Accelerating sustainable aquaculture development in Nigeria

by diversifying fish species, catalyzing local aquafeed production, and strengthening aquaclusters

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Introduction

The aquaculture industry contributes to dietary and nutritional diversity, creates employment, provides additional source of income, poverty alleviation and social inclusion.

However, the industry is affected with many challenges including inadequate supply of inputs, mainly quality fish seeds and feeds (FAO, 2015).

Improving seed quality, producing a variety of fish, with diverse feeding niches and making feed for production available and affordable to the out-growers within and without the clusters would be needed to sustain aquaculture fish production in Nigeria.

Objectives

This series of papers aims to provide empirical evidence to support policy formulation on interventions towards the development of the aquaculture industry, building and enhancing fish farmers' capacity to farm diverse fish species for food security and focuses on:

- **Aquaculture species diversification**
- **Aquafeeds** and
- **Aquaclusters**

Methodology

- A **structured questionnaire** was constructed for fish producers in Nigeria.
- **Primary data** were collected through personal interviews of fish and feed producers and other value chain actors.
- **Six enumerators** were drafted **per state (Fig. 1)** to administer the questionnaires
- Questions were uploaded to **Kobocollect app**

Figure 1: [Map of Nigeria (wikimedia.org)]

Aquaculture Species Diversification

- Nigerian aquaculture has been described as technologically immature given the limited number of farmed species (Subasinghe et al., 2021).
- Diversification of fish species in aquaculture can be of great benefit because of the availability of coastal and inland waters which can be used to farm different species of fish (Oboh, 2022).
- Catfish [and tilapia to some extent] is mostly reared in Nigeria with little attention on other indigenous species which grow in coastal and inland waters, hence aquaculture in Nigeria requires a paradigm shift in terms of diversity in production (Madu, 2021).
- Catfish alone will not solve malnutrition and poverty problems of the country! Diversification is needed! But how?

Main results

- Number of species being farmed are 19 but **8 species** are more pronounced
- Most dominant is the African catfish, *Clarias gariepinus*, followed by Nile tilapia, *Oreochromis niloticus* in 2nd position and African bony tongue, *Heterotis niloticus* in 3rd position
- The survey showed that monoculture was the most practiced culture technique across the seven states.
- **Some** practiced various combinations of **polyculture** with the most common form of polyculture being the farming of **tilapia and catfish together**
- Most dominant culture system used by farmers is the **dug-out/earthen pond system**
- Very few farmers are growing non-catfish and non-tilapia species (roughly **200 farmers** in 7 focus states)
- **Bayelsa State** had the highest potential of farming non-catfish and non-tilapia species followed by **Delta State,** attributed to the abundant natural water resources all year round and the seasonal availability of wild-caught fish seed which the farmers purchase from the fishers.

Some of the farmed non-catfish species

Nile tilapia

African snakehead

Moon fish

Some of the farmed non-catfish species

Gymnarchus niloticus

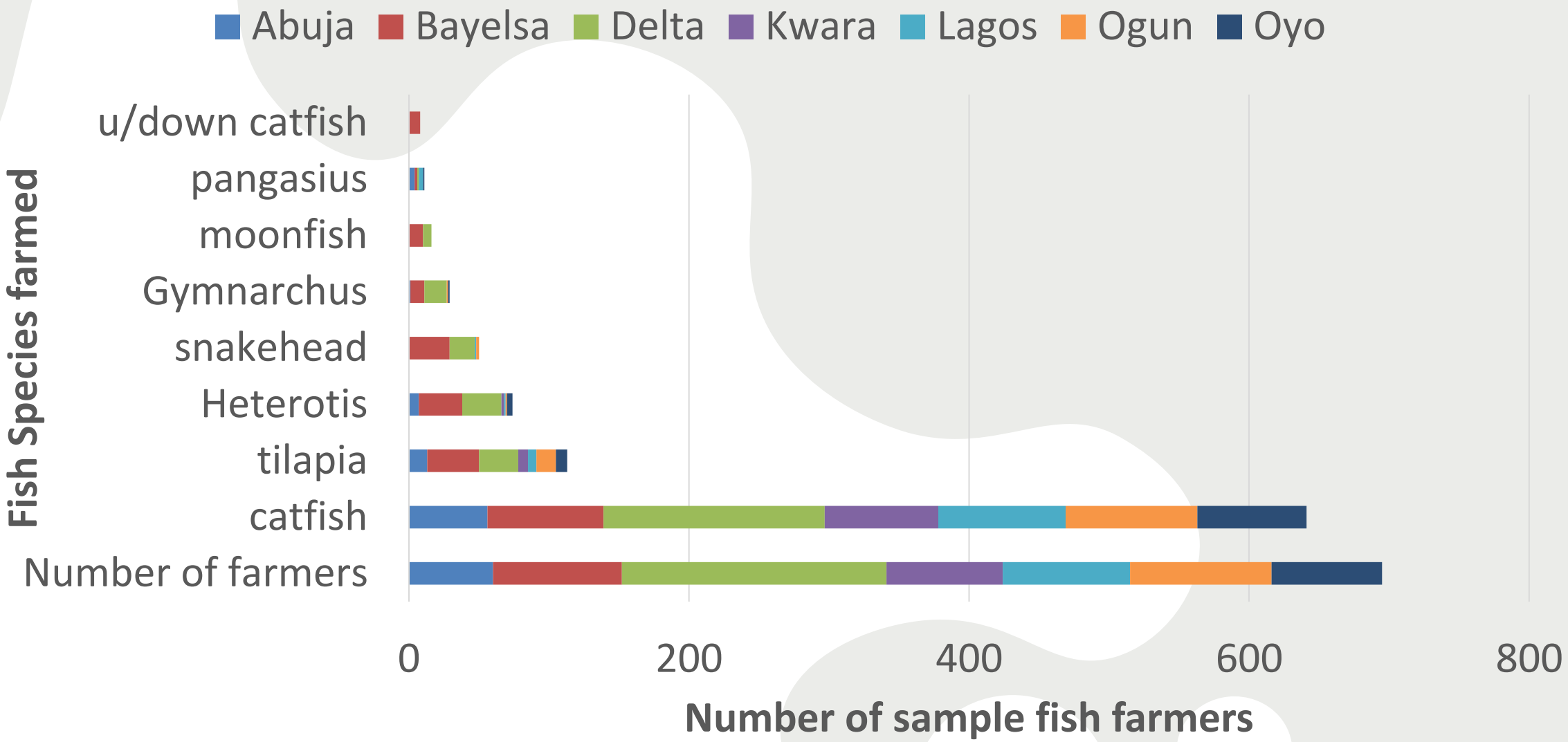
Pangasius - introduced

Some of the farmed non-catfish species

Heterotis niloticus **[bony tongue]**

Synodontis batensoda **[upside-down catfish]**

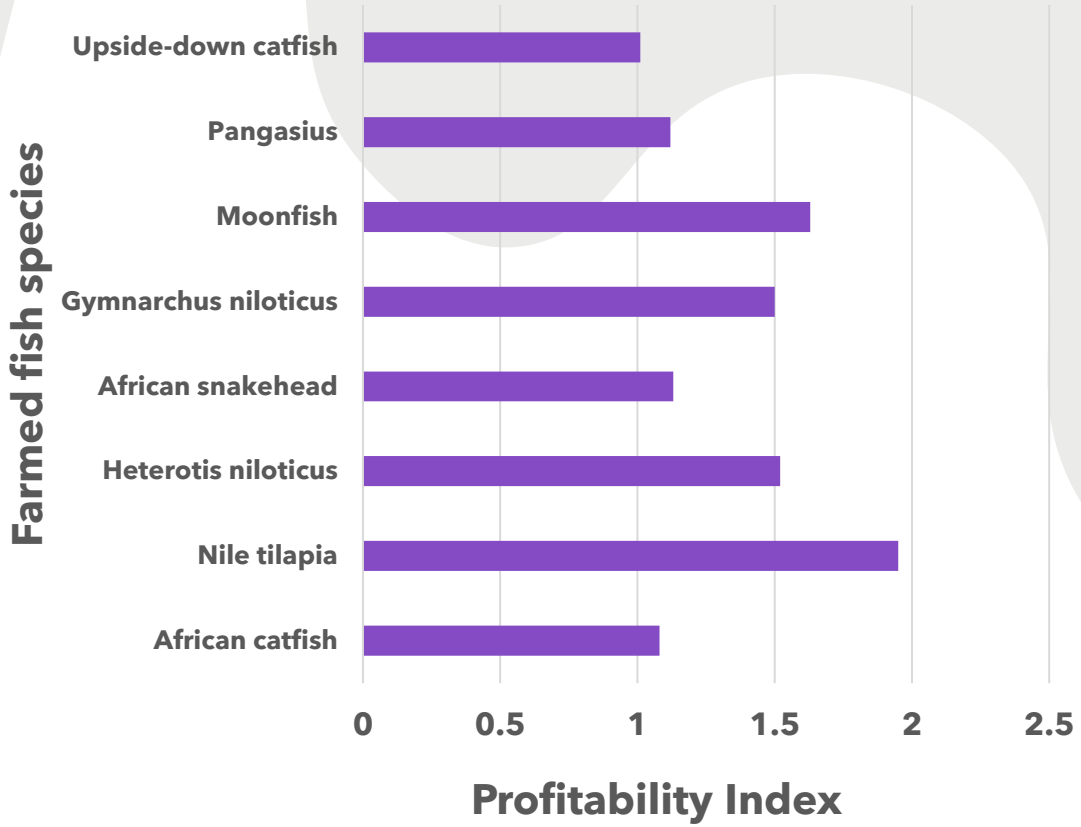
Number of fish species farmed by state

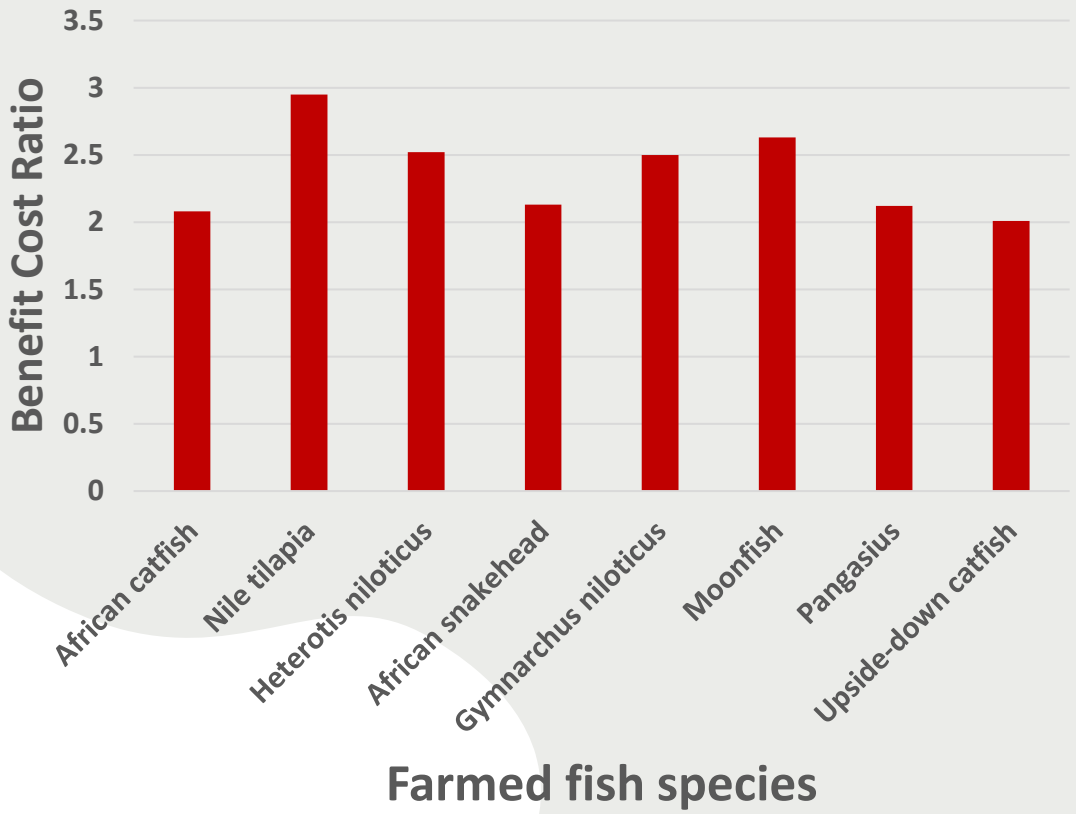


Number of sample farmers per farmed fish species across states

States	African Catfish	Nile Tilapia	*Heterotis niloticus*	African Snake-head	*Gymnarchus niloticus*	Moon fish	Pangasius	Upside-down catfish
Abuja	56	13	7	0	1	0	4	0
Bayelsa	83	37	31	29	10	10	2	8
Delta	158	28	28	18	16	6	1	0
Kwara	81	7	2	0	0	0	0	0
Lagos	91	6	1	1	0	0	3	0
Ogun	94	14	1	2	1	0	0	0
Oyo	94	8	4	0	1	0	1	0
Total	640	113	74	50	29	16	29	8

Profitability of non-catfish farms





- ✓ The Profitability Index [PI] of all farmed fish species had values >1.
- ✓ This is an indication that fish farming venture in the seven states is profitable.
- ✓ The BCR value for catfish and non-catfish production varied from 2.01 for upside down catfish to 2.95 for tilapia which indicates that fish farming business generated income above the investment cost.

Who are the farmers?

- Survey data showed that the farmers mostly practiced monogamous marriage
- The average age of the farmers was 46 years; a greater share of the farmers who farmed catfish, tilapia, Gymnarchus and snakehead were in their youthful active years (< 48 years)
- In contrast those who farmed Pangasius, Heterotis and Upside-down catfish were of older age (> 48 years)
- Gender involvement in aquaculture farming showed that 82% of grow-out farmers were men and 18% were women.
- Most farmers were literate with varying education statuses from primary to doctorate levels

Key challenges and barriers to growth

- Supply of fingerling is limited to their natural breeding season which occurs in certain months of the year, depending on the fish species
- Information is not readily available to hatchery operators and out-growers of non-catfish species.
- Poor formal data sharing and acquisition platforms
- Soaring costs of raw materials for making fish feeds, especially fish meal
- Few financing options for farmers to access credit for production
- Limited water and energy management technologies leading to huge costs
- Limited research and data generation on sustainable farming systems, efficient waste management systems, species diversification, feed types, etc.

Recommendations to catalyze aqua species diversification

- Review of all research work done by NIOMR, ARAC, and NIFFR on the artificial propagation of aquaculture species should be collated and publicized through campaigns and capacity building programs for hatchery producers and grow out farmers.
- Funding should be made available for more research on the artificial propagation of these species to standardize protocols for broodstock development, hatchery propagation, and culture.
- Based on consumption preferences priority should be given to tilapia, Heterotis, Gymnarchus, snakehead and moonfish and upside-down catfish in that order.

Recommendations to catalyze aqua species diversification

- Aquaculture is mostly practiced by youth in their active productive years between 32 and 47 years of age. Focus on youth in capacity building and promotion.
- Over 80% of aquaculture producers are males…more women should be encouraged to carry out fish farming as a means of income generation to meet household needs.
- Incentives such as capacity building programs and provision of adequate start up packs for youth and female start-ups in aquaculture business should be encouraged by the government

Aquafeed sector

- 60-80% of fish production cost is on FEEDS!
- Limited supply to cope with the requirements of the aquaculture sector
- FEED PRODUCERS' PROBLEM: High and increasing costs of producing feeds transportation and fuel costs in feed production and distribution; limited and decreasing demand for certified feeds as more farmers go for on-farm feeds
- FISH FARMERS' PROBLEM: Expensive feeds; quality issues
- RESULT: low supply of certified feeds; dominance of on-farm feed; decreasing number and volume of certified feeds; low productivity

How to break this cycle? How to facilitate a vibrant aquafeed industry and farmers' access to affordable and quality aquafeeds?

Sampling

Organization type	Small scale	Medium scale	Large scale
Government	4	0	0
Private	50	14	4

Note: small scale (<5000 ton/year), medium-scale (5000-15000 ton/year), and large-scale feed producers (> 15000 ton/year).

Raw materials

Producer type	Local	Imported
Small scale	Fish meal, bone meal, soybean meal, maize, premixes, cassava, methionine, lysine, groundnut cake, salt	Additives
Medium scale	Fish meal, bone meal, soybean meal, maize, premixes, groundnut cake, cornflakes, methionine, lysine, salt	Additives
Large scale	Fish meal, bone meal, soybean meal, maize, mixed flour, salt groundnut cake, cassava chips, cornflakes, wheatmeal, methionine, lysine	Additives, vitamin premixes, proteins, mould inhibitors

Aquafeed producers

Producer type	Capacity (Tons/annum)			Sources of input used	Technology deployed	Type of feed produced	Species	Pellet size (mm)
	Ave.	Min	Max					
Small-scale	2,343	240	5000	Local	locally fabricated equipment	sinking	catfish/ tilapia	2,4,6,8
Medium-scale	8,667	6,000	12,000	both local and imported	both locally fabricated and imported	floating/ sinking	catfish/ tilapia	2,3,4,6, 8
Large-scale	188,250	4,800	260,000	local and imported	Imported	floating/ sinking	catfish/ tilapia/ poultry	2,3,4,4. 5,6, 8,9

Profitability of aquafeed production

Producer's type	Statistics	Land required (Hectare)	Cost of production (Naira/ka)	Selling price (Naira/kg)	Variable costs (Naira/kg)	Net profits (Naira/kg)
Small-scale	Average	0.94	521	861	521	340
	Median	0.70	600	800	600	150
	Min	0.20	100	500	100	-50
	Max	4.00	1100	1800	1100	1150
Medium-scale	Average	1.53	780	926	780	146
	Median	0.80	850	950	850	100
	Min	0.02	150	310	150	50
	Max	4.00	1500	1550	1500	350
Large-scale	Average	4.02	530	901	530	371
	Median	10.0	500	877	500	377
	Min	0.20	420	465	420	45
	Max	20.00	700	1386	700	686

- ✓ Table above show positive but **very low profits** for existing feed producers.
- ✓ Many feed producers exited due to low demand, high production costs, and losses.
- ✓ Most feed producers reported increased production compared to 5 years ago (2016-2018), but decreased production recently (from 2022 to 2023-2024).

Key challenges and barriers to growth

Small-scale aquafeed producers

1. Lack of funds and lack of access to credit facilities
2. Poor electricity supply
3. High cost of transportation and fuel; poor road network
4. Inflation; high cost of raw materials
5. Lack of access to raw materials

Medium-scale aquafeed producers

1. High cost of transportation and fuel; poor road network
2. Unfavorable exchange rate; currency devaluation
3. Inflation; high cost of raw materials
4. Scarcity of labor

Large-scale aquafeed producers

1. High cost of transportation and fuel; poor road network
2. Lack of technical labor to operate machines
3. Unavailability of spare parts of most equipment used
4. Limited and decreasing demand for certified feeds (fish producers go for on-farm feed production due to their limited funds)

Recommendations

- The government should invest more in infrastructure development (power, road, transportation services, internet) and address high cost of transportation and distribution
- The government should incentivize growth of indigenous feed enterprises that incorporate local ingredients in feed production.
- Public and private sector should part to increase investments in research and development initiatives focused on developing innovative technologies that lower production costs and improve the quality of products.
- The government should strictly enforce feed quality standards and strengthen the capacity of feed producers of all sizes to adhere to these quality standards.
- Government, private sector, and NGOs need to intensify awareness and information campaign and training among farmers on the importance of quality feeds, environmentally-friendly feed production, feeding, and aquafarm management practices

Aquaclusters

A cluster is a geographically proximate group of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities…. The geographic scope of a cluster relates to the distance over which informational, transactional, incentive, and other efficiencies occur. [Porter 2000]

Aquaclusters have great potential to target investments and services and to reduce cost for delivery and distribution

Forming clusters is a way that input suppliers, farmers, and wholesalers could most easily co-innovate with the least risk and transaction cost is to take advantage of economies of agglomeration.

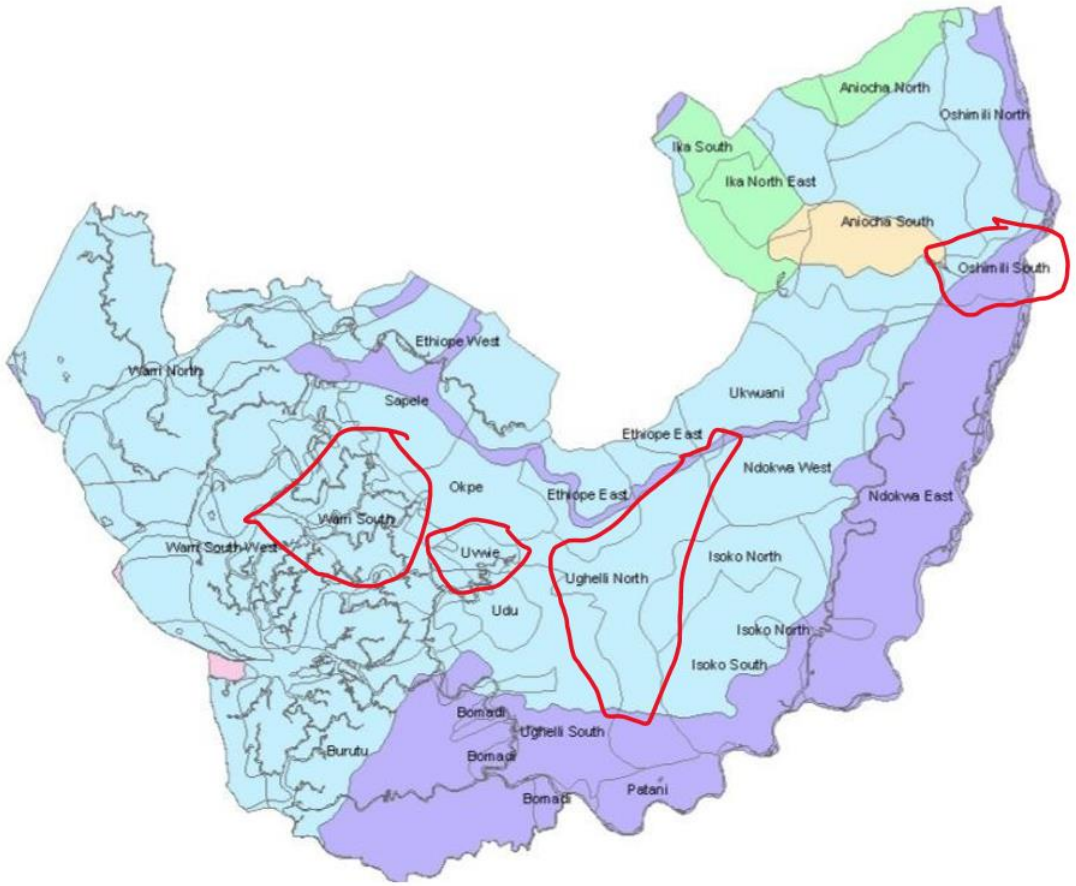
Clusters can induce “process upgrading” (e.g., in the production technology of an aquaculture farm) and “product upgrading” (e.g., a shift from a local niche to commodity non-traditional fish species and newly commercialized niche species).

Cluster formation can be a conscious group strategy or an accretive and spontaneous act.

How do aquaclusters function in Nigeria, and what strategies are crucial to support them?

Delta state

~40 farm clusters/cooperatives (~5,000 farmer-members)
4 LGAs with greatest clustering intensity



Challenges:

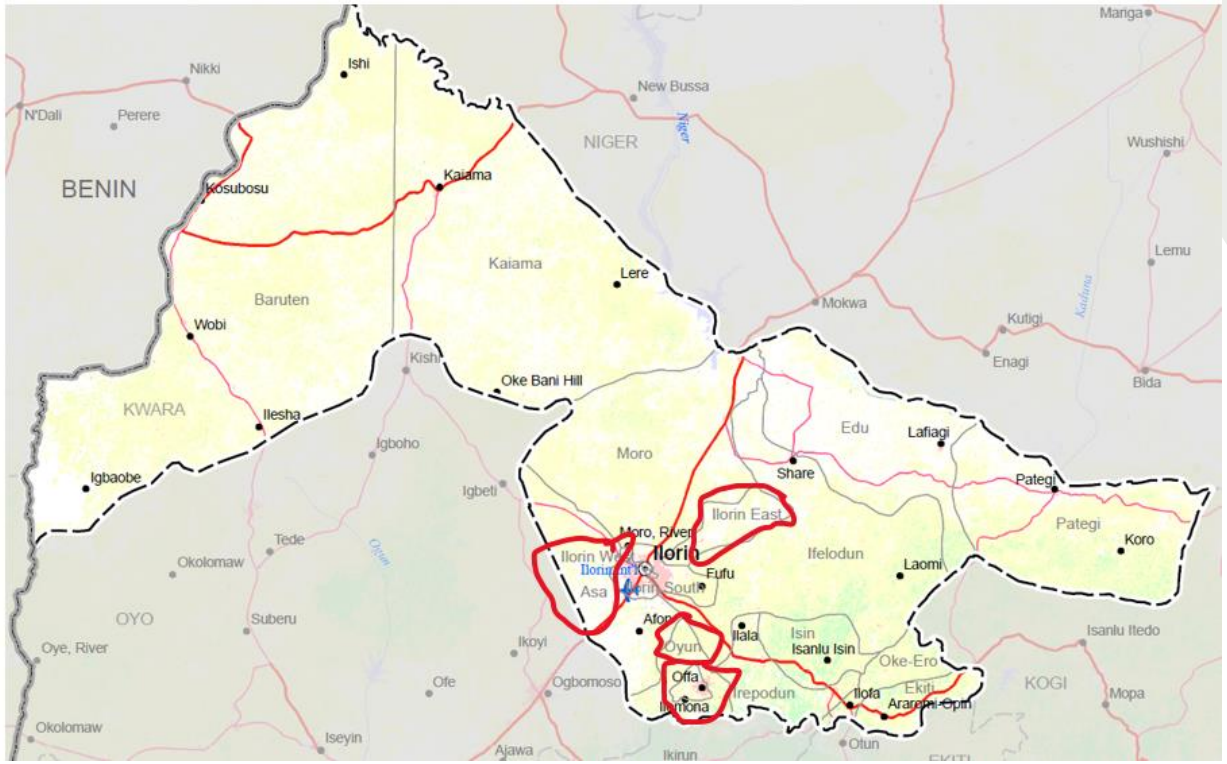
- Lack of water test kits and fish diagnostic lab
- High fish mortality
- Flooding
- Bad roads
- High cost of fish feeds, fuel, and raw materials
- Lack of funds to meet export requirements
- Lack of skilled labor
- Non-compliance of members to pricing agreements, timing of sales, and sanitation activities in the cluster

Recommendations for government action:

- Solve electricity issue
- Subsidize feed; provide loans for farmers
- Bring larger feed mills closer to the farmers
- Bring fish processing equipment and storage facility to the cluster
- Regulate and monitor price of fish feed
- Diversification of market
- Reduce importation levy

Kwara state

- Olam Agri – largest feed producer
- Association of Fish Farmers in Kwara (AFFAK) - large cooperative covering several LGAs
- In 4 focus LGAs, roughly 20 smaller clusters, with about 20 farmers/ponds each



Challenges:

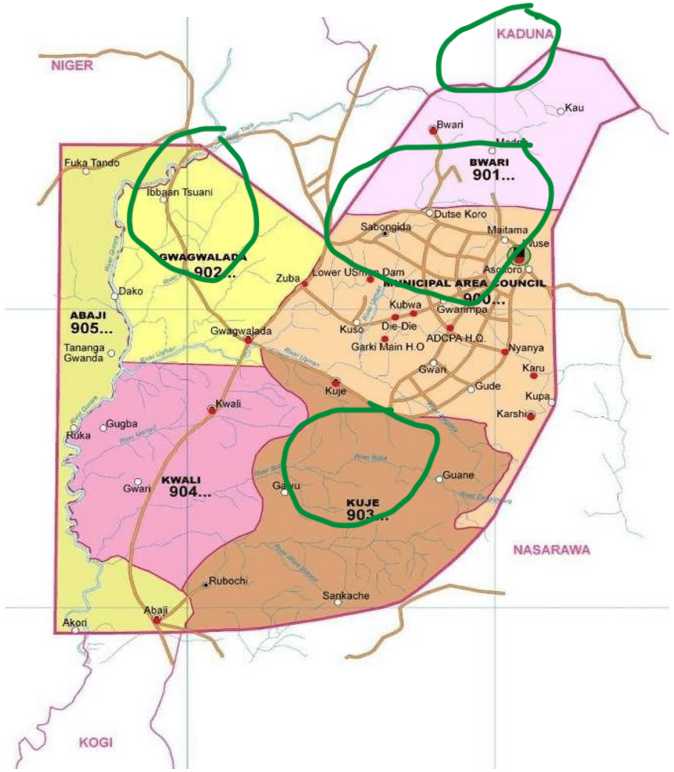
- Bad roads, high fish mortality during transportation
- Unstructured markets
- High cost of fish feeds, fuel, and raw materials
- Lack of funds to meet market requirements
- Insecurity and kidnapping of farmers
- Lack of certification for broodstock and fingerlings, are affecting the production, sometimes leading to poor harvest

Recommendations for government action:

- Solve electricity issue
- Regulate the Dollar exchange rate
- Subsidize feed; provide loans for farmers
- Credit facilities from feed producers and input suppliers
- Tax holiday for 2-3 years for all new businesses
- Farmers need to be trained properly on how to manage their business
- Developing vaccines for prevention of fish diseases
- Collaborations between fish producers and the research institutions
- Construction of a fish market

Abuja FCT

- Federal Capital Territory of Nigeria
- Clusters are well organized with 15 to 60 members per cluster
- Has one of the largest organized fish markets – Kado Fish Market
- In 4 focus LGAs Abuja Municipal, Bwari, Gwagwalada and Kuje have aquaculture clustering



Challenges:

- Poor water supply and management system
- High cost of fish feeds and other inputs
- High cost of fuel and transportation
- High land and tenement rates
- Lack of policy on tax and regulatory issues
- Multiple taxation from legal and illegal taskforces
- Drought leading to drying of ponds
- Poor pricing of table fish due to influence of middlemen
- Lack of electricity
- High staff turnover rates
- Lack of finance
- Lack of training on modern aquaculture production technologies

Recommendations for government action:

- Solve electricity issue
- Create a ministry with its own budget for fish production
- Reduce fish imports
- Credit facilities for fish farmers
- Tax holiday for 2-3 years for all new businesses
- Provide low-cost fish feeds
- Regulate pricing and cost of feed
- Solve problem of insecurity

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Thank you and God bless!