IMPROVED AQUACULTURE PRACTICES BY FISH FARMERS IN NIGER STATE.

Abdulsalam Nasimat Titilayo
Department of Agricultural Extension and Rural Development, Federal University of Technology Minna
E-mail::nasimat_titilayo@futminna.edu.ng
Phone no: +234(0)08065070812

Mohammed Ibrahim
Department of Agricultural Extension and Rural Development, Federal University of Technology Minna
E-mail: gausubrahama@yahoo.com
Phone no: +234(0)08065725897

Ajayi Oladipo Joseph
Department of Agricultural Extension and Rural Development, Federal University of Technology Minna
E-mail: pastordee@yahoo.com
Phone no: +234(0)08030754302

Pelemo Jacob Jide
Department of Agricultural Extension and Rural Development, Federal University of Technology Minna
E-mail: jacobjide1986@gmail.com
Phone no: +234(0)07069400942

Mohammed AbubakarAlhaji
Department of Agricultural Extension and Rural Development, Federal University of Technology Minna
E-mail: mohammedabubakaralhaji2020@gmail.com
Phone no: +234(0)07038940892

ABSTRACT
The study determined improved aquaculture practices by fish farmers in Niger State, Nigeria. Multi-stage sampling procedure was used to select 231 fish farmers. Data were collected using structured questionnaire and interview scheduled and analyzed using descriptive and inferential statistics. Utilization of medication to treat stress, control pest and disease (=2.79) and sorting density to separate jumpers (=2.77) were the most improved aquaculture practices applied. The coefficient of fingerlings, feed, fertilizer, depreciation, labour, age, education level, household size and application score had significant effect on fish farmers' output. Also, environmental pollution (=3.0) and unfavorable weather conditions for fish growth (=2.95) were the most constraining factors to improve aquaculture practices. It is recommended that older fish farmers should be encouraged by extension agents and other stakeholders to embrace aquaculture practices in the study area. It is also recommended that substances that contribute to environmental pollution should be discouraged by fish farmers. Also, fish farmers should forecast and put proper measures against pond flooding.
Keywords: Aquaculture, Practices, Fish-Farmers

INTRODUCTION

Fish provide high quality protein and essential vitamins and minerals to Nigerian populace(Arowolo*et al.*, 2019). Fish is crucial to human in the context of institutional development and change in protein calorie (Osawe and Salman 2016).Fish is also adjudged as cheaper source of animal protein with an indispensable role in world protein supplies, particularly in the developing countries, where fish equally provides energy, fatty acids, vitamins and minerals and this is quiet true in the tropical countries like Nigeria where animal protein is seriously inadequate (Nwezza *et al*., 2018).Nigeria has large population of fish consumers with a total consumption of more than 1.36 million metric tons while fish imports make up about 740, 000 MT annually (Ahmed and Vincent, 2017).Baruwa*et al.* (2015) reported that the present demand – supply deficit of over 60%, there is a steady decline in capture fisheries resource leading to renewed desire to evolve programmes by the government that could enhance greater productivity of fish in the natural water bodies of Nigeria and fostering sustained livelihood for the people whose lives depend on such environment (Baruwa*et al.*, 2015). Meanwhile, a good number of projects were initiated, funded and implemented by the National Institute for freshwater fisheries Research(NIFER), New Bussa in collaboration with the German Technical Corporation. Niger State is one of the major beneficiaries of these projects with special

attention on the communities at the shore lines of Niger State and other neighboring communities. Apart from the increased fishers' population, different fishing methods were introduced to fish farmers and some of the fishing methods had detrimental effects on the fish population dynamics (Sanni, 2017) These effort were to improve the utilization of fisheries resources at sustainable level assure the livelihood of fishing communities, protecting consumers and the conservation of aquatic resource. However, the level of awareness of fishing policies of the resource poor fisher folk was low because of lack of understanding of the benefits (Arowolo, 2019). Also the high cost of implementation and the control of illegal fishing continue to be a problem, hence an apparent ineffectiveness of the intervention programme.The application of aquaculture practices in Niger State has assumed a popular dimension in recent years starting from immediate communities around the NIFFR, New Busa and spreading by trickle-down effect to communities far and wide along the shorelines and hinterlands of Niger State. This understanding therefore, provided the basis forutilization of improved aquaculture practices by fish farmers in Niger State. The objective of the study were; assess the application level of improved aquaculture practices by the fish farmers, determine theeffects of improved aquaculture practices application on fish farmers' outputand examine constraining factors to application of improved aquaculture practices.

RESEARCH METHODOLOGY

The research was conducted in Niger State. The State is in the Guinea Savannah ecological zone of Nigeria. In terms of land mass, it is the largest State in Nigeria (Mohammed *et al.,* 2018). It covers a total land area of 74,224km^2 thus accounting for about eight percent of Nigeria's land area. About 85% of its land area is good for arable crop production (Niger State Geographical information system, 2015). It is located within longitude 3^o 30' and 7^o 20' East & latitude 8^o 20' and 11^o 30' North, with a population of about 3,950,249 (Pelemo*et al.,* 2018) and with a growth rate of 3.2%, the State has estimated population of 5,586,000 in 2017 (Niger State Geographical Information System, 2015).The population of the study consists of culture fish farmers in Niger State area. Multi stage sampling was adopted for this study. In the first stage, random selection of one L.G.A from each of the agricultural zones (Katcha, from zone 1, Bosso from zone II and Borgu from zone III). In the second stage, random selection was used to select three (3) were randomly selected communities from each of the L.G.A selected to get nine (9) communities. The third stage involved proportionate selection of 10% of fish farmers from each of the communities to get sample size of 231 respondents

Table 1: Sample outlay of the respondents

Agric Zone	L.G.A	Communities	Sample Frame	Sample Size
I	Katcha	Katcha	342	34
		Baddegi	205	21
		Gbakogi	270	27
II	Bosso	Bosso	167	18
		LapaiGwari	185	19
		Togwai Dam	285	29
III	Borgu	New Bussa	302	30
		Monnai	311	31
		Fakun	220	22
Total	**3**	**9**	**2287**	**231**

Data was collected from the fish farmers with the use of questionnaire and interview schedule administered by the researcher with the assistance of trained enumerators. Data wasanalysed using descriptive and inferential statistics. Objective i, ii and iv were achieved using descriptive statistics while objective iii was achieved using multiple regression model. Objective i was further subjected to 3 point likert scale of highly applied (3), Fairly applied (2), not applied (1). A weighted mean score was computed and compared to the cut-off mean i.e (1+2+3)/3 = 2.0. The decision score is any means score $\geq$2.0 is applied while <2.0 not applied.Also, objective ivwas subjected 4-point Likert type rating scale was used to measure the constraints to adoption of aquaculture practices across a continuum of 'very serious' (4) 'serious', (3) undecided' (2), not a constraint (1) A weighted mean score was computed and compared to the cut-off mean i.e (1+2+3+4)/4 = 2.5. The decision rule is any mean score $\geq$2.5 is serious, <2.5 is not serious

Objective iii was achieved using multiple regression analysis. Regression model.

The implicit form of the model is as follows:

FI = *f* (FI, FD, FE, DE, LA, AG, EX, ED, HS, ES, AP (1)

The explicit form of the model are as specified below:

Linear form

$FI = \alpha + \beta_1 FI_1 + \beta_2 FD_2 + \beta_3 FE_3 + \beta_4 DE_4 + \beta_5 LA_5 + \beta_6 AG_6 + \beta_7 EX_7 + \beta_8 ED_8 + \beta_9 HS_9 + \beta_{10} ES_{10} + \beta_{11} AP_{11} + \mu$ (2)

Double-log form:

$\ln Y = \alpha + \beta_1 \ln FI + \beta_2 \ln FD + \beta_3 \ln FE + \beta_4 \ln DE + \beta_5 \ln LA + \beta_6 \ln AG + \beta_7 \ln EX + \beta_8 \ln ED + \beta_9 \ln HS + \beta_{10} \ln ES + \beta_{11} \ln AP + \mu$ (3)

Semi-log form

$Y = \alpha + \beta_1 \ln FI + \beta_2 \ln FD + \beta_3 \ln FE + \beta_4 \ln DE + \beta_5 \ln LA + \beta_6 \ln AG + \beta_7 \ln EX + \beta_8 \ln ED + \beta_9 \ln EHS \beta_{10} \ln ES + \beta_{11} \ln AP + \mu$ (4)

Exponential form

$\ln Y = \alpha + \beta_1 FI + \beta_2 FD + \beta_3 FE + \beta_4 DE + \beta_5 LA + \beta_6 AG + \beta_7 EX + \beta_8 ED + \beta_9 HS + \beta_{10} ES + \beta_{11} AP + \mu$ (5)

Where;

F1 = Fish Income (in naira)
a = a constant
Fn1 = Fingerlings (number)
Fe_1 = Feed (Kg)
De = Depreciation (years)
L_1 = labour (man days)
Ag = Age (years)
Ex = Experience (years)
Ed = Education (years)
Hs = Household size (number)
Es = Extension (number)
As = Application score (score)

RESULTS AND DISCUSSION

Utilization Level of Improved Aquaculture Practices

Table 2 shows the distribution of respondents based on improved aquaculture practices in the study area. The result revealed that the improved aquaculture practices mostly applied by respondents were; medication to treat stress, control pest and disease(=2.79) and sorting density to separate jumpers (=2.77). This implies that medication to treat stress control of pest and disease and sorting density were the most improved practiced applied by respondents in the study area. This finding supported Susan and Peter (2016), who reported that sorting practices is needed in aquaculture practices for profit maximization.

Also, use of ash to control acidity in pond (=2.72) and use of organic and inorganic fertilizer (=2.68) were applied by the fish farmers. This implies that control of acidity and uses of organic and inorganic fertilizer were part of the highly practiced improved aquaculture method in the study area. This finding agreed with Olaoye*et al.*(2016), who reported that control of acidity is a common practice among fish farmers in Nigeria. Other improved aquaculture practices used by the fish farmers were use of threads to control predator birds(=2.65), knowledge on rainfall emergence and distribution (=2.52), water pumping machine (=2.50), use of tarpaulins (=1.72), aerator (=1.65).

Table 2: Utilization level of improved aquaculture practices

Variables	Mean
Medication to treat stress, control pest and disease	2.79
Sorting density to separate jumpers	2.77
Use of ash to control acidity in pond	2.72
Use of organic or inorganic fertilizer	2.68
Use of threads to control predator birds	2.65
Knowledge on rainfall emergence and distribution	2.52
Water pumping machine	2.50
Use of tarpaulins	1.72
Aerator	1.65

Source: Field survey 2019 *mean≥2.0Applied **<2.0 Not applied

Effects of Improved Aquaculture Practices Application on Fish Farmers' Output

The result of the regression model showingeffects of the improved aquaculture practices application on fish farmers' output the in the study area is presented in Table 3. The result of the multiple regression analysis showed R^2 value of 0.943 which implies that 94% variation in the improved aquaculture practices application on fish farmers' output in the study area was explained by the independent variables included in the model. Four functional forms (linear, exponential, double log and semi log) were tried. Exponential log function gave the best fit. The coefficient of fingerlings (.0000825) was positively significant at 1% level of probability, implying that increase in fingerlings will have significant increase on the output of fish farmers. This agreed with Sanni (2017) who reported that increase in fingerlings increases fish farmers output in Niger State, Nigeria. Also, the coefficient feed (.000154) was positive but significant at 10% level of probability, implying that availability of feed will increase the fish size and have effect on fish farmers output. This finding agreed with Onyekuru et al. (2019), who stated that feed availability most times prompt farmers to increase their pond size. Moreover, the coefficient of fertilizer (.0013279) was positively

significant at 1% level of probability. This result indicates as it is being applied t0 the p0nds it prepares the p0nd f0r fish gr0wth and sustain good0f the edaphic c0nditi0ns 0f the p0nds. This is in c0ns0nance with Wetegere, (2016) that 0bserved eff0rts t0wards water quality management in aquaculture tends t0 impr0ve 0utput 0f the fish and c0nsequently better inc0me. Moreover, the coefficient of depreciation (-3.38e-06) was negatively significant at 5% level of probability, implying that reduction in depreciation increase fish farmers output. This agreed with Arowolo *et al*. (2018) who stated that as depreciation reduces, fish producers tend to get reasonable output. Also, the coefficient of labour (-.0012519) was negatively significant at 1% level of probability, implying that reduction in labour increase fish farmers income. More so, the coefficient of age -.0046984 was negatively significant at 1% level of probability, implying that as farmers get older, their output reduce. The coefficient of education (.0067926) was positively significant at 1% level of probability, implying that increase in education is expected to increase fish farmers output. This agreed with Rozana and Roslina (2015) who stated that education played important roles in aquaculture production. Moreover, the coefficient of household size (.010459) was positive but significant at 5% level of probability increase in household size will increase fish farmers output. This is in line with Rozana and Roslina (2015), who reported that addition of one number to family is expected to increase farmers output. Also, the coefficient of application score was positive significant at 1% level of probability, implying that increase in application score increase farmers fish output.

Table 3: Regression estimates on the effects of improved aquaculture practices application on fish farmers' output

	Linear		Exponential		Cobb douglas		Semi-log	
Variables	**Coefficient**	**t-value**	**Coefficient**	**t-value**	**Coefficient**	**t-value**	**Coefficient**	**t-value**
Fingerlings	1.059614	27.06***	.0000825	8.54***	.6313611	22.29***	4996.091	14.39***
Feed	1.046756	2.86***	.000154	1.71*	.101011	4.36***	790.3703	2.78***
Fertilizer	1.785441	4.79***	.0013279	14.45***	.3357481	10.02***	-801.4523	-1.95*
Depreciation	-.0059344	-0.95	-3.38e-06	-2.20**	.0135616	1.25	-21.82472	-0.16
Labour	1.758288	1.85*	-.0012519	-5.35***	-.0420224	-1.19	1328.126	3.06***
Age	2.980272	0.56	-.0046984	-3.59***	.0448217	1.30	-380.9095	-0.90
Experience	-3.243253	-0.25	-.0040727	-1.29	.0592448	3.55***	-288.9718	-1.41
Education	26.27817	2.12**	.0067926	2.23**	.0215306	1.96*	58.52805	0.43
Household size	52.07661	3.07***	.010459	2.50**	.0654611	3.29***	-183.9719	-0.76
Extension	61.39551	1.92*	-.0004376	-0.06	-.0030972	-0.38	14.36661	0.14
Application score	10.05843	2.32**	.0055527	5.19***	.1733559	3.00***	335.6724	0.47
Constant	358.6849	0.82	7.618343	70.76***	1.469293	5.21***	-40299.36	-11.67***
F-value	1%		1%		1%		1%	
R-squared	0.9614		0.9435		0.9747		0.8422	
Adj R-squared	0.9595		0.9407		0.9734		0.8343	

Sources: Field survey 2019

*** significant at 1% level of probability, **=Significant at 5% level of probability, **=Significant at 5% level of probability

Constraining Application of Improved Aquaculture practices

Table 4 reveals that the following were major constraints experienced by fish farmers in the study area, environmental pollution(=3.0). This implies that environmental pollution such as use of toxic chemical is a serious constraint to improve aquaculture practices in the study. This was followed by unfavorable weather conditions for fish growth (=2.95). Also, flooding of ponds during rains (=2.90), implying that flood which arise as a result of heavy downpour is one of the major and serious factors to improve aquaculture practices in the study area, flood mostly arise from excessive downpour that wash away fish forks pond together with their fish. This finding agreed with Adeleke (2016) who reported that flood is a common problem faced by fish farmers in Ondo State, Nigeria.

Moreover, lack of technical know-how for the production of zoo planktons (=2.86), this was followed by no effective policy(=2.85). This is consonance with work of Sanni (2017), who reported that lack of technical know-how in the production of zoo-plankton and effective government policy were one of the major constraint to improved fish technologies in Niger State of Nigeria.In addition, the following constraining factors to improved aquaculture practices application were not serious inadequate training services improved feed are expensive(=1.90) and problems of pest and diseases (=1.87).

Table 4: Distribution of respondents according to constraining factors to improved aquaculture practices application

Variables	Mean
Environmental pollution	3.0
Unfavorable weather conditions for fish growth	2.95
Flooding of ponds during rains	2.90
Lack of technical know-how for the production of zoo planktons	2.86
No effective policy	2.85
Improved feeds are expensive	1.90
Problems of pest and diseases	1.87

Sources: Field survey 2019

*mean≥ 2.5serious **< 2.0 Not applied

CONCLUSION AND RECOMMENDATIONS

Based on the findings, it can be concluded that medication to treat stress, control pest and disease sorting density to separate jumpers were the most improved aquaculture practices applied by the respondents. The coefficient of fingerlings, feed, fertilizer, depreciation, labour, age, education level, household size and application score had significant effect on fish farmers' output. The constraints factors to improve practices in the study area were environmental pollution, unfavorable weather conditions for fish growth and flooding of ponds during rains. It is recommended that older fish farmers should be encouraged by extension agents and other stakeholders to embrace aquaculture practices in the study area.It is also recommended that substances that contribute to environmental pollution should be discouraged by fish farmers. Also, fish farmers should forecast and put proper measures against pond flooding. The use of tarpaulin and aerator were low, it is recommended that fish farmers should both tarpaulin and aerator should be utilized in the study area.

REFERENCES

Adeleke, M.L. (2016).The Socio-economic characteristics of the artisanal fisher-folks in the coastal region of Ondo State, Nigeria.Journal of Economics and Sustainable development, 2 (6), 23–31.

Ahmed, D. A. & Vincent A. Y. (2017). "Unlocking the Potentials of Nigerian Fishery Industry". Daily Trust of Nigeria, publisher Media Trust Limited. Daily Trust Newspaper Nigeria, Thursday, 02 January, 2017.

Arowolo, K.O. Pelemo, J.J., Buhari H.L., and Adeoye, A.A. (2019). Socio-economic factors influencing social capital formation on the livelihood of fisher-folks in Kainji Lake Basin, Nigeria, Journal of Agricultural Economics, Extension and Social Sciences (JAE2S2) University of Jos, 2 (1), 152-160

Baruwa O.I, Tijani, A.A., Adejobi, A.O (2015). Profitability and Constraints to Fishery Enterprises: A case of Artisanal and Aquaculture Fisheries in Lagos State, Nigeria, Journal of Agriculture, Food and Environment, 8(1), 52-58

Mohammed, U., Umar, I. S., Olaleye, R. S., Tyabo, I. S., Tsado, J.H., and Pelemo, J. J. (2018). Assessment of Forest Resources Utilization for the Livelihood of Farming Populace in Kogi and Niger States, Nigeria,

Dutse Journal of Agriculture and Food Security DUJAFS, 6 (1), 29-37

Pelemo, J. J., Tsado, J.H., Olaleye, R. S., Ajayi, O.J., and Mohammed, U. (2018). Evaluation of Farmers' Knowledge on Post-Harvest Technologies of Yam in Kogi and Niger States, Nigeria, Journal of Agricultural Economics, Extension and Social Sciences (JAE2S2) University of Jos, 1(2), 104-111

Niger State Geographic Information System (2015).Background information.Retrieved from www.nigergis.com/about_niger_state.Retrieved on 04/04/17.

Nwezza, S. N., Eshiet, I., Adeogun O., Jim-Saiki L. O., Unah, R. L., Obasi, E. U., Olajide, O. T. (2018). Gender And Participation In Artisanal Fishing And Fish Processing Activities In Badagry, Lagos State. Proceeding of 27th Annual Conference of Rural Sociology Society of Nigeria RUSAN held at Ahmadu Bello University Zaria, 7th-11th October 2018, 136-139

Olaoye, O.J.,Onyenoro, G.N.E.,Yemi A.S.,Awotunde J.M., and Oyebiyi, G. O. (2016) Dynamics of the adoption of improved aquaculture technologies among fish farmer in lagos state Nigeria CroatianJournal of Fisheries74, 56-70.

Osawe, O., Salman, K.K. (2016). Competitiveness of Fish Farming in Lagos State, Nigeria: An Application of Policy Analysis Matrix. Journal of Agriculture and Sustainability.9(1): 58-82.

Onyekuru, N.A.,Okorie,O.,Ugwu, E. and Nwokorie, U. M. (2019). Determinants of catfish production in Nigeria: a case study of Nsukka area of Enugu State, Nigeria. Proceedings of 53rd Annual Conference of Agricultural Society of Nigeria (ASN) held at National Cereal Research Institute Baddegi, 21st-25thOctober 2019

Rozana, S.,&Roslina, K. (2015).The influences of social-demographic factors in adopting good aquaculture practices" case of aquaculture farmers in Malaysia.Journal of Sustainable Development 8(9), 23-28.

Sanni, A.O (2017). Factors Influencing the Adoption of Improved Aquaculture Technologies by Fish Farmers inKainji and Jebba Lake Basins' Area, Nigeria.Ph.D thesis Summited to Department of Agricultural Extension and Rural Sociology, Federal University of Technology, Minna. Pp. 1-188

Susan, S & peter, M (2016).Factors Influencing adoption of pond fish farming innovation in PotsyMorobe Province Papua New Guinea University. Journal of Agricultural Research2(6), 191-197.

Wetegene, K. (2016). Determents 0f ad0pti0n 0f rec0mmended package 0f fish farming techn0l0gy: The case 0f selected village in eastern Tanzania advanced J0urnal 0fF00d Science and Techn0l0gy,2(4), 55-62.