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Adoption of Fishery Technologies by Fish Farmers in Akoko-edo Local Government Area, Edo State, Nigeria

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Abstract: The study examined the adoption of fishery technologies by fish farmers. The study was carried out in Akoko-Edo Local Government Area (LGA) of Edo State, Nigeria. A sample size of 72 respondents was used for the study. Data were collected through the use of a structured interview schedule. Trained field assistants in addition to the researcher collected the data. Descriptive statistics such as mean scores, frequency and percentage were used to summarize data. The sigma method was used in determining adoption scores. Results of the study reveal that respondents had moderate awareness of fishery technologies with a mean awareness percentage of 52.50%. The study also found a general low adoption of fishery technologies among the fish farmers with a mean adoption score of 4.81. A number of technologies which farmers were aware of were not adopted by them. This was due to certain constrains identified by the study which include lack of capital, high cost of procuring fingerlings, high cost of feeds, inadequate water supply, lack of farm credit and inadequate land space. The study recommends that more awareness should be created among the fish farmers in those technologies which there are awareness was low. Also, the cost of feeds and fingerlings should be subsidized by the government to make them affordable by the farmers. Farm credit should be made available to the farmers to raise their capital base such that they can have the financial capacity to adopt and implement fishery technologies.

Key words: Adoption, fishery technologies, fish farmers.

INTRODUCTON

Fishery products are a potential answer to the growing problems of world dietary animal proteins shortages. Fish provides 17% of world's animal proteins; in some countries the figure is as high as 50%[13]. Fish are able to convert their feed into flesh about two times more effectively than chickens and five to ten times more effectively than beef cattle. Fish also have excellent dress-out qualities, providing an average of 60% body weight as marketable product and a greater proportion of edible lean tissue than most livestock. According to Okorie[12], fish are rich in fats, phosphorus, sulphur, potassium, iron, calcium and copper. The flesh of fish is reported to be more quickly broken up by gastric juices and remains in the stomach for a shorter period of time than does meat.

The importance of fish and fish products in human diet and economy of Nigeria can not be overemphasized. Fish is known to be important for food, provision of livestock feed, raw material for industries, trade commodities, ornamental and medical purposes, in addition to its employment opportunities [2]. The availability and consumption of fish in Nigeria is of great importance as a source of protein of animal origin which is in short supply. Fish represents at least 55% of protein period intake sources of Nigeria citizens because of its richness in essential amino-acid [1].

Traditionally, harnessing water environment for fisheries production has mostly involved fishing of natural stocks in water bodies such as seas, oceans, lakes, rivers, reservoirs, streams, floodplains amongst others[6]. Both fresh water and salt water fishes are raised commercially throughout the world today. Fish culture, the practice of growing fish under controlled conditions is not a new concept. The Japanese, Chinese, Romans, Egyptians and Mayan Indians of South America farmed fish for food and recreation prior to 2000BC. They constructed ponds and raised fish much as fishes are raised today[8].

According to Anibeze[9], fish culture was the beginning of man's effort to culture his desired fish species. It is cheaper and more reliable method of

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producing fish. It utilizes vast available untapped land and water resources. It converts to useful purpose land otherwise not suitable for any other form of agriculture. Examples include swamps and burrow pits. It reduces pressure on fishing in natural waters. It restocks natural water bodies with fingerlings and helps generate more employment.

Chakroff[10] enumerated other advantages of fish culture to include:

(a) building a fish pond close to the home is more convenient than going to the nearest market or river; (b) it is easier to get fish out of the pond than it is to catch a fish from river or stream. Also, the number of fish taken out of the pond can be controlled. But it is difficult to know how many fish can be caught from a river or stream or lake at any time; (c) fish growth can be controlled in the pond. The fish can be fed extra food to make them better for market, natural enemies can be kept from killing the fish; (d) the only fish grown in the pond are the ones the farmer wants to grow. When he gets a fish out of his pond, he knows what kind or kinds he will be getting. When he catches a fish in the lake, stream, or river, many of the fishes will not be the ones that are good to eat or sell; (e) growing fish in pond allows the fish farmer to produce fish cheaply. The so called "fresh fish" in the market are usually expensive; and (f) capture fish is more likely to contain high amount of pesticides. Fish raised in ponds are healthier and free of diseases and without additional harmful toxicants.

Despite these advantages of fish culture, it has been observed that its contribution to the total annual fish production in Nigeria has not been impressive. This may however be due to some limiting factors as identified by Ajieh and Igbokwe,[7]. The Federal Department of Fisheries reports on fish production in Nigeria showed that there was no appreciable increase in the percentage contribution of aquaculture to the total annual fish production between 1998 and 2003. As can be seen from entries in Table 1, the percentage contribution of aquaculture stagnated between 2001 and 2003. This situation demands that urgent attention should be given to the development of culture fisheries by the government, policy makers and stakeholders in fish production if the increased demand for fish by Nigerians is to be met. Also, the general decline in the yield of marine and fresh water capture fisheries due largely to over fishing and pollution of natural water bodies due to industrialization by oil industries and others makes the development of culture fisheries in Nigeria a step in the right direction.

As part of efforts to encourage culture fisheries in Nigeria, the fishery research institutions have developed and distributed various fishery production technologies. The adoption of these technologies is assumed will boost fish production, improve self sufficiency in fish production and contribute to national food security[5]. In Edo State, the Agricultural Development Programme (ADP) through its fishery sub-programme has been involved in the dissemination of these fishery production technologies to fish farmers in the state over a decade ago. The level of adoption of these fishery technologies among the fish farmers has however not been examined. It is in the light of this that this study was conceived to:

(i) ascertain the fish farmers' level of awareness of fishery technologies; (ii) ascertain the level of adoption of fishery technologies by the fish farmers; and (iii) identify the constraints to adoption of fishery technologies by the fish farmers.

Methodology: Fish farmers in Akoko-Edo LGA of Edo State formed the population from which sample for the study was drawn. A multistage random sampling technique was used in selecting respondents for the study. The first stage involved the random selection of three out of the five clans in the LGA. The second stage involved the random selection of four village from each of the selected clans. This gave rise to 12 village involved in the study. The third stage involved the random of six fish farmers using the list provided by extension agents covering the selected villages. This sampling procedure gave rise to rise to a total of 72 respondents used in this study.

Respondents' awareness of fishery technologies was measured by providing a list of fishery technologies and then requesting the respondents to indicate those that they were aware of. The percentage awareness for each technology was then computed. For the purpose of the study, level of awareness was categorized into three, namely; low awareness(for technologies which had 0-39%); moderate awareness (for technologies which had 40-69), and high awareness (for technologies which had 70-100%).

Adoption of fishery technologies was measured by asking respondents to indicate the technologies they had adopted from a list of fishery production technologies. The percentage of adopters for each technology was computed and converted into adoption scores using the sigma method of scoring as used by Agbamu[4]. The method standardizes ordinary numbers or percentage through values known as sigma distance read from the statistical table of normal deviates. Usually, a constant 2 is used to increase the magnitude of the sigma distance. For instance, if 35 percent of fish farmers adopted a particular fishery technology, the

adoption score is calculated as follows: 100-35/2 = 82. Using the statistical table of normal deviates, 82 in the vertical row under 5 gives 0.95. A constant 2 is then used to increase the magnitude of this sigma distance as follows: (0.935 + 2) 2 = 5.87. Since the sigma method of scoring assigns weight in reverse relation on a 10 point scale, the actual adoption score, will be 10-5.87 = 4.13. For the purpose of the study, adoption level was categorized into three, namely: low adoption (for technologies whose adoption scores fell between 0-4.90); moderate adoption (for those technologies whose adoption fell scores between 5.0-6.90); and high adoption (for those technologies whose adoption scores fell between 7-10).

Constraints to adoption were measured by requesting respondents to rate the seriousness of possible constraints to adoption of fishery technologies along a 3-point, Likert-type scale as follows: not serious = 1; serious = 2; and very serious = 3 as used by Ajieh and Igbokwe[7]. The mean value of the response options which is 1.5 was then used as the cut-off point. Thus, constraints with mean value of 1.50 and above were regarded as serious constraints, while those with mean values below 1.50 were regarded as less serious constraints.

RESULTS AND DISCUSSION

Socio-economic Characteristic of Respondents: Entries in Table 1 reveal that the age of respondents ranged from 21 to 70 years. Results further show that 15.3% of the respondents were within the age brackets of 21 to 30 years, while 61.1% were within the age bracket of 31 to 50 years. The remaining 23.6% of the respondents fell within the age bracket of 50 and 70 years. The mean age of the respondents was 41.13years. This suggests that they are in their active age and can therefore cope with the activities involved in fish farming.

Data in Table 2 further show that 81.6% of the respondents had formal education, while 19.4% had no formal education. This indicates that the fish farmers are educated. Information on farming experience, revealed that 70.8% of the respondents had 1 to 10years experience, while 26% had 11 to 24 years experience. Data on respondents' annual income show that 83.3% of the respondents earn between N21,000 and N120,000, while 16.7% of the respondents earn between N121,000 and N220,000 annually. The mean annual income of respondents was found to be N77,583. This suggests that fish farmers in the area are operating at a small-scale level. The mean number of ponds owed by a farmer was found to be 2.8.

Respondents' Awareness of Fishery Technologies: Entries in Table 3 show the percentage distribution of respondents according to their awareness of fishery technologies. Results of the analysis reveal that respondents had low awareness in 7 technologies, moderate awareness in 7 technologies and high awareness in 4 technologies. The mean awareness percentage of the respondents was 52.50%. This indicates that the respondents' awareness regarding fishery technologies was generally moderate. This level of awareness is sufficient to engender adoption of technologies.

The technologies that respondents had moderate and high awareness include: use of concrete pond (49%); polyculture (85%); stocking density (82%); fingerlings handling techniques (56%) pond liming ((59%); pond fertilization (64%) weed control measures (60%) feed formulation (53%) checking pond pollution (64%) use of water pump for harvesting (76%) and checking pond temperature (73%).

A close look at the awareness percentage of the various fishery technologies reveals that respondents had moderate and high awareness in most of the pond stocking and pond management technologies, while there was a general low awareness in the breeding technologies. This suggests that more awareness could have been created among the fish farmers in stocking and pond management technologies which the farmers need for the day-to-day farm operations. Breeding technologies are better handled by fishery experts. It was therefore possible that much awareness was not created in the breeding technologies

Respondents' Adoption of Fishery Technologies: Entries in Table 4 show the percentage of adopters and adoption scores for the eighteen fishery technologies investigated by the study. Results of the analysis reveal that respondents had low adoption in 6 technologies and moderate adoption in twelve technologies. The mean adoption score for the respondents was 4.81 This indicates that there was a general low adoption of fishery technologies by the fish farmers.

The technologies that respondents had moderate adoption include: use of concrete pond (5.93); polyculture (5.96); fingerlings handling techniques (5.42); pond liming (5.81); pond fertilization (5.89) weed control (5.77); feed formulation (5.84); diseases control measures (5.53); checking pond pollution (5.77); use of water pump for harvesting (5.91); checking pond temperature (5.94) and checking nutrient availability (5.45).

Table 1: Fish production in Nigeria (1998-2003) in metric tons

Year	Total fish Production	Coastal/brackfish water	Inland water	Aquaculture	Aquaculture as % of total production
1998	483,482	219,073	213,996	20,755	4.30
1999	479,663	239,228	187,558	21,738	4.53
2000	467,098	236,801	181,268	25,920	5.50
2001	474,077	209,183	181,000	47,000	9.90
2002	504,371	218,496	195,000	50,000	9.90
2003	524,706	229,107	201,700	52,000	9.90

Source: Federal Office of Statistics (2004)

Table 2: Distribution of respondents according to their socioeconomic characteristics

Socioeconomic characteristic	Frequency	Percentage	mean
Age (in years)			
21 – 30	11	15.3	41.3
31 – 40	28	38.9	
41 – 50	16	22.2	
51 – 60	15	20.8	
61 – 70	2	2.8	
Educational status			
No. formal education	14	19.4	
Primary education	10	13.9	
Secondary education	11	15.3	
ND/NCE	29	40.3	
B.Sc/HND	5	4.2	
Higher Degree	3	4.2	
Farming experience (in years)			
1 – 5	22	30.5	
6 – 10	29	40.3	
11 – 15	17	23.6	8.3
16 – 20	2	2.8	
21 – 25	2	2.8	
Number of ponds owned			
1	6	8.3	
2	23	31.9	
3	24	33.3	
4	14	19.4	
5	5	6.9	
Annual income (Naira)			
21, 000 – 70,000	24	33.33	
71, 000 – 120, 0000	36	50.0	77,583

121,000 – 170,000	11	15.3	
171,000 – 220,000	1	1.4	

Table 3: Distribution of respondents according to their level of awareness of fishery technologies (n =72)

Fishery technologies	Frequency	Percentage	Remarks
Pond Construction Technologies			
(1) Use of concrete pond	35	49	Moderate awareness
(2) Sealing pond bottom	24	33	Low awareness
(3) Use of situation tank	21	29	Low awareness
Pond Stocking Technologies			
(4) Monoculture	27	38	Low awareness
(5) Polyculture	61	85	High awareness
(6) Stocking density	59	82	High awareness
Breeding Technologies			
(7) Hormone injection	19	26	Low awareness
(8) Eggs and fries handling techniques	26	32	Low awareness
(9) Fingerlings handling technique	40	56	Moderate awareness
Pond Management Technologies			
(10) Pond liming	42	59	Moderate awareness
(11) Pond fertilization	46	64	Moderate awareness
(12) Weed control	23	60	Moderate awareness
(13) Feed formulation	38	53	Moderate awareness
(14) Diseases control measures	27	38	Low awareness
(15) Checking pond pollution	46	64	Moderate awareness
(16) Use of water pump for harvesting	55	76	High awareness
(17) Checking pond temperature	52	73	High awareness
(18) Checking nutrient availability	20	28	Low awareness
Mean awareness percentage =		52.50	(Moderate awareness)

Table 4: percentage of adopters and adoption scores for fishery technologies (n = 72)

Fishery technologies	No. of adopters	Percentage of adopters	Adoption score	Remarks
Pond Construction Technologies				
(1) Use of concrete pond	68	94.4	5.93	Moderate adoption
(2) Sealing pond bottom	33	45.8	4.50	Low adoption
(3) Use of siltation tank	18	25.0	4.85	Low adoption
Pond Stocking Technologies				
(4) Monoculture	10	13.8	4.51	Low adoption
(5) Polyculture	70	97.2	5.96	Moderate adoption
(6) Stocking density	16	22.2	4.87	Low adoption
Breeding Technologies				
(7) Hormone injection	18	25.0	4.85	Low adoption
(8) Eggs and fries handling techniques	19	26.4	4.88	Low adoption
(9) Fingerlings handling technique	40	56.0	5.42	Moderate adoption

Pond Management Technologies				
(10) Pond liming	61	84.7	5.81	Moderate adoption
(11) Pond fertilization	66	91.6	5.89	Moderate adoption
(12) Weed control	59	81.9	5.77	Moderate adoption
(13) Feed formulation	63	87.5	5.84	Moderate adoption
(14) Diseases control measures	46	63.9	5.53	Moderate adoption
(15) Checking pond pollution	59	81.9	5.77	Moderate adoption
(16) Use of water pump for harvesting	67	93.1	5.91	Moderate adoption
(17) Checking pond temperature	69	95.8	5.94	Moderate adoption
(18) Checking nutrient availability	42	58.3	5.45	Moderate adoption
		Mean adoption score =	4.81	(Low adoption)

Table 5: Mean scores of constraints to adoption of fishery technologies (n=72)

Constraints		Means Scores
1.	Lack of capital	1.84*
2.	High cost of procuring fingerlings	1.94*
3.	High cost of fishery technologies	2.02*
4.	Fishery poaching/theft	0.81
5.	High cost of feeds	2.10*
6.	Poor income from fish	0.73
7.	Inadequate water supply	1.54*
8.	Pond Pollution	0.67
9.	Lack of credit facilities	1.93*
10.	Poor extension contact	0.85
11.	Inadequate fishery information	1.96*
12.	Lack of preservation techniques	0.62
13.	Perceived risk and uncertainties	0.84
14.	Complexity of fishery technologies	1.63*
15.	Inadequate land space	1.67*

Key: * = Serious constraints

Expectedly polyculture had the highest score among the technologies in which farmers had moderate adoption. This suggests that majority of the farmers use the polyculture method in stocking their ponds. Polycultre allows the rearing of different fish species in the same pond at the same time thereby making maximum use of available space in the pond. However, this practice is associated with overstocking of the fish pond. It was observed that ponds that can normally accommodate two hundred fingerlings were overstocked with as high as six hundred fingerlings.

Data in Table 5 show the mean scores of constraints to adoption of fishery technologies. Results reveal that 9 of the 15 possible constraints investigated by the study were serious constraints, while 6 were not serious. The 9 serious constraints and their mean scores include: lack of capital ($\overline{X}$ = 1.84); high cost of

procuring fingerlings ($\bar{X}$ = 1.94); high cost of fishery technologies ($\bar{X}$ = 2.02); high cost feed ($\bar{X}$ = 2.10); inadequate water supply ($\bar{X}$ = 1.54); lack of credit facilities ($\bar{X}$ = 1.93); inadequate fishery information ($\bar{X}$ = 1.96); complexity of fishery technologies ($\bar{X}$ =1.63); and inadequate land space ($\bar{X}$ = 1.96).

These constraints could be responsible for the low adoption of fishery technologies by fish farmers in the study area. For instance, inadequate land space and high cost of feeds and fingerlings could determine the size of fish farm, the number of ponds a fish farmer could own and the production level of the farm. Feeds have been estimated to account for about 60 – 80% total cost of production of fish depending on species and environment[3]. According to Ofor and Okpara[11], the realization of full potentials of aquaculture in Nigeria has been limited by expensive fish feed. Similarly, Agbamu and Orhorhoro[5] reported that inadequate fishery information and poor capital outlay could decrease the rate of technology adoption among fish farmers.

Conclusion and Recommendations: The study examined the adoption of fishery technologies among fish farmers in Akoko-Edo LGA of Edo State, Nigeria. Result show a moderate awareness of fishery technologies among fish farmers in the study area. Also, a general low adoption of fishery technologies was found by the study. The low adoption of technologies among the fish farmers could be attributed to the serious constraints to adoption identified by the study. These include: lack of capital, high cost of procuring fingerlings, high cost of fishery technologies; high cost of feed; inadequate water supply; lack of credit facilities; inadequate land space; and inadequate fishery information.

Based on the findings of the study, it recommends that more awareness should be created among the fish farmers by the Edo State Agricultural Development Programme (EDADP) especially in those technologies in which farmers' awareness level was low. Also, the cost of feeds and fingerlings should be subsidized by the government to make them affordable to the fish farmers. Farm credit should be made available to the farmers to raise their capital base such that they can have the financial capacity to adopt and implement fishery technologies.

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