Constraints to adoption of improved hatchery management practices among catfish farmers in Lagos State

Oghenetejiri DIGUN-AWETO[1*] and Ademuyiwa Hafiz OLADELE[2]

[1]North-West University, Potchefstroom South Africa, *correspondence: tejiri.aweto@gmail.com

[2]Departments of Fisheries and Aquaculture, Federal University Dutsinma, Dutsinma, Nigeria

Abstract

Aquaculture has shown capacities to serve as means of livelihood, improve living standards, provide employment and generate foreign exchange in many countries. Recent investment in Nigerian aquaculture has been target towards catfish farming. However, small quantity and poor quality fish seeds are one of the problems limiting production. Consequently, Lagos State government introduced improved breeding and hatchery management practices as a package to fish hatchery operators with the aim of improving fish seed quantity and quality in the state. Nevertheless, the dissemination of the package has not yielded the desired result. This study assessed the constraints to adoption of improved hatchery management practices among catfish farmers in Lagos State. With structured questionnaire, 150 catfish farmers, randomly selected from 12 local government areas spread across Lagos State were interviewed. Despite that majority of the respondents strongly agreed or agreed to the fact that improved hatchery management practices have positive impacts on breeding, hatching, and survival of fish fry, majority of them affirmed that high cost of acquisition, high technicality in using the improved management practices as well as inadequate information about the improved management practices are primary reasons for non-adoption of some of the improved practices. Some of the limitations faced by the respondents include insufficient capital, lack of technical expertise to use the methods adequately, non-availability of inputs, expensive cost of facility maintenance, poor information dissemination and insufficient technical support from the extension agents and the state government. Although the adoption of improved practices has not been total, due to these constraints, the farmers' knowledge of the improved hatchery management practices is broad. There is a need for the state government to subsidize the improved hatchery technologies and inputs, in addition to making them available to the farmers; frequently organize training workshops, and motivate more farmers to adopt the technology by providing credit facilities, incentives, and significant inputs.

Keywords: catfish farming, fish seed production, hatchery management, limitation, Lagos State

Introduction

Growth in world fish production has been gradual in the last fifty years with 3.2% average annual increase recorded in fish supply, thereby out-doing the world's population at 1.6% (Food and Agriculture Organization [FAO], 2014). The contribution of capture and culture fisheries to food security and economics has been through export earnings, food supplies, and employment (FAO, 2014). Fish and fish products provide about 3 million people with at least 20% of their animal protein intake (Olaifa, 2015). Despite the vastness of wild aquatic environments, landings from captured fisheries have become reduced to levels unsustainable to meeting the global dietary protein requirements. According to Faturoti (1999), recent trend all over the world shows a fall in output of fishing efforts in open water bodies. This pointed to the fact that the wild fish stock have approached or even exceeded the point of maximum sustainable yield. It is widely believed that capture fisheries would not be able to meet global demand and aquaculture hold the promise to bridge the supply demand gap (Sikoki, 2013). This has placed aquaculture in a prominent position to augment deficit in fish landings from capture fisheries.

Recognizing these potentials, Nigerian Government has given high priority to aquaculture in its development plans (Federal Department of Fisheries [FDF], 2007). However, this has not yielded the desired results. In fact, the outlook for the nation's fish production is worrisome given the growing domestic demand for fish and the widening gap between fish demand and domestic production (Mgbakor et al., 2014). In Nigeria, aquaculture has been estimated to have a potential of producing 2.5 million tonnes annually which if fully harnessed can almost satisfy the nation's demand for fish (FDF, 2007). Increased fish production in the past came through expansion in production and to some extent, improvement in yield associated with intensification of aquaculture practices. Most recent investment in aquaculture has been targeted towards catfish farming. In addition to the strong nature of the catfish and ease of culture, live and smoked catfish attracts premium prices in Nigeria. Despite this, inadequate quantity and poor quality fish seeds are one of the problems facing catfish farming in Nigeria (Omitoyin, 2007).

Besides the issue of seasonality, natural production of fish seed in water bodies is inadequate due to low survival rates caused by factors such as anthropogenic activities, effect of climate change, predation, pests and diseases. The fact that African catfish, *Clarias gariepinus*, spawn seasonally in natural environments has made artificial production and management of fish seed very pertinent to achieve all year round production. Artificial propagation, through hormonal inducement and stripping, under controlled hatchery environmental conditions has become important in ensuring mass production of seeds of African catfish (Faturoti, 1999; Atanda, 2007). This has led to the establishment of catfish hatcheries, especially in the southern part of the country where most of the medium- and large-scale producers are located. More than 80 percent of the total pond and hatchery seeds are produced from these hatcheries (Atanda, 2007). Based on this development, the expectation is that fish seeds become available for farmers in sufficient quantities. However, inadequate fish seed supply from the hatcheries still persists, thereby limiting catfish production among other factors (Ozigbo et al., 2014).

Lagos State is a south-western state and former federal capital city of Nigeria. Lagos is the leading manufacturing and port town in West Africa, and the hub of business and economic development in Nigeria (Jenyo-Oni and Adepoju, 2013). According to Heinrich-Boll-Stiftung (HBS) foundation research, Lagos is the 7th fastest growing city in the world with a population of 21 million (HBS, 2012). The task of feeding over 21 million people with fish and seafood products is a large one. Its industrial status poses a lot of competing needs for land (FAO, 2011), thereby limiting the amount of land available for aquaculture. In a bid to boost table-size catfish production in the state, Lagos State government introduced improved breeding and hatchery management practices as a package to fish hatchery operators in Lagos State. The package comprised an introduction and use of improved brood stocks, hatching troughs, live feed for fish frys, use of sorting trays, graders, synthetic hormone for hormonal inducement, water exchange systems as well as effluent management (Lagos State Agricultural Development Programme [LSADP], 2010). The package was disseminated to improve the quality and quantity of fish seed which will directly increase fish production. However, the dissemination of the package has not satisfied the demand for fish seed by farmers in Lagos State. Therefore, the study assessed the constraints to adoption of improved hatchery management practices among catfish farmers in Lagos State.

Materials and methods

The study was carried out in Lagos State. The state has a 3,577 km^2. Size, the maritime shoreline of 180 km with 30% of the total land mass made up of a network of water bodies (Olaoye et al., 2016). The state lies approximately within longitude 2°42'E and 3°42'E and stretches between latitude 6°22'N and 6°42'N. Although Lagos is blessed with 147,877 hectares of swamp land and a large area of water bodies suitable for aquaculture and adequate to feed its ever increasing human population of over 21 million, only 61.28 hectares which constitute about 0.04% is used for aquaculture. Lagos is made up of 5 administrative divisions which are further divided into twenty (20) local government areas (LGAs). Twelve (12) LGAs, which spread across all the 5 administrative divisions, were randomly selected for this study. From a total of 1,466 state registered fish farmers, one hundred and fifty (150) fish farmers, were randomly selected from the 12 LGAs and interviewed using structured questionnaires. Table 1 shows the distribution of the fish farmers randomly selected from the study area. Frequency counts and percentages were used to describe the distribution of measured variables while 5-likert scale was used to measure the respondents' attitude towards improved hatchery management practices.

Table 1. Distribution of sampled fish farmers across the selected 12 LGAs of Lagos State

LGA	Frequency	Percentage (%)
Alimoso	12	8
Amuwo-odofin	12	8
Badagry	12	8
Eti-osa	12	8
Eredo	12	8
Ibeju	12	8
Ikosi/Ejinrin	12	8
Ipaja	12	8
Surulere	12	8
Epe	14	9.3
Ikorodu	14	9.3
Ojoo	14	9.3
Total	150	100

Results and discussion

The attitude of the respondents towards improved hatchery management practices are presented in Table 2. About 81% and 18.7% of the respondents strongly agreed and agreed respectively that improved broodstock selection determines the fertility rate of hatchery management success, even as 21.3% and 74% respectively strongly agreed and agreed that improved broodstock selection determine fecundity rate for hatchery management success. Similarly, 70% respondents' population strongly agreed that improved broodstock selection influences survival rate of hatchlings and the remaining 30% agreed to this practice. Also, 82.7% and 17.3% of them respectively strongly agreed and agreed that the weight of brood stock affects breeding success. Thirty six percent (36%) and 45.3% respondents' population strongly agreed and agreed respectively that the use of hatching troughs enhanced the hatching rate of fertilized eggs. Despite this, 54.7% and 36% strongly agreed and agreed respectively that hatching troughs make separating hatchlings from un-hatched eggs easier, even as 42 respondents' majority disagreed that the use of hatching troughs is not necessary for siphoning of fry.

Among the respondents, 22.7% and 35.5% strongly agreed and agreed that frys respond better to *Daphnia* (*Daphnia* spp) than *Artemia* (*Artemia* spp), with 28% of them having their response as undecided. Furthermore, 73.3% agreed that *Daphnia* is cheaper to use than *Artemia* while respective populations of 30.7% and 64.7% strongly agreed and agreed that *Daphnia* is easy to culture. Meanwhile, 17.3% and 36% of the respondents strongly agreed and agreed respectively that *Daphnia* production in fish hatcheries could completely replace *Artemia*, although 30% and 65.3% strongly agreed and agreed that *Artemia* is easier to use in feeding fry than *Daphnia*. 86% of the respondents' population strongly agreed that early sorting of frys has an effect on fry growth rate while the remaining 14% agreed to this fact. Similarly, 82% of them strongly agreed that early sorting has an effect on fry survival.

67.3% majority of the respondents strongly agreed that the National Institute for Oceanography and Marine Research (NIOMR) sorting trays are effective in sorting

Table 2. Attitude of respondents towards improved hatchery practices

Improved management practices	SA	A	UD	D	SD
Improved brood stock selection determine the fertility rate of hatchery management success	122 (81.3%)	28 (18.7%)	0 (0%)	0 (0%)	0 (0%)
Improved brood stock selection determine fecundity rate for hatchery management success	32 (21.3%)	111 (74%)	07 (4.7%)	0 (0%)	0 (0%)
Improved broodstock selection influences survival rate of hatchling	105 (70%)	45 (30%)	0 (0%)	0 (0%)	0 (0%)
The weight of brood stock affects breeding success	124 (82.7%)	26 (17.3%)	0 (0%)	0 (0%)	0 (0%)
The use hatching troughs enhances hatching rate of fertilized eggs	54 (36%)	68 (45.3%)	21 (14%)	07 (4.7%)	0 (0%)
Hatching troughs make separating hatchlings from un hatched eggs easier	82 (54.7%)	54 (36%)	0 (0%)	14 (9.3%)	0 (0%)
The use of hatching troughs is not necessary for siphoning of fry	53 (35.3%)	13 (8.7%)	14 (9.3%)	63 (42%)	07 (4.7%)
Frys respond better to *Daphnia* than *Artemia*	34 (22.7%)	53 (35.3%)	42 (28%)	14 (9.3%)	07 (4.7%)
Daphnia is cheaper to use than *Artemia*	26 (17.3%)	110 (73.3%)	07 (4.7%)	0 (0%)	07 (4.7%)
Daphnia is easy to culture	46 (30.7%)	97 (64.7%)	07 (4.7%)	0 (0%)	0 (0%)
Daphnia production in hatchery can completely replace A*rtemia*	26 (17.3%)	54 (36%)	42 (28%)	28 (18.7%)	0 (0%)
Artemia is easier to use in feeding fry than *Daphnia*	45 (30%)	98 (65.3%)	07 (4.7%)	0 (0%)	0 (0%)
Early sorting has an effect on growth rate of fry	129 (86%)	21 (14%)	0 (0%)	0 (0%)	0 (0%)
Early sorting has an effect on survival of fry	123 (82%)	27 (18%)	0 (0%)	0 (0%)	0 (0%)
NIOMR sorting trays are effective in sorting fingerlings	101 (67.3%)	42 (28%)	07 (4.7%)	0 (0%)	0 (0%)
Pilot asset acquisition makes farmer more adaptable to programme implementation	101 (67.3%)	42 (28%)	07 (4.7%)	0 (0%)	0 (0%)

fingerlings, 28.7% agreed while the remaining 4.7% are undecided. Also, 67.3% and 28% respective population strongly agreed and agreed that pilot asset acquisition makes farmer more adaptable to programme implementation, whereas 16.7% respondents' majority strongly agreed that advisory services and input support are not an important aspect of programme implementation.

Despite that majority of the respondents reported positive feedbacks on the roles played by improved hatchery management practices on hatching and survival of fish fry, Table 3 reveals that high cost of acquisition, high technicality in using the improved management practices as well as inadequate information about the practices are among major reasons for non-adoption of some of the improved practices by some fish farmers. With these problems addressed, full adoption of improved hatchery management practices may be achievable, since innovations, which are compatible with existing practice, divisible, viable and readily available often record high adoption rates (Ogunfowora, 1997).

In order of importance, some of the constraints faced by respondents in the study area are revealed in Table 4. Lack of capital was ranked as the first major constraint by highest number (94) of respondents, while lack of technical expertise ranked 2nd (63), non-availability of inputs was ranked 3rd (54), difficulty of handling was ranked 4th (42), expensive to maintain was ranked 5th (39), poor dissemination, inadequacy of technical support and immediate and long term benefits were jointly ranked 6th (35). This result is in line with the submission of Ogunremi and Oladele (2012) that credit is a primary reason for non-adoption of aquaculture technologies in Lagos State, Nigeria. Similarly, it is in consonance with the findings of Ifejika et al. (2007) that availability of technology and pro-active information dissemination affects adoption of innovations. According to Nwachukwu and Onuegbu (2007), the crucial point for fish farmers is to be able to afford any technology extended to them. The inability of farmers to afford and/or maintain such technology will make them ignore and abandon it.

Table 3. Respondents' reasons for not adopting improved management practices (%)

Management practices	Grounds for non-adoption of improved management practices									
Rank	1	2	3	4	5	6	7	8	9	10
Improved brood stock	7.7	7.7	23.1	0	0	0	0	0	61.5	0
Early sorting of fry	0	0	0	0	0	0	16.7	0	83.3	0
Hatching troughs	0	0	0	0	0	0	50	0	50	0
Sieve cloth/Glass jar incubators	29.6	0	11.1	3.7	11.1	13	25.9	0	5.6	0
Feeding with *Artemia*	11.5	0	0	13.1	14.8	34.4	0	26.2	0	0
Feeding with *Daphnia*	0	0	0%	0	11.5	0	0	30.8	57.7	0
Use of sorting trays	30.8	0	0	0	0	0	0	15.4	53.8	0
Use of trash fish as substitute for fish meal	0	0	0	16.7	20.8	0	0	0	18.8	43.7
Use of Graders	59.2	8	0	0	0	20.8	0	0	12	0
Hatching jars	67.2	0	0	0	0	0	0	14.8	18	0
Siphoning of hatchlings	0	0	0	0	0	30.3	0	0	69.7	0
Pituitary hormone	0	10.1	2.9	20.3	6.5	28.3	0	0	31.9	0
Common carp (dried pituitary hormone)	13	10.7	0	16	0	42	0	0	18.3	0
Ovaprim	0	11.8	5.5	11.8	5.5	35.4	0	0	30	0
HCG hormone	13.7	10.7	6.1	16	3.1	29.8	0	0	20.6	0
Mechanical aerators/air stones	59.4	0	0	15.6	0	0	0	0	25	0
Use of Kakaban	10.9	10.2	0	19.7	0	28.5	0	10.9	10.2	0
Flow through water system	29.2	0	0	25	0	12.5	0	0	33.3	0
Recirculatory water system	50.4	8	2.2	10.9	3.6	21.2	0	0	3.6	0
Water temperature regulators	8.3	11.7	8.3	5	5	20	0	23.3	18.4	0
Effluent waste management	16.7	0	5.5	25.9	5.5	28	0	0	18.4	0
Water quality management	36.3	27.7	0	4.3	4.3	0	0	10.6	17	0
Use of hammock for transporting brood stock	21	10.1	4.3	20.3	5	28.3	0	0	10.9	0
Use of indigenous floating pellets	7.4	0	0	18.5	0	0	0	7.4	66.7	0

[a]Key for respondents' reasons for not adopting improved management practices 1 - high cost of acquisition, 2 - inadequacy of technical support, 3 - not compatible with traditional practice, 4 - no clear advantage, 5 - immediate and long term benefits foreseeable, 6 - difficulty of handling, 7 - non-availability of inputs, 8 - difficulty of adapting, 9 - information not adequate, 10 - poor output quality.

Table 4. Constraints faced by respondents in the study area (ranked 1-12)

Constraints	0	1	2	3	4	5	6	7	8	9	10	11	12
Lack of technical expertise	07 4.7%	00 0%	63 42%	14 9.3%	00 0%	21 14%	00 0%	13 8.7%	07 4.7%	19 12.7%	06 4%	00 0%	00 0%
Expensive to maintain	07 4.7%	14 9.3%	13 8.7%	28 18.7%	14 9.3%	14 9.3%	21 14%	00 0%	39 26%	00 0%	00 0%	00 0%	00 0%
Poor dissemination	07 4.7%	00 0%	14 9.3%	00 0%	00 0%	21 14%	28 18.7%	26 17.3%	35 23.3%	00 0%	13 8.7%	06 4%	00 0%
Inadequacy of technical support	07 4.7%	07 4.7%	14 9.3%	13 8.7%	21 14%	13 8.7%	35 23.3%	13 8.7%	00 0%	07 4.7%	00 0%	07 4.7%	07 4.7%
Not compatible with traditional practice	07 4.7%	14 9.3%	00 0%	00 0%	00 0%	20 13.3%	19 12.7%	28 18.7%	13 8.7%	00 0%	21 14%	00 0%	28 18.7
No clear advantage	07 4.7%	07 4.7%	19 12.7%	00 0%	13 8.7%	07 4.7%	00 0%	06 4%	28 18.7%	14 9.3%	07 4.7%	42 28%	00 0%
Difficulty of handling	07 4.7%	07 4.7%	07 4.7%	06 4%	13 8.7%	14 9.3%	12 8%	14 9.3%	14 9.3%	42 28%	07 4.7%	07 4.7%	00 0%
Non-availability of input	07 4.7%	14 9.3%	07 4.7%	54 36%	06 4%	13 8.7%	07 4.7%	00 0%	07 4.7%	14 9.3%	14 9.3%	07 4.7%	00 0%
Difficulty of adapting information	07 4.7%	00 0%	14 9.3%	07 4.7%	34 22.7%	14 9.3%	14 9.3%	04 2.7%	14 9.3%	00 0%	20 13.3%	12 8%	00 0%
Immediate and long term benefits	07 4.7%	00 0%	14 9.3%	21 14%	07 4.7%	35 23.3%	07 4.7%	00 0%	21 14%	26 17.3%	12 8%	00 0%	00 0%
Poor output quality	14 9.3%	00 0%	14 9.3%	06 4%	14 9.3%	21 14%	14 9.3%	07 4.7%	00 0%	07 4.7%	28 18.7%	00 0%	25 16.7%

Conclusion

Fish farmers' knowledge of the improved hatchery management practices introduced by the Lagos State government is not shallow since the majority of them are not only aware of the practices but also strongly agreed or agreed to its use in boosting fish seed production. However, the adoption of the practices has not been total or complete due to reasons such as high cost of facility acquisition, strong technical knowledge involved in using the improved management practices as well as inadequate information about the improved management practices. Lack of capital and technological expertise, non-availability of inputs, difficulty in handling, expensive cost of maintenance as well as inadequate technical supports from the government were the major constraints faced by the farmers in using the improved hatchery management practices. There is a need for Lagos State government to subsidize the improved hatchery technologies and inputs, in addition to making them available to the farmers. Training and re-training of fish farmers on better and easier ways of using the improved methods should be organized frequently. More farmers should be motivated to adopt new technologies through the provision of credit facilities, incentives, and important inputs. Subsequently, the improved hatchery management package should be made cheaper to buy, maintain and easier to use.

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