RESEARCH ARTICLE

Survey on the recent advances in fish hatchery operations around Sokoto metropolis

Badaru AA*, Abubakar Y, Ibrahim B

Badaru AA, Abubakar Y, Ibrahim B. Survey on the recent advances in fish hatchery operations around Sokoto metropolis. J Aqua Fish 2022;2(7):1-5.

ABSTRACT

Fish provides a comparatively cheap source of animal protein for man and his livestock. Attention is now being focused on fish production, both from natural waters and aquaculture. It is also an important source of food and income to many developing countries including Nigeria. The research was conducted in Sokoto metropolis, Sokoto state, Nigeria. The sample procedure was non-probability chain referral. Sampling and sample size for the study was on 30 respondents from farms who undergo hatchery operators in the metropolis. A structured questionnaires consisting of both close and open ended question was used for the collections of data from the commercial fish farmers, the data collected were subjected to descriptive statistics, percentages and frequency distribution. The results shows that out of 30 respondents 27 (90%) were male, 22 (73.3%) were married with age range 31-40 years have the highest number with 15 (50%) of the respondents. The respondent shows a vast educational experience with the majority of them 21 (70%) having formal aquaculture training. Based on the information obtained during survey, the primary problem and challenge affecting the fish spawning operation include environment challenges among others. Water quality, seasonal shortfall in water supply and extreme temperature ranges are major barrier in fish spawning operation. Other problems include high cost of feed used, broodstock unavailability, problems with required expertise skills as hatchery operators, and inadequate fund (capital). Fish spawning operation will be a successful under a suitable environment with available water in a good quality and a recommended range of temperature. It serves as sources of employment to the people and fish seed in the state.

keywords: Exotic carp, Broodstock, Spawning, Aquaculture, Metropolis

INTRODUCTION

According to little and Edwards, fish farming is expanding rapidly throughout the world and has a high potential for the provision of valuable protein in less developed countries. Aquaculture benefits range from rural development, income generation particularly in the socio economically weaker communities of fisherman which represent the poorest sections of the society in many developing countries, farm sustainability as well as reduction in vulnerability to disease and poverty [1].

The present total production and supply from all sources is less than 50 million fingerings annually, until about 15 years ago, no less than 60% of all fish seed supply in Nigeria was from wild. Many fish farms have been abandoned in the country due to lack of fish seed. Many technical problems arise in the production of seed either in the pond or hatchery system, principal among these include; improper record and poor management of brood stock, especially feeding and handling; and poor record keeping of all activities regarding induced spawning, care of eggs, fry, feeding and general management of fingerling. In Nigeria cultivable fish species include clariid catfish, Tilapia and Exotic carp which are facilitated with the acquisition of induced breeding technology

According to Ayinla aquaculture in Nigeria has turned a new leaf; it has become wide scale since FAO introduce modern aquaculture and aquatic technology into a new a system. In Nigeria today aquaculture practices seek to improve fish yield and productivity. It benefits ranges from rural development, income generation, farm sustainability as well as reduction in vulnerability. Aquatic resources are finite although renewable; every effort should be made toward increasing fish production through improved resources management, conservation and intensive aquaculture [2].

The culture fisheries industry is witnessing a faster rate of development in contrast to the slow pace witnessed in the last three decades. The current trend is a result of profitably and feasibility of aquaculture projects in addition to the increased demand for fish protein, which has resulted to the establishment of many fish farms across the world including both the small and large commercial fish farms. The success or viability of this aquaculture project depends among others regular supply of fingerlings of desire species to stock the pond or tanks. However in many instances farmers do not obtain sufficient numbers of fingerlings from the existing hatcheries and sometime have to source fingerlings from the wild. Aquaculture genetics show immense potential for enhancing production in a way that meets aquaculture development goals for the new millennium. A major pre requisite for a successful fish farming enterprise is a reliable and consistent source of fish seed (fingerlings) of commercially important species [3].

MATERIALS AND METHODS

Study area

The study research was carried out in Sokoto state of Nigeria. The state is bounded in the North and West by Niger Republic, in the South and East by Kebbi and Zamfara State respectively. The state is located in the North-West geographical zone of Nigeria within longitudes 11o30-13o50 E and latitudes 4o-6o40 N. It covers a land of 26,648 km^2 .The population of Sokoto is estimated at 3,696,999 million people. The climate of Sokoto is tropical continental, with much of the rains between June and September while the long dry season is from October and may [4].

Study population

The target respondents for this study were commercial fish farmers (part and full time) who operate fish hatcheries in Sokoto metropolis [5].

Sampling procedure and sample size

The sample procedure was non-probability chain referral. Sampling and sample size for the study was on 30 respondents from farms who undergo hatchery operators in the metropolis [6].

Department of Fisheries and Aquaculture, Usmanu Danfodiyo University, Sokoto, Nigeria

Correspondence: *Badaru AA, Department of Fisheries and Aquaculture, Usmanu Danfodiyo University, Sokoto, Nigeria, E-mail: aabadaru1@gmail.com*

Received: June 23, 2022, Manuscript No. PULJAFM-22-5077; **Editor assigned:** June 25, 2022, PreQC No. PULJAFM-22-5077 (QC); **Reviewed:** July 11, 2022, QC No. PULJAFM-22-5077; **Revised:** August 23, 2022, Manuscript No. PULJAFM-22-5077 (R); **Published:** August 30, 2022, DOI: DOI: 10.37532/PULJAFM. 2022.2(7).1-5

Data requirement

The data were collected from both primary and secondary sources. The collection of data through primary sources was with the aid of structured questionnaire administered in the form of interview with the commercial fish farmers [7].

The secondary data were restricted to the information obtained from the official records and related literatures such as research projects, seminars, journals, textbooks and other relevant published and unpublished materials [8].

Data collection

A structured questionnaires consisting of both close and open ended question was used for the collections of data from the commercial fish farmers [9].

The questionnaire covers the following information which is categorized into three (3) sections:

- **Section A:** Demographic and socio economic characteristics of the respondent.
- **Section B:** Production system/technology.
- **Section C:** Output and input used in production.

MEASUREMENT OF VARIABLES

Demographic information

Age: Age in years was identified by the respondents.

Sex: Respondents were distributed according to their gender and measured at nominal level; score of 1 and 2 was assigned to male and female respectively.

Marital status: This was measured at nominal level and respondents were categorized into single, married, separated, and widowed. Arbitrary score of 1,2,3,4 and 5 was assigned to each category respectively.

Educational level: Respondents were asked to indicate the highest level education attained and it is categorized into non formal, qur'an, adult literacy training, primary education, secondary education and tertiary education. Arbitrary score of 0,1,2,3, 4 and 5 was assigned to each category respectively.

Type of fish farming engaged: The respondents were asked to indicate the type of fish farming they engaged in and it is categorized into fish seed production, table size/growth out production and brood stock production; score of 1,2, and 3 were assigned to each category.

Duration of engagement: The respondents were asked to indicate the duration in months or years they have been into production of different categories of fish [10].

Species cultured in the farm: The respondents were asked to indicate the kind of species cultured in the farm and it is categorized into *Clarias* spp, *Heterobranchus* spp, *Tilapia* spp and others; score of 1,2, 3 are used and specification in the case of other species.

Scale of operation: The respondents were asked to indicate the scale of operation and it is categorized into homestead/subsistence production, small scale production, commercial production and community project/ comparatives; score of 1,2,3, and 4 was assigned to each category respectively.

Data analysis

The data collected were subjected to descriptive statistics, percentages and frequency distribution.

RESULTS

The results from the study are represented in frequency distribution and percentage table as follows.

Distribution of commercial fish hatchery operators based on gender (sex)

Table 1 shows that (90%) of the respondents were males and only (10%) were females involved in commercial fish farming.

Table 1: Distribution of commercial fish hatchery operators based on gender (sex).

Gender	Frequency	Percentage (%)
Male	27	90
Female	3	10
Total	30	100

Sources: Field survey, 2014.

Distribution of commercial fish farmers by marital status

Table 2 shows that (26.7%) of the respondents were single, majority (73.3%) were married and none were separated or widowed.

Table 2: Distribution of commercial fish farmers by marital status.

Marital status	Frequency	Percentage (%)
Single	8	26.7
Married	22	73.3
Separated	0	0
Widowed	0	0
Total	30	100

Distribution of commercial fish farms according to their age (years)

Table 3 shows that (3.3%) of the respondents were above 50 years while the majority (50%) fall between 31-40 years, followed by those in the range of 41-50 years of age (26.7%). The result indicate that majority of the respondents were the farm managers not the real owners of the farms.

Table 3: Distribution of commercial fish farms according to their age (years).

Age (in years)	Frequency	Percentage (%)
Below 20	0	0
21-30	6	20
31-40	15	50
41-50	8	26.7
Above 50	1	3.3
Total	30	100

Distribution of commercial fish farmers by educational experience

Table 4 shows that none of the respondents had educational experience below 2 years, (6.7%) range between 3-5 years, (10%) between 6-10 years, (23.3%) between 11- 15 years and (60%) above 15 years.

Table 4: Distribution of commercial fish farmers by educational experience.

Year of education	Frequency	Percentage (%)
Below 2 years	0	0

3-5 years	2	6.7
6-10 years	3	10
11-15 years	7	23.3
Above 15 years	18	60
Total	30	100

Distribution of commercial fish farmers based on acquisition of formal aquaculture training

Table 5 shows that only 30% of the respondents acquire formal aquaculture training while 70% lack formal aquaculture training but employs experts who comes as a full time workers or part time worker to spawn on the farm.

Table 5: Distributions of commercial fish farmers based on acquisition of formal aquaculture training.

Farmers with formal aquaculture training	Frequency	Percentage (%)
Yes	9	30
No	21	70
Total	30	100

Distribution of commercial fish farmers based on difficulty in sourcing species brood stock for spawning.

Table 6 shows that (93.3%) of the respondents indicate that *Heterobranchus species* are difficult to source, while (6.7%) state that Tilapia species are difficult to get and manage while *clarias* species are much available.

Distribution of commercial fish farmers based on culture system

Table 6 shows that only (6.7%) of the respondents used earthen pond as culture system, (63.3%) concrete pond, and (26.7%) plastic tank, while none of fish farms used fiber glass tank, and wooden though as culture medium.

Table 6: Distributions of commercial fish farmers based on culture enclosures.

Culture system	Frequency	Percentage (%)
Earthen pond	2	6.7
Concrete tanks	20	66.6
Plastic tank	8	26.7
Fiber glass tank	0	0
Wooden through	0	0
Total	30	100

Distribution of commercial fish farmers based on technology used in rearing fry

Table 7 shows that (83.3%) of respondents adopted static renewal as the techniques used as culture medium, (16.7%) use continuous flow through, while none of the respondents used re circulatory system or any other techniques.

Table 7: Distribution of commercial fish farmers based on technology used in rearing fry.

Technology	Frequency	Percentage (%)
Static renewal	25	83.3
Flow through	5	16.7
Recirculatatory system	0	0
Others	0	0
Total	30	100

Distribution of commercial fish farmers based on feed used in the farm

Table 8 shows that (33.3%) of the respondents used imported commercial feed as fish feed, (20%) locally commercial feed, (26.7%) compounded feed and (20%) used both type of feed.

Table 8: Distributions of commercial fish farmers based on feed used in the farm.

Feed sources	Frequency	Percentage (%)
Imported commercial feed	10	33.3
Locally commercial feed	6	20
Compounded feed	8	26.7
All the feed	6	20
Total	30	100

Distribution of commercial fish farmers based on number of time of production

Interaction with most of the respondents with regards to table size fish production revealed that the farmers stock their ponds in batches at different time of the year depending on pond harvested, but 82.3% of them grow their fish up to 6-7 months before harvest while 17.7% of them grow their fish within the range of 8-9 months before harvest.

In terms of fish seed production 86.7% the respondents do not have specific time range for spawning; rather spawning depends on the availability of good brood stock and hatchery experts but 66.7% of the farms produce fish seed up to five (5) times a year and 90.0% of the respondent sources their brood stock outside Sokoto area such as Kaduna, Kwara, Niger, Ibadan and Lagos among others while 10% of the respondents used brood stock within the state as supplement [11-15].

Problems and prospects of fish spawning operations in commercial fish farms in Sokoto

Based on the information obtained during survey, the primary problem and challenge affecting the fish spawning operation include environment challenges among others. Water quality, seasonal shortfall in water supply and extreme temperature ranges are major barrier in fish spawning operation. Other problems include high cost of feed used, brood stock unavailability, problems with required expertise skills as hatchery operators, and inadequate fund (capital).

The prospects of fish spawning operation in commercial fish farm in Sokoto as obtained from the respondents rely on the commitment of the authorities in supervision of farmers activities supporting the present devotion of CAFAN (Catfish Farmers Association of Nigeria) which include all the hatchery operators to bring all fish farmers in Sokoto together by provision of subsidy and creating access to loan, will bring success to fish production by increasing availability of quality fish seed and creating employment and income to the people as well as the state in general [16-18].

DISCUSSION

Result of the field survey, the sex or gender result Table 1 shows that majority of the hatchery operators in commercial fish farm around Sokoto were men. This has to be with the tradition, culture and attitude of the people. The predominantly Muslims culture gave women assigned gender role which reduced their participation in fisheries.

Table 2 revealed that majority of the spawning operators in commercial fish farm were married and they found farming as an easier way to solve many responsibilities in terms of food need, clothing and shelter apart from salary allowances [19].

Table 3 shows that among the commercial fish farmers in Sokoto, middle age groups (31-40) were found to be actively involved in fish spawning operation, this group constitutes the highest percent (50%). This is in agreement with earlier findings by Yunusa, who observed that this age bracket contain the innovative, motivated and adoptable population in any production system. Also the respondents were majority farm managers not the real owners.

With little formal aquaculture training that makes them to employ expert who comes as either full or part time worker to spawn for the farmers. According to Bolorunduro, years of educational experience especially in the fishery aspect is an important variable in promoting fish farming around the globe.

Table 6 shows that table size production is an old business in Sokoto metropolis were majority of the respondents are in the production for about 4-6 years long while fingerling production started between the range of 1-3 years. These indicate that many fish farmers have recently develop interest in hatchery operation to overcome dependence on the wild seed. Minority of the respondent engage in brood stock production which resulted to shortage and difficulties in obtaining a good quality brood stock within the state.

The culture system adopted by the majority of the respondents is concrete tank with static renewal used as water exchange methods in the hatcheries as it help to maintain water quality through removal of contaminated water completely from the tanks or pond. The feed used by the majority of the commercial fish farms is imported commercial feed which contain all the necessary nutrient requirement compare to other commercial or locally made feed which sometime used as a supplement. The results also compare well with comparative feed trials of who recorded best growth results for imported commercial feed over local feed, the growth of fish depend upon the ingredient and its percentage in the formulated feed [20].

The major problem affecting the spawning operation in commercial fish farms is environmental challenges such as water quality, availability and temperature fluctuations. Water and temperature play a key role towards a successful fish spawning operation and fish production as a whole. Other problems include brood stock availability which occur as a result of little engagement of commercial fish farmer in brood stock production and feed sources among others.

Fish spawning operation will be a successful under a suitable environment with available water in a good quality and a recommended range of temperature. It serves as sources of employment to the people and fish seed in the state [21,22].

CONCLUSION

The study reveals that majority of the commercial fish farmers are married men with an age range of 31-40 with vast of educational experiences. The commercial fish farmers usually employ farm expert as a consultant due lack of much knowledge of fish farming. Imported commercial feed was used by the majority of fish farmers which make the cost of production high.

The ultimate goal of development in fisheries sector is to meet the state's demand for fish and also alleviate or reduce the level of poverty in the state.

In view of the findings, it is therefore recommended that the commercial fish farmers should engage more in the production of brood stock which may reduce the difficulties of brood stock in the state and reduce the cost of transportation.

Commercial fish farmers should expand their knowledge to cover aspect such as nutrition which will help them to know various nutrient requirement for every stage of fish production and easier way in formulating the local feed in order to reduce the cost of feed sources, processing, feed milling, packaging and distribution which will also benefit the community by creating a job opportunity to reduce the level of poverty in the state.

Farm record is an important aspect as regard to good management practice of fish production therefore; commercial fish farmers should take fully all the record of production, cost of production as well as profit and lost made through the production. This will help in a proper management and smooth running of the production.

Lastly, government should perform their supportive and supervisory role in commercial fish farms, loan should be granted to commercial fish farmer with little or no interest to boost their spawning operation in order to meet the demand for fish in the state.

REFERENCES

1. Adekoya BB, Ayansanwo TO, Iduwu AA, et al. In directory of fish hatcheries in Ogun State. Ogun State Agricultural Development Programme. (OGADEP). Abeokuta; 2006;18.
2. Areerat S. Clarias culture in Thailand. Aquaculture. 1987:63(1-4): 355-62.
3. Atanda AN. Analysis of freshwater fish seed resource in Nigeria. 21st Annual Conference of the Fisheries Society of Nigeria (FISON), 13-17 Nov, Calabar, Nigeria; 2006.
4. Ayinla OA. Ezenwa BI. Constraints in Aquaculture. Research and Training in Nigeria; Ned for Petroleum Trust Fund (PTF) Intervension. 1991; 1-17
5. Bolorunduro PI, Falaye AE. Socio economic characteristics as predictors of adoption of improved fish smoking kilns by fish processors in Nigeria. Nig J Fish. 2003;1:70-84.
6. Bonded-Reantaso MG. Assessment of freshwater fish seed resources for sustainable agriculture. FAO Fisheries Technical Paper, Food and Agriculture Organization of the United Nations, Rome; 2007.
7. Brain FD, Army C, Induced fish breeding in south east Asia. Report of the workshop held in Singapore, 25-26 November. IDRC, Ottawa, ON, CA, Singapore; 1980.
8. Eweka JA. Proceeding of the National Agricultural Development Seminar 1971. Caxton press, Ibadan, Nigeria; 1973:34.
9. Eyo AA. Fish Processing Technology in the Tropics. NIFFR Annual Report, New Bussa, Nigeria; 2001;403-15.
10. Ezeri GN, Olaoye OJ, Agbon AO. Fish Fingerlings Production and Management. Agricultural Media Resources and Extension Center, University of Abeakuta; 2009;36.
11. Glencross BD, Booth M, Allan GL, et al. A feed is only as good as its ingredients–a review of ingredient evaluation strategies for aquaculture feeds. Aquaculture nutrition. 2007;13(1):17-34.
12. Henken AM, Machiels MA, Dekker W, et al. The effect of dietary protein and energy content on growth rate and feed utilization of the African catfish Clarias gariepinus (Burchell 1822). Aquaculture. 1986;58(1-2):55-74.
13. Huisman EA, Richter CJ. Reproduction, growth, health control and aquacultural potential of the African catfish, Clarias gariepinus (Burchell 1822). Aquaculture. 1987;63(1-4):1-4.
14. Ita EO, Balogun JK, Ademola A. A Preliminary report of pre-impoundment fisheries study of Goronyo reserviour, Sokoto state, Nigeria. A report submitted to the Sokoto Rima Basin River Development Authority (SRBDA), Sokoto, Nigeria; 1982.
15. Little DC, Edward P. Integrated livestock fish farming system. Inland Water Biol. 2003;67:164-70.
16. Maar A, Martimer MAE. Van DI. Fish Culture in Central East Africa. FAO/UN (Food And Agriculture Organization Of The United Nations), Rome; 1996;158:5.
17. Mamman B. Nigeria: A people United, A feature Assured (Sokoto state). Gabumo Publishing co. ltd, Lagos, Nigeria; 2000;298.

18. National Informatics Centre (NIC). Fish seed production 2004-2005. Fisheries of a glance in Tripura. 2007.
19. Neumayer E, Plümper T. The gendered nature of natural disasters: The impact of catastrophic events on the gender gap in life expectancy, 1981–2002. Ann Am Assoc Geogr. 2007;97(3):551-66.
20. Nwuba LA. Aguigwo JN. Studies on the effect of different food items on the survival of Hatchlings of *Clariasanguillaris*. J Aquat Sci. 2002;17(2):121–4.
21. Rahman MA, Badhra A, Begum N, et al. Effects of some selective supplemental feeds on the survival and growth of catfish (*Clarias batrachus* Lin) fry. Bangladesh J Fish Res. 1997;1(2):55-8.
22. Yunusa BB. Not farm Alone: A study of rural livelihood in the middle belt of Nigeria. DARE ASC Working paper. 1999;38.