices not only in the Anambra River but also in similar ecosystems. The long-term viability of fisheries resources of Anambra River relies on the collective commitment to sustainable fishing practices, ensuring the continued well-being of the aquatic ecosystem and the communities dependent on the river.

Keywords: Anambra River, Fisheries resources, Sustainable fishing, Aquatic ecosystem, Conservation

INTRODUCTION

The sustainable management and optimisation of fisheries resources is of paramount importance to ensure the long-term viability of aquatic ecosystem resources and the well-being of communities that depends on them. Sustainable fishing is a fundamental concept in fisheries management, emphasizing the need for a balanced approach to harvesting fish resources, while preserving the ecological integrity of aquatic ecosystems. It involves adopting fishing practices that are ecologically responsible, economically viable and socially

equitable (FAO, 2012). The goal of sustainable fishing is to ensure the long-term viability of fish populations by maintaining their reproductive capacity, minimizing by-catch and habitat destruction, and promoting ecosystem resilience (FAO, 2012). This approach recognizes that fish are valuable natural resource, providing food, food security, livelihoods and cultural benefits to communities worldwide (Nwabeze and Erie, 2013). To achieve sustainability, various principles and strategies must guide sustainable fishing practices. One key principle is the application of science-based management, which involves monitoring fish populations,

assessing their health and abundance, and setting catch limits based on sustainable levels (Tanner *et al.*, 2021). This approach ensures that fishing activities do not exceed the capacity of the fish populations to replenish themselves through reproduction (Hixon *et al.*, 2014).

Furthermore, sustainable fishing emphasizes the use of selective fishing gear and practices that minimize unintended catch and environmental damage. Selective fishing gears such as size-selective meshes, escapement devices and modified fishing techniques allow for the release of undersized or non-target species, reducing the impact on the ecosystem (Bjordal, 2001). In addition to responsible fishing practices, the conservation and restoration of fish habitats play a crucial role in sustainable fishing. Protecting and rehabilitating critical habitats, such as spawning areas, nursery grounds and coral reefs, ensure the availability of suitable environments for fish reproduction, growth and survival (Janekarn and Chullasorn, 1996). Habitat conservation also contributes to the maintenance of overall ecosystem health, as healthy habitats support diverse species and ecological interactions. Sustainable fishing practices go beyond the ecological dimension and encompass social and economic aspects. They aim to promote social equity by considering the rights and needs of small-scale fishers, indigenous communities and marginalized groups dependent on fisheries resources (Amos and Peter, 2018). Sustainable fishing provides equitable access to resources, support local livelihoods, and foster community participation in decision-making processes. By adopting sustainable fishing practices, fisheries can provide long-term benefits for both present and future generations. Sustainable management ensures the continued availability of fish as a valuable food source, contributes to poverty reduction, and preserves cultural traditions linked to fishing activities (Giron-Nava *et al.*, 2021).

Anambra River holds great importance to the communities through which it flows. It is a significant water body that supports various social, economic, and cultural aspects of the area. The river provides essential ecosystem services and serves as a vital habitat for diverse

fish species, which play a central role in the lives of the local communities. It is a home to a wide range of fish species that are highly valued for their nutritional and economic benefits. Fish from the river serves as an important source of protein and essential nutrients for the local population (Odo *et al.*, 2009). They form a significant part of the diet and contribute to food security and nutrition in the surrounding communities. In addition to being a vital food source, the fisheries of the Anambra River also support the livelihoods of numerous individuals and communities. Fishing activities provide employment opportunities and income generation for fishers, processors, traders and other stakeholders along the value chain (Kurien, 2015). The river's fisheries contribute to the local economy, fostering economic development and poverty reduction. The cultural significance of the Anambra River cannot be overstated. Fishing traditions and practices have been passed down through generations, forming an integral part of the cultural heritage of the local communities. The river and its fish species are deeply embedded in folklore, rituals, and social ceremonies, connecting people to their cultural roots and identity (Anderson *et al.*, 2019). Anambra River is a symbol of cultural heritage and plays a role in shaping community identity and social cohesion. However, the fisheries resources in the Anambra River have been facing various challenges, leading to a decline in fish populations. It is crucial to address these issues and implement sustainable fishing practices to reverse the decline and ensure the long-term health and productivity of the river's fisheries (Ezeh *et al.*, 2019). The importance of the Anambra River to the community underscores the need for sustainable fishing practices and conservation efforts to reverse the decline of fisheries resources. By implementing measures to protect the river's ecosystem, promote responsible fishing practices, and ensure the long-term viability of fish populations, it is possible to safeguard the river's invaluable contributions to the well-being, economy, and cultural heritage of the communities.

various sources of pollution. Untreated industrial effluents, agricultural runoff, and domestic sewage contribute to a decline in water quality. This degradation can negatively impact aquatic life, biodiversity, and the overall health of the river's ecosystem. The need for effective management practices to mitigate pollution and protect water quality becomes imperative in ensuring the river's sustainability and the well-being of its dependent communities (Ogoko *et al.*, 2020).

Anambra river resources: The seasonal overflow of the Anambra River creates temporary wetlands along its course. These wetland habitats play a vital role in supporting diverse ecological communities. They act as crucial breeding grounds for various aquatic species, including fish, amphibians, and invertebrates. Migratory birds also find sanctuary in these wetlands, making stopovers during their arduous journeys. This seasonal congregation of avian visitors adds to the region's biodiversity, offering a spectacle for birdwatchers and nature enthusiasts alike. The Anambra River stands as an ecological haven, teeming with an impressive diversity of biological resources. Its riparian zones, characterized by lush vegetation and verdant landscapes, create a thriving ecosystem that sustains an array of plant and animal species (Odo *et al.*, 2012; Ezeh *et al.*, 2019). The river's banks are adorned with a rich tapestry of plant life. From towering trees to dense undergrowth, the riparian vegetation provides vital habitats for numerous plant species. These areas serve as nesting sites for various bird species, offering a sheltered sanctuary for breeding and raising their young (Odo *et al.*, 2007; Odo *et al.*, 2009). The heart of the Anambra River lies in its waters, where aquatic life thrives in abundance. The river's flowing currents and diverse habitats create a welcoming environment for a myriad of fish species. Among the most notable are the catfish, tilapia, and freshwater shrimps, which play a significant role in the river's ecosystem dynamics (Odo *et al.*, 2007; Odo *et al.*, 2009). Catfish, known for their prominent barbels and diverse adaptations, have found a home in the Anambra River. These hardy fish are highly

sought after by local fishing communities, making them a vital economic resource for the region. Tilapias, another popular species, are revered for their delicate flavour and nutritional value. The presence of freshwater shrimps contributes to the ecological balance, as they serve as essential links in the aquatic food chain (Odo *et al.*, 2007; Odo *et al.*, 2009). The exploitation of the Anambra River's resources involves multiple stakeholders. Local fishing communities depend on the river for their subsistence and livelihoods, relying on its generous yield to sustain their families. The fishing industry, driven by the river's abundance, contributes significantly to the local economy and food security (Odo *et al.*, 2007; Odo *et al.*, 2009). Industries draw water from the river to support their operations, and agriculture relies heavily on its waters for irrigation during the dry season. Government agencies play a pivotal role in regulating these activities, ensuring that water usage remains sustainable and does not compromise the river's ecological health. Collaboration between governmental bodies, local communities, and private enterprises is crucial in achieving a balance between economic development and environmental preservation (Odo *et al.*, 2012).

Management practices and conservation efforts: The management of the Anambra River requires a comprehensive and collaborative approach. Local and regional authorities have initiated several initiatives to monitor water quality, control pollution, and promote sustainable fishing practices. Additionally, awareness campaigns are conducted to educate communities about the importance of preserving the river's biodiversity and ecosystems. Furthermore, the establishment of protected areas and wetland conservation zones has proven effective in safeguarding critical habitats and promoting sustainable use of resources. By involving stakeholders in decision-making processes, a sense of ownership and responsibility is fostered, leading to more effective management and conservation efforts (Eyo and Akpati, 1995; Bjordal, 2001). To safeguard the Anambra River's health and integrity, a multifaceted approach to

management is essential. Collaborative efforts between government agencies, local communities, and other stakeholders are crucial to addressing the challenges posed by anthropogenic activities.

Pollution control and regulation: Implementing strict regulations on waste discharge from industries and improving sewage treatment in urban areas can significantly reduce pollution levels in the river. Regular monitoring of water quality is imperative to detect any adverse changes promptly (FAO, 2012).

Wetland conservation: Designating and protecting wetland areas along the river's course can ensure the preservation of critical habitats for biodiversity. By safeguarding wetlands, migratory bird populations can be protected, and the natural filtering capacity of wetlands can help maintain water quality (FAO, 2012).

Sustainable agriculture practices: Promoting sustainable agricultural practices can mitigate soil erosion and reduce the impact of agricultural runoff on the river's water quality. Encouraging practices such as contour farming and agroforestry can enhance soil health and limit the use of harmful chemicals (FAO, 2012).

Community participation and awareness: Involving local communities in the conservation efforts of the river will foster a sense of ownership and responsibility. Educational programs can raise awareness about the importance of preserving the river's resources and how individual actions can positively impact its health (FAO, 2012).

Integrated watershed management: Adopting an integrated approach to watershed management considers the interconnectedness of the entire river basin. This approach can help address upstream activities that may affect downstream water quality and ecosystems (FAO, 2012).

Causes of Fish Decline in Anambra River

Use of inappropriate fishing gears: The use of inappropriate fishing gears, particularly the utilisation of mosquito nets, poses a significant threat to the fish populations in the Anambra River. Mosquito nets, which are primarily designed for mosquito control and disease prevention, are being employed by fishermen in the river for capturing juvenile fish (Figure 2).



Figure 2: Mosquito nets distributed to combat malaria in developing tropical countries are also being routinely used for fishing (Source: Adopted from Carrington, 2018)

However, this practice has detrimental consequences for the sustainability of fish populations and the overall health of the ecosystem. The use of mosquito nets as fishing gear is unsustainable and harmful to fish populations (Carrington, 2018; Larsen *et al.*, 2021). Juvenile fish are essential for maintaining the reproductive capacity and replenishment of fish stocks. When mosquito nets are used to capture juvenile fish, it disrupts their natural growth and development, hindering their ability to reach reproductive maturity, as indicated in Figure 3 where immature fishes were sold at Anambra River fish landing site. This impedes the replenishment of fish populations and has a cascading effect on the entire ecosystem (Short *et al.*, 2018; Larsen *et al.*, 2021). The Food and Agriculture Organization (FAO) has highlighted the negative impact of using mosquito nets as fishing gear. In their technical guidelines on responsible fisheries, the FAO emphasizes the need to adopt sustainable fishing practices that prioritize the conservation of fish populations

and the protection of aquatic habitats. The use of mosquito nets for fishing is recognized as an unsustainable practice that leads to overfishing and the decline of fish stocks (FAO, 2012).



Figure 3: Immature fishes sold at Anambra River fish landing site (Source: Author's field work)

Use of poison and explosives: The use of poison and explosives in fishing is a severe threat to the fish populations and overall health of aquatic ecosystem (Raji *et al.*, 2012; Sogbesan and Kwaji, 2018). These destructive methods lead to a significant decline in fish populations and have detrimental effects on the aquatic environment. Poisoning and the use of explosives in fishing are highly indiscriminate practices that result in the large-scale killing of fish. Fishermen often use toxic substances, such as pesticides or chemicals, to immobilize or kill fish, making them easier to capture. Herbicides and pesticides in common use in Nigeria are tabulated in Table 1 together with World Health Organisation (WHO) classification for toxicity and EPA criteria for protection of aquatic life in freshwaters. Furthermore, most of these herbicides and pesticides are employed in crop production and their run-off ends up in the aquatic ecosystem where they pollute and caused decline of fish population (Ita, 1993). Poisonous plants have been implicated in fishing (Table 2). Additionally, explosives are sometimes employed to stun or kill fish, making them float to the surface for easy collection. However, these methods not only deplete the target fish populations but also harm non-target species, including endangered or protected species, and disrupt the delicate balance of the ecosystem (Raji *et al.*, 2012; Sogbesan and

Kwaji, 2018). The use of poison and explosives in fishing has destructive consequences for the Anambra River's biodiversity and ecological integrity. Non-target species, such as crustaceans, amphibians, and other aquatic organisms, suffer from the lethal effects of these practices. Moreover, the widespread use of poison and explosives contributes to habitat degradation by damaging coral reefs, sea grass beds, and other critical aquatic habitats that serve as nurseries and breeding grounds for fish (Garcia *et al.*, 2003).

Lack of political will and commitment from the government to enforce fishing regulations and conservation laws: The lack of political will and commitment from the government to enforce fishing regulations and conservation laws has had detrimental effects on the fisheries resources in the Anambra River. Inadequate enforcement of fishing regulations and conservation laws and poor governance has contributed to the on-going decline of fish populations and the degradation of their habitats (Warren and Steenbergen, 2021). One of the primary issues is the persistence of illegal fishing practices. Despite the existence of regulations and laws to protect fish populations, the weak enforcement of these measures allows illegal fishing methods to continue unchecked. This includes activities such as using banned fishing gears, exceeding catch limits, and engaging in destructive fishing practices. The absence of strict enforcement mechanisms undermines the sustainability of fisheries resources and exacerbates the decline of fish populations (FAO, 2012).

The absence of robust governance and enforcement mechanisms undermines the conservation of fish populations and their habitats. Without adequate policies, coordination, and resources dedicated to fisheries management, the Anambra River ecosystem is left vulnerable to exploitation and degradation. Political will and commitment are necessary to establish and enforce regulations that promote sustainable fishing practices, protect critical habitats, and ensure the long-term viability of fisheries resources (McLain *et al.*, 2018).

Table 1: Herbicides and insecticides produced and distributed by CIBA GEIGY Company in Nigeria

Herbicide	Active ingredients	Crops	Dosage
Codal 400 EC	Metachlor and Prometryn	Cotton, maize, cowpea, groundnut, melon, okra and mixed crops	4-6 I/ha
Cotoron 500 FW	Fluometron	Cotton and cassava	4-6 I/ha
Cotoron Multi 50 WP	Fluometron + Metachlor	Cotton and cassava	4-6 I/ha
Dicuran 500 FW	Chlortoluron	Wheat	4 I/ha
Erbotan 80 WP	Thiazofluron	In brush <i>and</i> tree forms once in 2-3 years	8-15 kg/ha
Estimine 2.4-D	2.4-D	Broad-leaved weeds and sedges in rice	5-10 I/ha
Galex 500 EC	Metabromuron + Metalochlor	Cowpea, soya, tomatoes and peppers	6-6 I/ha
Gardoprim A 500 FW	Atrazine+ Terbutylazone	Millet, sorghum, maize	4-6 I/ha
Gepiron ET	MSMA	Sugar cane, banana, tree crops	4-6 I/ha
Gespax 500 PW	Ametryn	Pineapple, banana, oil palm, sugar cane	5-6 I/ha
Gesatop 2500 FW	Ametryn + Simazine	Banana, pineapple, citrus, sugar cane	5-8 I/ha
Sorgoprim 500 FW	Terbutylazine +Terbutryn	Sorghum	4 I/ha
Stomp 500 EC	Pendimethalin	Sugar cane, maize	4-5 I/ha
Insecticide	Active ingredients	Crops	
Basudin 600 EC	Diazinon	Orchard, horticulture	
Basudin 10 G	Diazinon	Maize, yam, rice, vegetables	
Elocron 50 WP	Diozocarb	Cocoa	
Furadon	Carbofuran	Rice, maize, groundnut	
Nogas 50 EC	Dichlorvos	Broad spectrum	
Polytrin C-440 EC	Profenopos + Cypermethrin + Polytrin	Cowpea, cotton	
Ultracide 40 EC	Methidathion	Cassava	
Apron plus 500 S	Metalaxyl + Carboxin + Furathiocarb	Seed treatment: maize, millet, sorghum, groundnut, cotton, cowpea etc.	
Furadam 3 G	Carbofuran	Soil pests in rice, maize and groundnut	
Ridomil plus 72 WP	Metalaxyl + Cuprom oxide	Cocoa and pineapple	
Damfin 2 P	Methacritos	Stored products	
Damfin 500 EC	Methacritos	Stored products	
Nuvan 100 EC	Dichlorvos	Public hygiene, control of flies, cockroaches, bugs, ants and insects in stored products	

Source: Ita (1993)

Table 2: A list of some plants used as poison for fishing around Kainji Lake, Nigeria

Latin name	Hausa name	Active ingredient
<i>Tephrosia vogelii</i>	<i>Magimfa</i>	Tephrosin (C ₂₃ H ₂₂ O ₇). It is closely related to rotenone (C ₂₃ H ₂₂ O ₇).
<i>Mondulea sericea</i>	<i>Magimfa</i>	Mundulone (C ₁ H ₂₆ O ₆). Also similar to rotenone.
<i>Perkia clappertoniana</i>	<i>Doruwa</i>	Unknown but made from crushing the mature pods
<i>Lasiosiphona krussianus</i>	<i>Turunibi</i>	Unknown but highly poisonous to cattle and human without antidote
<i>Boerhaavia coccinea</i>	<i>Kashin shanu</i>	Unknown but speeds up the effect of other poisons

Source: Raji et al. (2012)

Over fishing: Overfishing is another consequence of the lack of political will and commitment to enforce fishing regulations. Without proper monitoring and control, fishermen can exploit fish stocks beyond sustainable levels. Overfishing depletes fish populations, disrupts the balance of the ecosystem, and impairs the ability of fish stocks to regenerate and replenish. It is crucial for the government to

demonstrate commitment and take proactive measures to prevent overfishing through effective regulations, monitoring, and enforcement (Canyon *et al.*, 2021).

Control Measures

Provision of access to legal fishing gears: Ensuring access to legal and appropriate fishing

gears is crucial for promoting sustainable fishing practices in the Anambra River. Local fishermen should have access to fishing gears that are selective, minimizes by-catch, and allows for the escape of juvenile fish. Providing affordable and accessible legal fishing gears encourages responsible fishing practices, contributing to the preservation of fish stocks and the ecosystem (Eyo and Akpati, 1995; Bjordal, 2001).

Provision of alternative livelihoods: Reducing the pressure on fisheries resources in the Anambra River requires the provision of alternative livelihood options for the local communities. By diversifying income sources, communities can reduce their reliance solely on fishing and alleviate the strain on fish populations. Initiatives should focus on promoting alternative income-generating activities, such as crop agriculture, aquaculture, eco-tourism, small-scale enterprises, and adoption of the FAO's action for Blue Growth in inland fisheries (Table 3). This approach ensures a sustainable balance between economic development and the conservation of fisheries resources (Bartley *et al.*, 2018).

Awareness creation: Raising awareness among fishermen and the local community is vital for curbing the use of poison and explosives in fishing. Awareness campaigns should highlight the ecological consequences, legal implications, and health hazards associated with these destructive practices. By educating and sensitizing the community about sustainable fishing methods and the importance of conservation, a collective sense of responsibility can be fostered through the adoption of FAO Blue Growth initiative on inland fisheries resources (Table 3) (Bartley *et al.*, 2018; Olopade and Dienye, 2020).

Enforcement of regulations: Strong enforcement measures are essential for deterring illegal fishing practices and ensuring compliance with fishing regulations. Government agencies and local authorities should actively enforce the use of legal fishing gears and penalize those engaged in destructive fishing practices.

Regular monitoring, surveillance, and strict enforcement can contribute to the conservation of fish populations and the restoration of the Anambra River's ecosystem (FAO, 2012).

Legislation and policy development:

Comprehensive legislation and policy frameworks should be developed and implemented to support sustainable fishing practices and protect fisheries resources in the Anambra River. These legal instruments should address issues such as habitat protection, fishing gear regulations, closed seasons, and size limits. Collaborative efforts between government agencies, local communities, and fisheries management institutions are necessary for the effective formulation and implementation of fisheries-related legislations (FAO, 2012).

Training of extension workers: Capacity-building programs and training initiatives should be conducted for extension workers, fisheries officers, and other relevant stakeholders. These training programs enhance their knowledge and skills in sustainable fisheries practices, stock assessment, ecosystem-based management, and conservation strategies. Well-trained extension workers can effectively disseminate information, provide technical assistance, and promote sustainable fishing practices within the community (Eyo and Akpati, 1995; Bjordal, 2001).

Conclusion: Sustainable fishing practices are crucial for the long-term viability of fish populations and the preservation of aquatic ecosystems. Sustainable fishing involves adopting ecologically responsible, economically viable, and socially equitable approaches to harvesting fish resources. It requires the application of science-based management, the use of selective fishing gears, the conservation of fish habitats, and consideration of social and economic aspects. Anambra River holds immense importance to the communities, providing essential ecosystem services, supporting livelihoods, and preserving cultural traditions. However, the fisheries resources in the Anambra River have been declining due to various factors, including the use of inappropriate fishing gears, use of

Table 3: FAO's action for Blue Growth in inland fisheries

Actions to support implementation of the Blue Growth Strategy for Eastern Africa	Streams within the FAO Blue Growth Initiative			
	Capture Fisheries	Aquaculture	Ecosystem contributing to livelihoods	Trade, markets, post-harvest and social support
Responsible inland fish production				
Production from inland capture fisheries will be based on an ecosystem approach that considers the status of the fish stocks and appropriate fishing technologies. Often there is over capacity on many of the sub-region's fisheries that reduces the fish stocks and reduced economic gains from the fishery. Stock enhancement through aquaculture and/or habitat improvement will help, but fishing capacity may need to be reduced in some areas.				
Actions to support implementation of the Blue Growth Strategy for Eastern Africa	Streams within the FAO Blue Growth Initiative			
	Capture Fisheries	Aquaculture	Services contributing to livelihoods	Trade, markets, post-harvest and social support
How: Government resource managers, researchers and development agencies will work together to identify priority fisheries and to develop best fishing practices based on the status of the stock. Fishery management plans will be developed and stock enhancement activities can be undertaken once the implementation of a management plan is underway to monitor and assess the fishery and any enhancements. An economically viable fishery that is sustainable both environmentally and economically will serve as a model for further Blue Growth.				
1. Conduct stock enhancement for appropriate species.	X	X		
2. Train fishers' in good fishing practices.	X			X
3. Implement buy-out schemes to reduce fishing capacity and illegal gears.	X		X	
Governance and Management				
Governance is the overarching mechanism coordinating environmental well-being, i.e. conservation of habitats, ecosystem services and biodiversity, and human well-being, i.e. economic, social and cultural development. Management of fisheries and importantly for inland fisheries, water and land management will depend on effective governance and the ability to enforce regulations and policies.				
How: Often good policies and management exist, but are not communicated to the appropriate level or to all involved sectors. Governments and development agencies should strengthen cross-sectorial communication and understand the needs of fishers and fish workers through stakeholder engagement/participatory processes. Fishing associations and civil society organizations will be especially useful in information exchange and further in assisting with on-the-ground fishery management and enforcement. Guidelines on small scale fisheries and on governance and tenure will further help the transition to Blue Growth.				
4. Create or improve mechanisms at various levels of governance for planning, policy harmonization and info exchange.	X		X	X
5. Harmonize fisheries management regulations.	X			X
6. Strengthen co-management structure and intra and interagency collaboration.	X			
7. Create Fishery Management Bodies where needed.	X			X
8. Develop Standard Operating Procedures and laws to enforce them.	X	X		X
9. Develop policy for biodiversity conservation.	X	X	X	X
10. Review fisheries biodiversity for potential listing under CITES and IUCN.	X	X		X
11. Invest in habitat rehabilitation and conservation.	X	X	X	
12. Identify and protect critical habitat and migratory routes.	X	X	X	

13. Develop and disseminate guidelines for managing aquatic ecosystems.	X	X	X	
14. Conduct valuation studies on ecosystem services.	X	X	X	
15. Integrate fisheries into dam and irrigation planning and design.	X	X	X	
16. Establish MCS strategy and systems.	X			
17. Conduct fish stock assessment on key species.	X		X	X
18. Monitor and control invasive species and develop guidelines.	X	X	X	X
19. Harmonize policies on species introduction within the region.	X	X	X	X
Streams within the FAO Blue Growth Initiative				
Actions to support implementation of the Blue Growth Strategy for Eastern Africa	Capture Fisheries	Aquaculture	Ecosystem services contributing to livelihoods	Trade, markets, Postharvest and social support
Marketing and Trade				
Trade in fish and fishery products from inland fisheries is important at local, sub-regional, regional and international levels. However, few fish products are traded within the sub-region. Trade is often constrained by lack of fish quality assurance, value addition. However, increased trade within the sub-region and the region has been identified as a means for greater economic returns from inland fisheries.				
How: Government and private industry will work with traders, fish quality assessors and certification schemes to analyse markets and trade opportunities. Promotion of certification and eco-labelling schemes and facilitating access to them by small scale fishers and business will help ensure the small holder sector are included in development and understand how to increase economic returns from trade.				
20. Conduct physical /chemical assessment of traded fish and fish products and standardize protocols for the assessments.	X	X	X	X
21. Develop guidelines and standards for product development along the value chain.	X	X	X	X
22. Create traceability program for regional trade.	X	X	X	X
23. Create or improve fishing associations along the value chains.	X	X	X	X
24. Support eco-labelling scheme for regional trade.	X	X	X	X
25. Develop new and improved products.	X	X	X	X
26. Conduct market and trends analysis.	X	X	X	X
27. Conduct national and regional SPS meetings for developing and harmonizing SPS protocols and building capacity.	X	X	X	X
28. Establish SPS infrastructures such as laboratories and testing kits.	X	X	X	X
29. Establish cold chain facilities.	X	X	X	X
30. Establish processing facilities.	X	X	X	X
31. Provide inspection services.	X	X	X	X
32. Conduct aquarium fish trade analysis to assess viability.	X	X	X	X
33. Identify and support business incubation centres	X	X	X	X
Information				
Blue Growth requires accurate and up to date information on all components of the fishery sector. However, knowledge on the catch and economic value of inland fisheries is often incomplete due to the nature of many inland capture fisheries that are small-scale, seasonal, bartered rather than sold in the formal economy, and are often dispersed over large areas with few standardized landing sites, The value of inland fisheries as an				

inexpensive source of good nutrition and as an activity with a low carbon footprint is unappreciated by many governments and development agencies.

How: Members of FAO have agreed to provide fishery statistics and FAO and other development agencies will work with countries to develop or improve fishery assessments and monitoring using practical information technologies and informed fishery resource managers. Local fishers will also be involved to provide indigenous knowledge. Additionally, novel technologies such as fishery modelling of habitats, food consumption surveys and remote sensing will be used to improve information on inland fisheries.

34. Establish a database of fishers.	X	X	X	X
35. Undertake research in appropriate technologies for climate change mitigation and adaptation.	X	X	X	X

Streams within the FAO Blue Growth Initiative

Actions to support implementation of the Blue Growth Strategy for Eastern Africa	Capture Fisheries	Aquaculture	Ecosystem services contributing to livelihoods	Trade, markets, Postharvest and social support
36. Advocate, create awareness of inland fishery as a low carbon footprint activity.	X	X	X	X
37. Conduct an assessment of the indigenous knowledge base on fishing and processing and integrate into management and processing as appropriate.	X	X	X	X
38. Disseminate knowledge among stakeholders.	X	X	X	X
39. Conduct socio-economic surveys on the value of inland fishery products to society and nature.	X	X	X	X
40. Develop and implement communication strategy.	X	X	X	X
41. Address the stigma and poor attitude toward fish that exists in some areas.	X	X	X	X
42. Conduct research on fish consumption for example by household surveys.	X	X	X	X
43. Map and demarcate watershed and buffer zones.	X	X	X	X
44. Assess potential Ramsar sites within the sub-region.	X	X	X	X
45. Develop community and school awareness programme.	X	X	X	X
46. Identify aquarium fish species for the aquarium trade.	X	X	X	X
47. Conduct frame surveys, catch assessment and hydroacoustic surveys on key fisheries.	X	X	X	X
48. Identify existing centres of excellence on fishing issues.	X	X	X	X
49. Establish a Blue Growth network within the sub region.	X	X	X	X
50. Facilitate expertise exchange and study tours within sub region.	X	X	X	X
51. Establish intraregional forum to share information.	X	X	X	X
52. Assess recreational fishing potential.	X	X	X	X
53. Create awareness on potential role of recreational fishing as an alternative livelihood.	X	X	X	X

Community development

Strong and resilient communities are essential to long-term Blue Growth. The contribution of women, children,

seasonal and full-time fishers, and fish workers are essential, but often over-looked or under-appreciated components of fishing communities. To achieve sustainable fisheries, fishing capacity may need to be reduced in some areas and these fishers will need to find alternate employment in the community and the community will need to develop coping strategies.

How: Government, development agencies and the private sector will work together to evaluate the needs and capabilities of fishing communities. Improved education, especially for women, will help communities take advantage of new opportunities and transition to Blue Growth. Additional training in fish handling, value addition to fish products and marketing will further help communities develop.

54. Conduct gender and equity analysis along the fish value chain.	X	X	X	X
55. Identify stakeholders to undertake needs and capacity assessment.	X	X	X	X
56. Conduct vulnerability assessments of fishing communities.	X	X	X	X
57. Develop livelihood coping mechanisms and alternative livelihoods.	X	X	X	X
58. Address and correct traditional practices preventing women from working in fisheries.	X	X	X	X
Actions to support implementation of the Blue Growth Strategy for Eastern Africa	Capture Fisheries	Aquaculture	Ecosystem services contributing to livelihoods	Trade, markets, postharvest and social support
60. Develop policies to enable PPP.	X	X		X
59. Support/develop day care facilities.	X	X		X
61. Develop joint investment plans with communities, government, and investors.	X	X		X
62. Develop credit and loan facilities and guarantees.	X	X		X
63. Provide social protection subsidies, insurance.	X	X		X
64. Develop education/literacy programmes.	X	X	X	X
65. Support community demand driven initiatives.	X	X	X	X
66. Provide training on financial management-loans and credit.	X	X		X
67. Train communities in fish collection, breeding and transport and marketing.	X	X		X
68. Organize fishing communities to link with existing tourism agencies and if appropriate establish tourism facilities, including selling fishing products and gear.	X			X

Source: Bartley et al. (2018)

poison and explosives, lack of political will and commitment to enforce fishing regulations. To address these challenges and promote sustainable fishing in the Anambra River, several control measures were recommended. These include providing access to legal fishing gears, offering alternative livelihood options, raising awareness about sustainable fishing practices, enforcing regulations, and developing legislation and policies. Additionally, training programs for extension workers and relevant stakeholders can enhance their capacity to

promote and implement sustainable fishing practices. By adopting these measures and prioritizing the conservation of fisheries resources, Anambra River can continue to provide food security, livelihoods, and cultural significance to the local communities, while preserving the ecological integrity of the river ecosystem. Sustainable fishing practices are essential for ensuring the well-being, economic development, and cultural heritage of the communities dependent on the Anambra River's fisheries.

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