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SURVEY OF CATFISH HATCHERY KNOWLEDGE AND PRACTICES IN OBIO-AKPOR LOCAL GOVERNMENT AREA, RIVERS STATE, NIGERIA

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ABSTRACT

The study was carried out to determine the hatchery knowledge and practices among catfish farmers in the Obio-Akpor District of Rivers State, Nigeria. Interviews and administered questionnaires were used to collect information on knowledge and practices associated with catfish hatcheries from 48 catfish farmers. The socio-economic analysis revealed that the farmers were predominantly males (62.5%) with formal education (93.75%) in primary school (25%), secondary education (18.75%), and higher education (50%). Using a 4-point Likert scale, catfish farmers were asked questions including the range of age and weight for brood stocks, conditioning, feeding and feeding frequency of the broodfish, feeding management of Fry/fingerlings, and their recommendations for government intervention. The data collected were analyzed using descriptive and inferential statistics. Results show that 85.42% of the catfish farmers had knowledge of and practice hatchery operations. Brood stock was sourced from different sources – mostly from other farms within the State (79.17%). The age of broodfish ranged from 2 to 3 years plus (89.58 and 79.17%) at the weight of 1.5 to 3.0kg (62.5-85.42% strongly agree and agree). Of the total respondents, 79.2% feed broodfish with commercial feeds while farm-made feed (10.4%) with the majority (54.17%) feeding once per day. Recommendations include the provision of extensions, the development of fast-growing strains, and central facilities for the procurement of improved brood stock. The result of the present study should inform ongoing research and development and policy changes to regulate the hatchery industry in Nigeria.

***Keywords*:** Hatchery practices, Hatchery knowledge, Catfish, Brood-fish, Rivers State

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1. INTRODUCTION

The fisheries sectors' contribution to the livelihood, employment, and food security of coastal communities in Nigeria has grown in recent years. While capture fisheries have shown a declining trend over the past several decades, the aquaculture sector in Nigeria has experienced tremendous growth of 12% in the last three decades (Kaleem and Sabi 2021). The aquaculture industry in Nigeria is not diversified but restricted to a few freshwater finfish cultures, being driven principally by catfish culture. The growth in freshwater finfish production can be attributed to i) the successful development of artificial propagation protocols, ii) the government's policy support programs documented in the National aquaculture strategy, iii) improved management practices and technologies at hatcheries and production levels, and iv) the availability of high-quality feeds both imported (Udo and Dickson 2017) and locally manufactured. The huge contribution made by catfish culture is further supported by the acceptability of the species by consumers and farmers due to many zootechnical characteristics that included high fecundity, resistance to disease, high market demands, ability to tolerate a range of environmental extremes-temperature, low dissolved oxygen and salinity, high stocking densities, voracious consumers of different types of foods, firm and excellent taste and good quality meat and fast growth (Ikeogu et al. 2022), attaining market weight within four to five months.

The Clariids and their hybrids make up about 80% of cultured species in Nigeria, with African catfish (*Clarias gariepinus*) the most significant (Atanda 2007; Anetekhai 2010; Adewumi and Olaleye 2011). At the same time, the contribution of mariculture to Nigeria's aquaculture production is not commendable despite the abundant marine resources. Thus, Nigeria has not demonstrated efficient use of water resources for fish culture. For example, of the 1.7 mil hectares of land available for aquaculture, only 60,000 hectares are existing pond areas under water (National Aquaculture Development Strategy, https://faolex.fao.org/docs/pdf/nig189027.pdf).

Nigeria ranks second in aquaculture production in Africa after Egypt. As in some other countries, aquaculture is the fastest-growing food-producing industry in Nigeria. There is currently a huge demand for quality catfish seeds in Nigeria. The demand for fish seeds in Nigeria was estimated at over 4.3 billion annually; however, production may be less than 56 million (FDF 2008). The lack of good-quality fingerlings is one of the major

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challenges facing finfish production in Nigeria (Kaleem and Sabi 2021). Local and small-scale hatcheries are making a significant impact towards meeting the rising demands for catfish seeds. To build upon the growth recorded in aquaculture, it is important to address emerging challenges and improve catfish seed quality and promote good aquaculture practices. Given the hatchery's key role in providing quality seed, the aim of this study was to assess the hatchery practices among catfish farmers in Obio-Akpor LGA of Rivers State, Nigeria. The objective of this survey was to determine hatchery practices to identify areas that need further research and extension education.

2. MATERIALS AND METHODS

This study was conducted in Rivers State. Rivers State is in the Niger Delta region during September and November 2019. It lies within latitudes 4°45'N and longitudes 6°50'E. The population of the study constitutes registered fish farmers under the Rivers State ADPs. Questionnaires containing closed-ended items including Likert scale responses were administered to retrieve information in Obio-Akpor Local Government Area to determine the opinions, attitudes, preferences, and perceptions of catfish farmers with respect to catfish hatchery operations. The first part of the questionnaire comprised questions concerning socio-economic information, including age, educational level, farming experience, types of farming activities, etc. while the second sought to understand the catfish farmers' knowledge and practices in the hatchery using four statements**.** Respondents were asked to indicate their level of agreement or disagreement on a 4-point Likert-type scale, where 1=Strongly Disagree, 2=Disagree, 3=Agree, 4=Strongly Agree. When the sum of strongly agree and agree was above 50%, the knowledge and practices of the farmers were positive. But when the sum of strongly disagree and disagree is above 50%, the opinion of farmers on the knowledge and practices they exhibit was negative.

2.1. Data Analysis

Data obtained from this study were descriptively analyzed using Statistical Package for Social Sciences (SPSS) version 21.0. Results were presented in frequencies and percentages.

3. RESULTS AND DISCUSSION

3.1. Socio-economic Characteristics

Out of the total of 49 questionnaires distributed 48 were retrieved. Table 1 shows the socio-economic characteristics of the respondents. The gender involvement in catfish production operations shows that 62.5% of respondents were male. This is consistent with research on gender involvement in fish farming in Nigeria (Adeniyi et al. 2014; Ibemere and Ezeano 2014; Aliu et al. 2016; Aliu et al. 2017; Alfred et al. 2020; Egwenomhe et al. 2020). The result also revealed that 25, 18.75, and 50% had primary, secondary, and higher education, respectively. Only 6.25% of the respondents had no formal education. The level of education observed here is lower than those reported by Olaoye et al. (2011) in Ijebu-Ode. The implication of educational level could be viewed from the level of understanding and adoption of improved hatchery practices will be enhanced. Education is very important in enhancing farmers' technical capability and approach to constraints (Mithun et al. 2020), resulting in better and more efficient hatchery management. This implied that the majority of the catfish farmers in Obio-Akpor are literate and presumably more disposed to adopting new innovations in fish hatchery management. While 66.7% manage the hatchery by themselves, 33.3% do not. Some of the hatcheries employed managers (75%), specialists (12.5%), and other farmhands (12.5%). Hatchery operations require a highly skilled workforce. A recent study has shown that educational attainment significantly affects the farmers' decision to hire an external labor force in their farms (N'Souvi et al. 2021). Table 1 also shows that 66.7% of the hatchery operators in Obio-Akpor Local Government Area carry out hatcheries as their sole business while others engage in some trading (16.66%) and cultivation of crops and rearing some livestock (16.66%). Furthermore, the staff in the hatchery mostly ranged from 1 to 4 staff constituting 77.1%. Of the interviewed fish farmers, 52% had between 6 months and two years of fish farming experience, while 41.67% had experience ranging from two and a half to ten years (Table 1).

3.2. Production Technologies/Infrastructure Used by Hatchery Operators in Obio-Akpor District of Rivers State

85.42% of the farmers indicated knowledge of hatchery protocols. However, the majority (72.92%) have not put into practice such knowledge, depending on others to hatch.

3.3. Broodstock Management

About 79.17% of the catfish farmers source broodstock from other farms within the State and 6.3% obtained them from outside the State (Table 2). Thus, 85.5% obtained broodfish from other farms and 12.5% represent their own farm-raised brood fish. Some hatcheries obtained brood fish from dubious sources. Sourcing brood fish from the wild was the norm at the early stages of the culture of the species with many disadvantages that included inaccuracy in identification, high mortality of seeds, difficulty in the determination of age, unreliable, time-

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consuming, and uneconomical for large-scale culture. Thus, most often such brood fish and seeds do not meet the necessary criteria for good aquaculture production.

Table 1: Socio-demographic characteristics of hatchery operators in the study area

Socio-Economic Characteristics	Frequency	Percentage (%)
Gender		
Male	30	62.5
Female	18	37.5
Responsible for Hatchery		
Yes	32	66.7
No	16	33.3
Responsibility for Hatchery Management		
Specialist	6	12.5
Self and other Farm Hands	6	12.5
Farm Manager	36	75.0
Other business Involved		
Trading	8	16.66
Farming	8	16.66
None	32	66.7
Level of Education		
Primary	12	25.0
Degree (Fisheries)	11	22.92
OND	13	27.08
Secondary	9	18.75
None	3	6.25
Number of Staff Employed in Hatchery		
1-4	37	77.1
5-10	8	16.7
11-14	1	2.1
Above 15	2	4.2
When did you start the hatchery business?		
<6 months	12	25.00
7 months-2years	13	27.08
2.5years-4years	12	25.00
4.5years-7years	4	8.3
7.5years-10years	4	8.3
>10years	3	6.3
Date Established		
2001-2005	4	8.3
2006-2010	8	16.7
2011-2015	8	16.7
2016-date	28	58.3

Table 2: Response (%) of catfish farmers' to feeding frequency and quantity feed fed of Clarias gariepinus fingerlings in Obio-Akpor District of Rivers State, Nigeria.

Feeding rate	Frequency	Percentage of respondents	Quantity of Feed	No. of Respondents			
				SA	A	D	SD
Occasionally	7	14.58	Do not know the quantity of feed	10	7	19	12
3x times per day	4	8.33	less than 5% body weight per day	6	14	22	6
2x per day	11	22.92	5% weight per day	6	19	19	4
1x per day	26	54.17	feed the broodfish with to satiation	3	9	26	10
			feed them 10% body weight per day	7	12	20	9
Total	48	100					

3.3.1. Age of brood-fish: The catfish farmers' knowledge with respect to the age of brood-fish was good as can be seen by the percentage of those who strongly agree and agree in Fig. 1. The results show that the minority of farmers agree or strongly agree that brood-stock less than 1year be utilized for breeding while 75% either agree or strongly agree that brood-fish must be up to 1 year before use.

Similarly, 89.58, 79.17, and 41.67% strongly agree and agree that brood stock of 2, 3, and 4 years plus were better for breeding purposes. Most often, catfish are not mature for use during the first year of life. Some researchers have shown that fish at 2 years and above provide the best product to produce offspring (Jokthan 2013; Umanah 2020).

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3.3.2. Weight of brood-fish: The catfish farmers showed a preference for brood stock weighing 1.5 to 3.5kg (Fig. 2). Less than 50% agree or strongly agree that brood stocks ranging in size from 0.5 to 1.00kg be used for as brood-fish while 47.92% also strongly agree and agree on the use of brood-stock between 1.00 and 1.5kg.

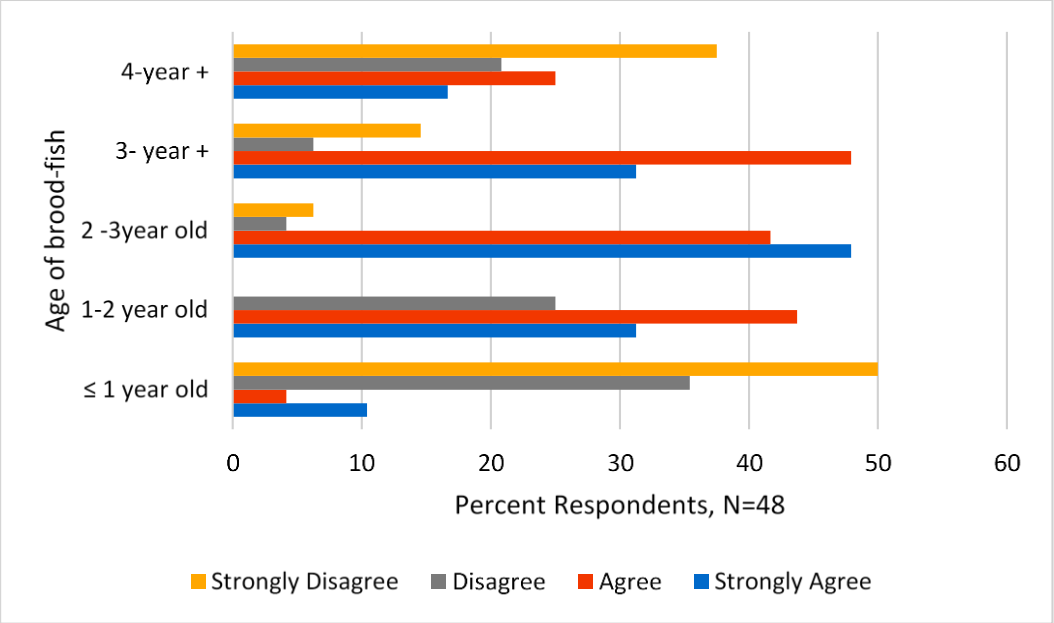

Fig. 1: Age of brood fish preferred by catfish farmers in Obio-Akpor District (n=48)

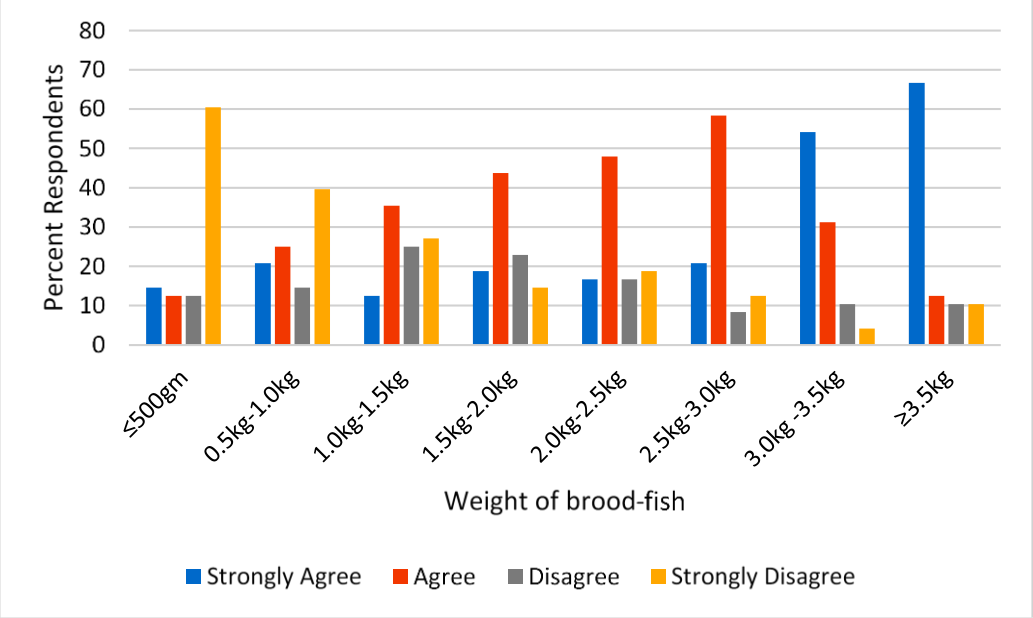

Fig. 2: Weight of brood-fish preferred by catfish farmers for seed production in Obio-Akpor District (n=48).

The majority of the catfish farmers believe in using brood-fish weighing between 1.5 and 2.00kg (62.5%), 2.00 to 2.50kg (64.58%), 2.50 to 3.00kg (79.17%), 3.00 to 3.50kg (85.42%) and above 3.50kg (79.17%). This was perhaps based on the premise that bigger and heavy fish produce better eggs and ensures the survival of Fry. The effect of weight in the African catfish on hatchability is still not very clear (Salami et al. 1993; Nlewadim et al. 2004); however, Ataguba et al. (2013), Bichi et al. (2014), Uedeme-Naa and Nwafili (2017) and Jokthan (2013) recommended brood-fish weighing more than 1.00kg. In fact, Jokthan (2013) demonstrated that hatchability improved with weight and age in *Clarias gariepinus* and recommended that brood stock should be at least 2 years of age before use for breeding and weighing 1200-1500g. Ibiwoye (2017) reported a weight range of between 1.6 to

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2kg, although, some farms use larger brood fish weighing up to 4kg. In recommending the weight of brood fish, ease of handling and economical use of hormones have to be considered as bigger and heavier individuals will require more hormones to induce spawning. Without a doubt, heavier broodfish spawn more and better-quality eggs, which could increase the survival of the eggs and juveniles.

3.3.3. Conditioning of brood-fish: Brood-stock conditioning normally takes place (Fig. 3) in concrete tanks (43.8%), earthen ponds (29.2%), and plastic tanks (20.83%). In Sokoto State, Badaru et al. (2022) also found that 66.6% of fish farmers make use of concrete tanks in the culture of fish. The reason concrete tanks are more popular and acceptable may not be unrelated to the ease of erection and dismantling if the need arises.

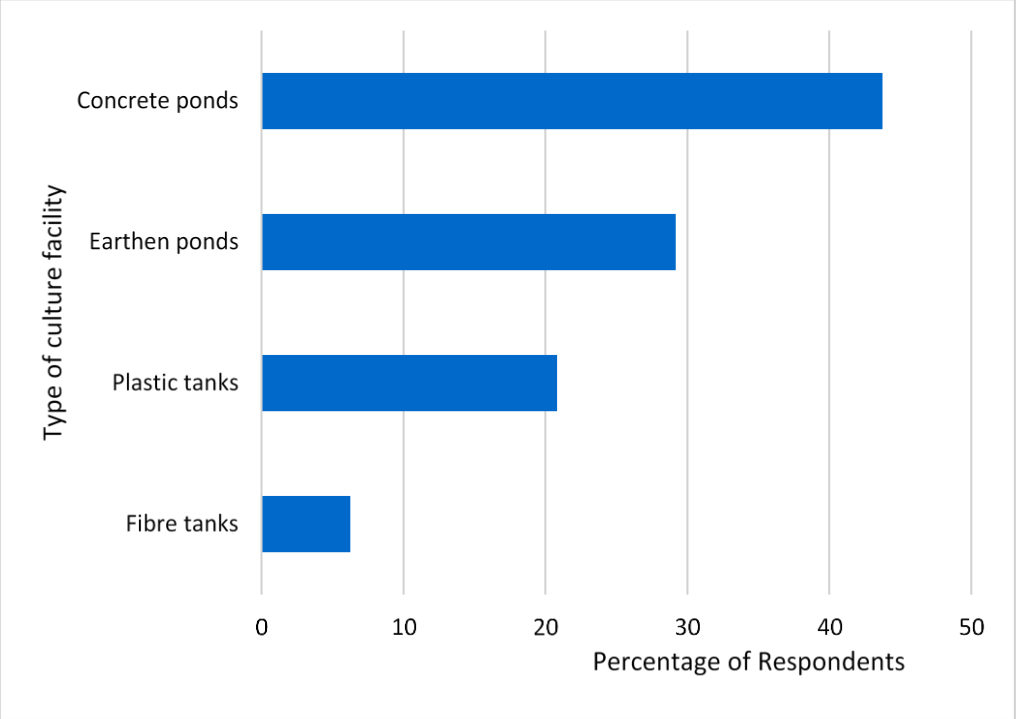

Fig. 3: Culture facilities for brood fish conditioning in Obio-Akpor District (n=48).

3.3.4. Feeding and feeding frequency of broodfish: Feeding is another important aspect of broodfish management. Table 2 shows the feeding frequency and rates as practiced by the farmers. Different types of feeds were used by the respondents including commercial feeds (79.2%), fish waste from fishmongers (8.3%), farm-made feed (10.4%), and agro-processing waste (2.1%). About 54.17% of the farmers prefer feeding the fish once a day while another 22.92% feed twice per day. According to Elekwachi (2018), 86.4% of fish farmers prefer to feed their fish twice a day and 5.7% chose once a day especially those only into brood fish production. In a survey of Nigeria, Ibiwoye (2017) reports that more than half of the hatcheries (52%) feed the brood fish every other day, 32% feed them once daily while only 12% feed twice daily (Ibiwoye 2017). The frequency of feeding broodstock has been suggested to have a significant effect on the weight of eggs and consequently the survival of Fry (Cerda et al. 1994; Shourbela et al. 2016).

3.3.5. Re-spawning: Our results (Fig. 4) further show that 4.17% and 8.33% of the respondents strongly agree and agree, respectively to re-spawning female brood fish every 2 months and 4 months. However, most farmers were comfortable with re-spawning in 6 months as represented by 22.92% and 39.58% of respondents who strongly agreed and agree. This present result agrees with the findings of Ibiwoye (2017) who reported similar practices by catfish farmers where 45% of the farmers reuse the female brood fish after 3 months**.** Our result concurs with the findings of Elena et al. (2021) who proposed an inter-spawning interval of 3-4 months depending on the substance used to provoke gametogenesis. It can be concluded that the re-spawning frequency affects the weight of eggs released and the chances of survival of Fry (Rideout et al. 2005). The optimum period between spawning and re-spawning must be determined for the catfish brood stock in order to maximize their potential of supplying quality eggs and ensure the survival of Fry.

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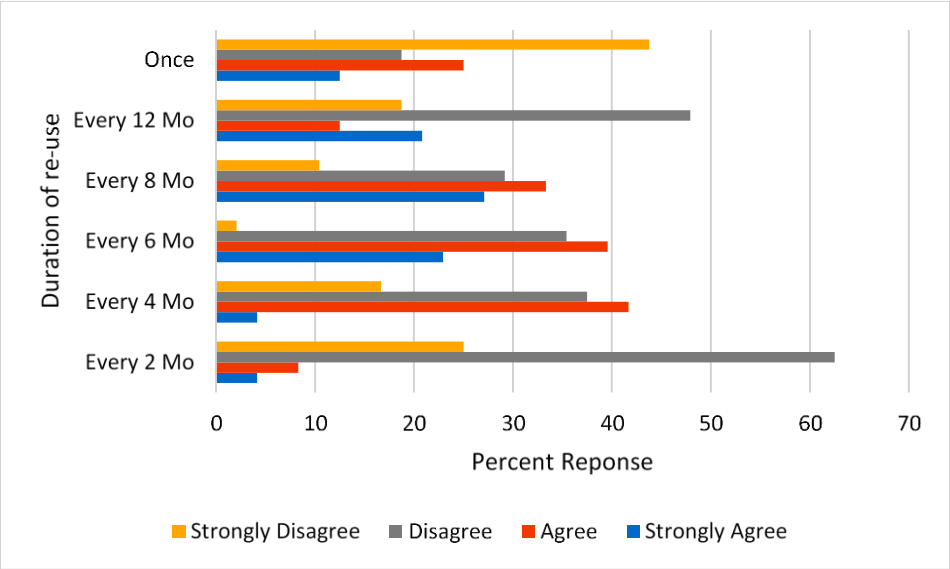

Fig. 4: Frequency of re-spawning of female brood stock catfish after first spawning in Obio-Akpor District (n=48).

3.3.6. Hormones: The hormones commonly acknowledged as used by the catfish farmers were shown in Fig. 5. It can be seen that 25.0 and 35.42% strongly agreed and agreed on the use of Human Chorionic Gonadotropin (HCG) in the induction of spawning in the African catfish. This represents about 70% of the respondents who have knowledge of the hormone. Far more than this was their knowledge of the application of natural or non-synthetic hormones of which the combined positive response was above 85% (45.83 strongly agree and 39.58% agree). Knowledge of dried carp pituitary was also good, representing a totally positive response of 62.50% (20.83% strongly agree and 41.67% agree). The knowledge of non-synthetic hormones exhibited by the respondent may be influenced by availability, cost-effectiveness, and the fact that most often male catfish are sacrificed to extract the pituitary. Abdul et al. (2017) compared the efficacy and cost-effectiveness of catfish pituitary and Ovaprim in the induction of spawning, suggesting that fish seed production can be promoted using natural hormones since synthetic hormones have to be imported with associated import duties. Despite the availability of a wide range of drugs for stimulating gametogenesis in *C. gariepinus*, a suspension of freshly obtained or acetonated pituitary gland is most often used (Elena et al. 2021).

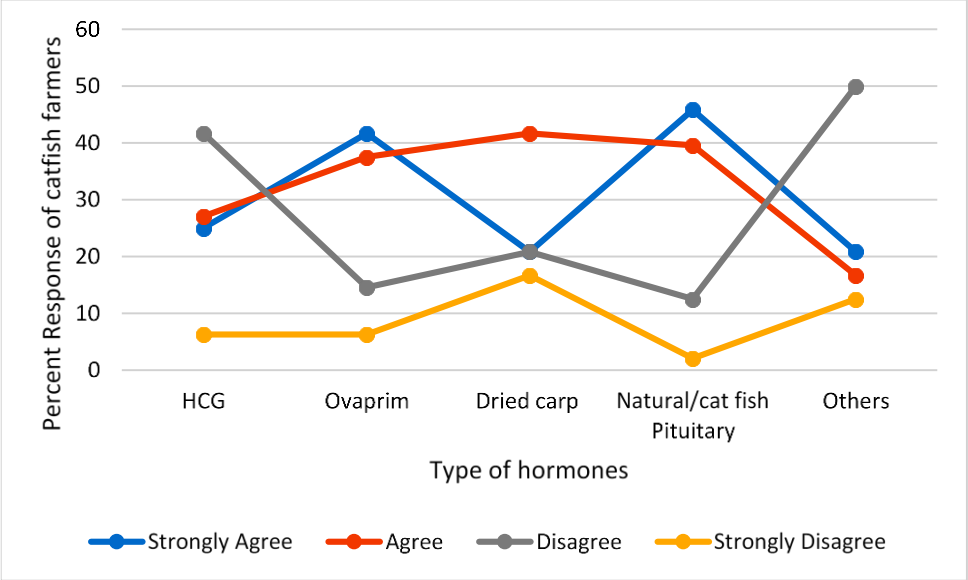

Fig. 5: Catfish Farmers' knowledge on use of hormones in hatcheries in Obio-Akpor District (n=48).

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3.4. Fry/Fingerlings Feeding Practices

Fig. 6 shows catfish farmers' feeding practices for Fry and fingerlings. The majority of the farmers favor feeding multiple times per day (18.75 and 41.67% strongly agree and agree, respectively). They were average on feeding the little animals once or thrice/d as another majority did not favor feeding twice daily (45.83% and 16.67% disagree and strongly disagree, respectively). Many workers have demonstrated that feeding the Fry and fingerlings to satiation once daily proved satisfactory (Oso 2015; Anpe et al. 2019). However, some other workers have shown conflicting reports. Aderolu et al. (2010), Ndome et al. (2011) and Hasimuna et al. (2019) observed that a minimum feeding frequency of three times per day gave the best results. Better growth was also achieved for *C. gariepinus* fingerlings by feeding continuously for 24h/d than by feeding 4 meals/d (Hogendoorn 1981; Dada and Olarewaju 2002). The rule of thumb is to feed fish to satiation (FEAP-Aquamedia 2010), once a day as much feed as they can consume without adversely affecting water quality.

Recommendations

The catfish farmers were asked if they are satisfied with fingerlings emanating from hatcheries and to make recommendations on areas that needed government intervention. Overwhelming 83.33% answered 'No', citing inconsistencies in the quality of eggs and fingerlings, stunting, and lack of uniformity in growth and survival. The recommendations for improvement are shown in Fig. 7. The results demonstrate that the majority of catfish farmers agree or strongly agree that extension services (91.67%), central facilities for procurement of brood-stocks (93.75%), reduction in cost of feeds (93.75%), research and development on fast growing strains (93.75%), certification of fingerlings and brood-fish (66.67 and 58.33%, respectively) be given priority attention by government.

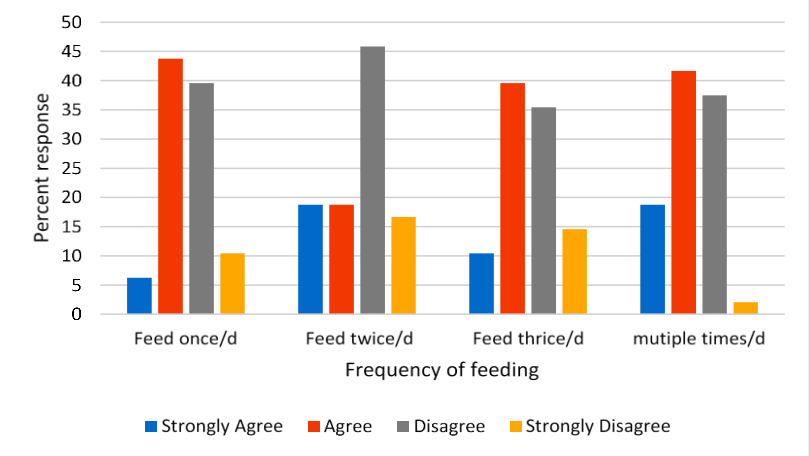

Fig. 6: Fry/fingerling feeding practices in Obio-Akpor District.

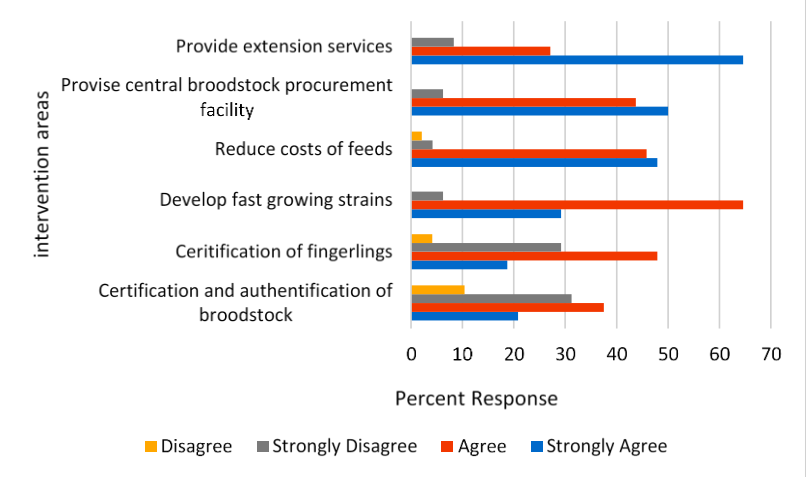

Fig. 7: Catfish farmers' recommendations for government intervention in Obio-Akpor District (n=48).

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4. Conclusion

The catfish farmers demonstrated adequate knowledge and practice of hatchery operations. However, the knowledge, practices, and recommendations reported by the catfish farmers in the present study should inform ongoing research and development and policy changes to regulate the hatchery industry in Nigeria. Fish hatchery requires highly skilled and unskilled workers who must be trained to build capacity. More pressing is the need to set up breeding programs to improve the performance of aquaculture catfish in terms of growth and survival. Through coordinated brood-stock breeding and development programs, brood fish can be produced and distributed to hatcheries to sustain the industry. This is a task for the government or larger aquaculture companies.

Conflict of interest: There is no conflict of interest. An aspect of this research on biosecurity has been sent out for publication.

Author's Contribution: The authors equally contributed to the research.

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