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Status of Climate Smart Aquaculture Practices in Ilorin West Local Government Area of Kwara State, Nigeria

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Abstract

This study examined the status of climate smart aquaculture practices (CSAP) in Ilorin West Local Government Area of Kwara State, Nigeria. About 120 fish farmers were selected for the study. Statistical tools such as frequency count, percentage, mean score, binary logistic regression and Pearson product moment correlation were used to analyse the data. The result revealed that the average age of the respondents was 45 years and 79.2% of them were males. About 65% of them had tertiary education with an average of 6 years' experience in fish farming. The average annual income of the respondents was about 379. 25 Dollars, and the average household size was 5 persons. The result also showed that about 65% of the respondents used earthen ponds for fishing with an average of 8 fishing ponds per farmer. The most stocked species of fish was catfish (79.2%). Majority (88.3%) of the respondents owned the ponds used and about 90.8 % of them indicated that they farm on the pond all-year-round. About 87.5% of them had high status on the use of climate smart aquaculture practices. The result of binary logistic regression showed that pond type (b=1.350), source of stocked fish (b= 0.850), sources of credit (b= 0.456) and access to extension services (B=1.607) were the determinant factors of the use of CSAP. The study concludes that the main climate smart aquaculture practices used by the fish farmers were stocking of fish, liming of pond, feeding of fish, provision of measures, sorting of fish, water transparency farmers.

Keywords: Status, Climate Smart, Aquaculture Practices, Fish farming Enterprise, Climate Change, Kwara State, Nigeria.

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Introduction

Climate change refers to changes in climate brought about by anthropogenic activities and natural variations that alter the composition of the global atmosphere observed over comparable period of time (Intergovernmental Panel on Climate Change [IPCC], 2001). Climate change has become a new reality and has attracted attention in the global corridor of developmental policies and global governance (Onada and Ogunola, 2016). It is one of the biggest challenges to food security in the 21st Century (IPCC, 2014). Climate change and aquaculture seem to be interrelated in such a way that it has direct effects on aquaculture through changes in temperature and precipitation patterns which affect fish physiological processes (Tubiello and Fischer, 2007). The impact of climate change is felt in the aquaculture sector where it has significantly affected fish production. The impacts of increased flooding of the freshwater bodies has been negative through erosion of watershed, destruction of fish feeding and breeding habitats, decrease in primary productivity and alteration of the normal resilience of the aquatic systems, or positive in expansion of aquatic habitats for primary and fish productions especially during the dry season (Tubiello and Fischer, 2007). Drought incidence draws down the lakes and reservoirs (Few, Ahern, Matthies and Kovats, 2004).

Fish is an important source of nutritious and affordable food for low income people in the world (Bene *et al.,* 2015). Globally, the fisheries sector is an important source of livelihoods for people (Food and Agriculture Organization [FAO], 2018). Fisheries and aquaculture employed over 59.6 million people in the world and aquaculture production is about 362 Billion United States dollars (FAO, 2016; 2018).

Nigerians are high fish consumers as the per capital consumption is 14.9 kg per year and has the largest market for fish and fishery products in Africa (FAO, 2016; Olaoye and Oloruntoba, 2010). Fish products and foods are consumed in Nigeria because of their high protein contents and their relatively cheap prices when compared with meat (FAO, 2012).
According to the IPCC (2021) Sixth Assessment Report, the last five years (2016-2021) have been the hottest on record since 1850, the global surface temperature was 1.09 centigrade higher and human activities had resulted in widespread and rapid changes to the earth (atmosphere, cryosphere and biosphere). The major consequences of climate change include the unreliable precipitation, floods, drought, storms and Land-

slides which lead to loss of human life, decline in crop and n livestock production which had resulted in food insecurity (Goglio, *et al.,* 2018). Nigerian farmers would be severely affected as the agricultural sector is characterized by low productivity, low technology and high labour intensity (International Institute of Tropical Agriculture [IITA], 2017). The impacts of these changes are expected to increase pests and diseases for fish production, affect water supplies, adversely affect biodiversity, hence food insecurity of the populace (Goglio *et al.,* 2018).

Considering the importance of fisheries and aquaculture to food security and in order to reduce the climatic risks and threats on fish farming, it is important to develop strategy of resilience of fisheries and aquaculture sector to the effects of climate change. Also, to ensure the sector delivers sustainable benefits, it is essential to adopt Climate Smart Strategy which is obtainable in Climate Smart Aquaculture Practices (Onada and Ogunola, 2016).

Climate smart aquaculture practices are practices aimed to support food security while taking into account the need for adaptation (resilience) and the potential for mitigation (reduction of greenhouse gases emission). The approach involves the use of practices which increase resilience and stability in aquaculture thereby helping farmers adapt to climate change risk and threats (Oladele, 2015). Climate smart aquaculture practices refer to agricultural approach that sustainably increases productivity, resilience (adaptation), reduces/removes greenhouse gases emission (mitigation), and enhances achievement of national food security and development goals (FAO, 2010). Climate smart aquaculture approach serve as a guide to the needed changes of agricultural systems, given the necessity to jointly address food security and climate change (Long *et al.,* 2016). The climate smart aquaculture practices are expected to boost adaptive capacity, food security, and contribute to climate change mitigation in resource-poor smallholder fishing systems like Nigeria.

The increasing focus on the adaptation of fish farming to climate change indicates the need for CSAP which could help build resilience and see to the reduction of greenhouse gas emissions and their negative effects. The widespread changes in climatic conditions threaten food production and livelihoods of many people in agriculture. There is increased exposure of people dependent on fish production to hunger and poverty. There is need to determine the level of use of climate smart practices among the fish farmers as the adoption of potentially beneficial practices had been described to be low (Arslan *et al.*, 2013). Application of climate smart aquaculture practices could increase fish farmers' production and income, enhance resilience and mitigation to climate change. Severally studies such as the one of Onada and Ogunola, (2016) have been conducted on climate smart aqua-cultural practices. However, there is paucity of information on the status of climate smart aquaculture practices in the Ilorin West Local Government Area of Kwara State, Nigeria. Therefore, there is a need to determine the status of climate smart aquaculture practices in Ilorin West Local Government Area of Kwara State, Nigeria.

The specific Objectives were to: 1) Identify the socioeconomic characteristics of the respondents in the study area, 2) Identify the fish farming enterprise characteristics of the respondents in the study area, 3) investigate the use of climate smart aquaculture practices used by the respondents, and 4) determine the factors affecting fish farming practices in the study Area.

Hypotheses of the study:

HO_1-There is no significant relationship between some selected fish farming enterprise characteristics of the respondents and the use of climate smart aquaculture practices.

HO_2-There is no significant relationship between the factors affecting fish production and the use of climate smart aquaculture practices.

Methodology

The study was carried out in Ilorin West Local Government Area of Kwara State, Nigeria which is one of the sixteen (16) Local government Areas in the state and is one of the local government areas that constitute Ilorin Metropolis. The total respondents for the study consist of 120 fish farmers purposively selected from four communities in Ilorin West Local Government Area of Kwara State based on their proximity to the rivers and availability of fishing ponds. The selected fishing communities were Egbejila water-side = 30, Odore = 30, Obate = 30 and Ajegunle =30. The climate smart aquaculture practice was measured on a scale of *Yes* and *No* where *Yes* =1 and *No* = 0. In order to determine the respondents' status on climate smart aquaculture practices, any respondents that utilized at least 18 of the climate smart aquaculture practices (representing more than50%) is categorized as High Status while any respondent that utilized less than 18 of the climate smart aquaculture practices representing less than 50 % is categorized as Low Status. For Binary Logistic regression analysis, any respondent that utilized at least 18 (representing 50 % and above) of the climate smart aquaculture practices was assigned a qualitative value of 1 and any respondent that utilized less than 18 of the practices (representing less than 50 %) was assigned a qualitative value of 0. This same procedure was also used by Ifabiyi, Opeyemi and Banjoko (2022) in determination of Status of Climate smart small ruminant production practices in Kwara State, Nigeria. The factors affecting fish farming practices were measured using 3-point Likert type scale where Not a factor =1, Less severe = 2, Highly severe = 3. Descriptive statistics such as frequency counts, percentage and means were used to analyse the finding of the study. Inferential statistics used to test the hypotheses was Binary logistic regression and Pearson Product Moment Correlation.

Results and Discussion

Socio-economic Characteristics of the Respondents

The socio-economic characteristics of the respondents are presented in Table 1. The table showed that 79.2% of the respondents were males while the remaining 20.8% were females. This implies that fish production was dominated by males in the study area. This result is in agreement with the findings of Ifabiyi, Komolafe & Banjoko (2022) who reported that male dominated the fishing enterprise in Kwara State, Nigeria. The average age of the respondents was 45 years and this implies that the fish farmers were agile and were still within the economic active age bracket. This result is similar to the findings of Ogunlade (2007) who reported that the average of age of fish farmers was 44.6 years. Most of the respondents were married (70.8%) while about 65% of them had tertiary education. Education is expected to influence their decision to utilize climate smart aquaculture practices as Khan (1986) stated that the level of education is a factor affecting utilization of pond for fish farming.

This result is in agreement with the findings of Ogunlade (2007) who reported that the majority of backyard fish farmers had post-secondary education. In terms of religion, about 67.5% of them practiced Christianity. The average household size of the respondents was 5 person.

Most (62.5%) of them did not belong to any social group/cooperative society. The main supportive occupation was crop.

Table 1: Socio-economic Characteristics of the Respondents

Variables	Frequency	Percentage	Mean (SD)
Gender			
Male	95	79.2	
Female	25	20.8	
Age (years)			45.1(9.897)
30 and below	9	7.5	
31 – 40	39	32.5	
41 – 50	44	36.7	
51 – 60	20	16.7	
61 and above	8	6.7	
Marital Status			
Single	14	11.7	
Married	85	70.8	
Separated	7	5.8	
Widowed	8	6.7	
Divorced	6	5.0	
Educational Level			
No formal	10	8.3	
Primary	6	5.0	
Secondary	26	21.7	
Tertiary	78	65.0	
Religion affiliation			
Christianity	81	67.5	
Islam	37	30.8	
Others	2	1.7	
Household Family Size			5(2.208)
0 – 3	32	26.7	
4 – 6	60	50.0	
7 – 9	27	22.5	
10 and above	1	0.8	
Membership of social group/cooperatives			
Yes	45	Yes	45
No	75	No	75
Other supportive Occupation			
Crop farming	53	44.2	
Trading	32		
Civil servant	21	17.5	
Artisan	4	3.3	
None	10	8.3	

Source: Field Survey 2021

farming (44.2%) and trading (26.7%). This shows that farming and trading were the main supportive occupation of the fish farmers in the study area.

The Enterprise Characteristics of the Respondents

The results in Table 2 showed that respondents had 6 years as the average years of experience in fish farming. This indicated that they had some meaningful years of experience in fish production activities. The average annual income of the respondents was ₦291,725.00. This result indicated that fish farming is a profitable venture that several unemployed youths can go into.

The result in table 2 also showed that 65% of the respondents used earthen pond for fishing activities implying that earthen pond was the dominant in the study area. The average number of ponds for fish farming was 8-ponds with an average stocking capacity of 38,500.00 fishes. Furthermore, the main sources of water for fish farming was rivers (75%). The choice of water used may be associated with use of earthen pond along the river banks in the study area. The most reared fish species in the study area was catfish (79.2%).

This result confirmed that catfish was the most reared fish in the study area. Majority (88.3%) of the respondents owned the ponds used for fishing operation while 90.8% of them operated the pond all-year-round.

This implies that fish farming is a viable enterprise that could serve as a source of livelihood. The main source of credit was through personal savings (52.5%). The majority (62.5%) of respondents had access to extension services on fish farming and it a reflection that extension service coverage on fish production was high in the study area.

Table 2: Enterprise Characteristics of the Respondents

Variables	Frequency	Percentage	Mean (SD)
Annual Income from fish farming			291,725.00 (239776.365)
100,000 and below	25	20.8	
100,001 - 300,000	59	49.2	
300,001 – 600,000	23	19.2	
600,001 and above	13	10.8	
Years of Experience in Fish farming			5.9(3.002)
1 – 3	25	20.8	
4 – 6	57	47.5	
7 – 9	19	15.8	
10 and above	19	15.8	
Type of Pond used for fish farming			
Earthen pond	78	65.0	
Concrete pond	21	16.7	
Plastic pond	11	9.2	
Tarpaulin	10	8.3	
Number of fish pond used for fish farming			7.9(4.113)
1 – 5	39	32.5	
6 – 10	58	48.3	
11 – 15	19	15.8	
Above 15	4	3.3	
Total number of Stocked fish in pond			38,500.00 (63287.791)
10,000 and below	38	31.7	
10,001 – 50,000	55	45.8	
50,001 – 100,000	24	20.0	
Above 10,000	3	2.5	
Main Sources of water for fish farming			
Borehole	16	13.3	
Rivers	90	75.0	
Wells	4	3.3	
Rainfall	1	0.8	
Pipe Borne water	6	5.0	
Others	2	1.7	
Size of fish at the stocking stage			
Juveniles	38	31.7	
Fingerlings	68	56.7	
Fray	13	11.7	
Main Source of the stocked Fish			
Breeding farm	89	74.2	
Fingerlings/frays vendor	14	11.7	

Open fish market	10	8.3	
Ministry of Agriculture	7	5.8	
Species of Fish stocked			
Cat fish	95	79.2	
Tilapia	6	5.0	
Cat fish and Tilapia fish	18	15.0	
Other	1	0.8	
Pond ownership type			
Owned the pond	106	88.3	
Lease/rent the pond	14	11.7	
Pond operating period			
Raining season	11	9.2	
All year round	109	90.8	
Sources of credits			
Personal Savings	63	52.5	
Family/neighbor	19	15.8	
Friends	8	6.7	
Cooperative society	20	16.7	
Bank	10	8.3	
Access to Extension Services on fish farming			
Yes	75	62.5	
No	45	37.5	

Source: Field Survey 2021

Climate Smart Aquaculture Practices

The results of climate smart aquaculture practices (Table 3) showed that pond construction was practiced by 94.2% of the respondents, stocking of fish (96.7%), liming of pond (93.3%), feeding of fish (98.3%), provision of medication/health care (98.3%), predators prevention measures (95.8%), sorting of fish (97.5%), water transparency check (96.7%), water PH check (acidic/alkanity) (92.5%), feeding high quality feeds (91.7%), and use of feed additives (anti-biotics, enzymes) (95.0%).

This could be due to the fact that fish farming requires technical knowledge and majority of the farmers were educated enough to perform the various tasks. According to Olorunfemi, *et al.*, (2019), increase in agricultural production can occur by incorporating a good deal of technological, social and environmental intervention known as climate smart agriculture practices (CSAP) by farmers in mitigating and adapting the devastating impact caused by climate change.

Table 3: Climate Smart Aquaculture Practices among the Respondents

Production Practices	**Yes**	
	Frequency	**Percentage**
Pond construction	113	94.2
Stocking of fish	116	96.7
Pond fertilization	99	82.5
Liming of pond	112	93.3
Feeding of fish	118	98.3
Provision of medication/health care	118	98.3
Predators prevention measures	115	95.8
Sorting of fish	117	97.5
Water transparency check	116	96.7
Temperature check	78	65.0
Water PH check (Acidic/Alkanity)	111	92.5
Feeding high quality feeds	110	91.7
Flooding/run-off prevention measures	77	64.2
Harvesting at maturity	111	92.5
Breeding (production of fingerlings & frays)	56	46.7
Value addition initiatives (fish processing & preservation)	53	44.2
Record keeping	94	78.3
Packaging of processed fish	54	45.0
Marketing and distribution of fish	108	90.0
Climate Change Adaptation/ Resilience Practices		
Erecting cover/shades over pond to reduce evaporation	80	66.7
Use of weather forecasting information	41	34.2
Adjusting stocking period to the time of abundance of water	49	40.8
Stocking quick maturing fish species	103	85.8
Rears more than one species	39	32.5
Use of Tarpaulin/plastic tank as pond during the dry season	47	39.2
Diversify livelihoods/supportive occupations	77	64.2
Stocking species that are tolerant to harsh weather conditions	107	89.2
Farm/pond insurance	46	38.3

Membership of association/social group/cooperative societies	42	35.0
Use of feed additives (Anti-Biotics, enzymes)	114	95.0
Green House Gas Reduction/Mitigation Practices		
Use of low carbon energy (gas or electricity) instead of charcoal or wood during fish processing	52	43.3
Avoids putting excessive fish feeds in the pond to prevent water pollution	92	76.7
Pond waste water treatment before discharging	77	64.2
Use of Aerator to improve dissolved oxygen content of pond	96	80.0

Sources: Field Survey, 2021

Status/Level of Use of Climate Smart Aquaculture Practices

The status of climate smart practices for fish farming practices among respondents as presented in Table 4 showed that majority (87.5%) of the respondents highly used the climate smart aquaculture practices for fish farming in the study area.

This indicated that majority had high status on the use of climate smart aquaculture practice. This might be due to the fact that majority of the respondents had tertiary education and had access to extension services. This further implies that fish farmers in the study area have accepted the reality of climate change and its adverse effects on fish production.

CSA practices are not only to minimize the effect of climate change, but to increase input efficiency and profits for farmers (Omerkhil *et al.*, 2020).

Table 4: Status/Level of Usage of Climate Smart Fish Farming Practices among the Respondents

Status/Level of Usage	Percentage score range of total Usage	Frequency	Percentage
Low	0 – 50.0	15	12.5
High	51.0 – 100.0	105	87.5

Sources: Field Survey, 2021

Table 4: Factors affecting Fish Farming among the Respondents

Factors	Not a factor	Less severe	High severe	Mean(SD)	Rank
Lack of start-up capital	78(65.0)	36(30.0)	6(5.0)	1.40(.586)	10th
Non-availability of high-quality breeds of fingerlings	90(75.0)	23(19.2)	7(5.8)	1.31(.577)	15th
Unavailability of machine/equipment	88(73.3)	25(20.8)	7(5.8)	1.33(.582)	14th
Insufficient water in dry season	80(66.7)	29(24.2)	11(9.2)	1.43(.657)	9th
Inadequate technical know how	79(65.8)	36(30.0)	5(4.2)	1.38(.568)	11th
Low patronage/consumption of locally farmed fish	55(45.8)	53(44.2)	12(10.0)	1.64(.658)	8th
Annual flooding of ponds	92(76.7)	20(16.7)	8(6.7)	1.30(.588)	16th
Lack of adequate information/extension services on fishery practices	85(70.8)	31(25.8)	4(3.3)	1.33(.537)	13th
Incessant occurrence of drought during dry season	86(71.7)	25(20.8)	9(7.5)	1.36(.619)	12th
High cost of pond construction	17(14.2)	29(24.2)	74(61.7)	2.48(.733)	2nd
Heft	16(13.3)	81(67.5)	23(19.2)	2.06(.569)	3rd
Predators problem	17(14.2)	89(74.2)	14(11.7)	1.98(.510)	6th
Marketing problem	14(11.7)	85(70.8)	21(17.5)	2.06(.539)	4th
High cost of feeds	11(9.2)	25(20.8)	84(70.0)	2.61(.652)	1st
Fish disease outbreak	8(6.7)	98(81.7)	14(11.7)	2.05(.427)	5th
High mortality rate	16(13.3)	96(80.0)	8(6.7)	1.93(.444)	7th

Sources: Field Survey, 2021

Factors affecting Fish Farming among the Respondents

The factors affecting fish production is presented in Table 4. The result revealed that high cost of feeds (mean =2.61) was ranked first, high cost of pond construction (mean = 2.48) ranked second and theft (mean

= 2.06) was ranked third. This finding implies that high cost of feeds, high cost of pond construction and theft were the main factors affecting fish production in the study area. This is in agreement with the findings of Oppong *et al.,* (2021) and Onada and Ogunola, (2016) who reported that no proper training/education, lack of governmental support, lack of finance, lack of climate information, limited availability of inputs, land tenure insecurity and non-availability of extension field officers were the main challenges farmers.

Test of Hypotheses

Hypothesis 1: There is no significant relationship between some selected fish farming enterprises characteristics of respondents and climate smart fish farming practices.

The result of binary logistic regression in Table 5 showed the relationship between socio-economic characteristics of respondents and the use of climate smart practices. The table showed that type of fish pond used (b =1.350), source of stocked fish (b = 0.850), sources of credit (b = 0.456), and access to extension (b =1.607) had positive significant ($p \leq 0.05$) relationship with the use of climate smart aquaculture practices among respondents.

This implies that an increase in the level of participation in religion affiliation, choice of type of fish pond used and the source of stocked fish including access to sources of credit and extension services for fish farming are expected to increase the use of climate smart aquaculture practices among respondents in the study area.

These findings corroborate report by Adeagbo, Ojo, & Adetoro (2021) who found that climate information, access to credit, and access to extension were factors influencing the adoption of climate smart strategies among the farmers.

Table 5: Binary Logistic Regression of the relationship between some selected Fish Farming Enterprise Characteristics of Respondents and the Use of Climate Smart Aquaculture Practices

Variables	**b**	**S.E.**	**Wald**	**Sig.**	**Exp(b)**	**95% C.I. for Exp(b)**	
						Lower	**Upper**
Type of fish pond	1.350	0.535	6.361	**0.012***	3.857	1.351	11.013
Number of fish pond	-0.078	0.107	0.535	0.465	0.925	0.750	1.141
Number of stocked fish	0.000	0.000	0.083	0.774	1.000	1.000	1.000
Main source of water	-0.118	0.324	0.132	0.716	0.889	0.471	1.677
Size of fish	0.098	0.414	0.056	0.813	1.103	0.490	2.484
Source of stocked fish	0.850	0.421	4.075	**0.044***	2.340	1.025	5.344
Species stocked	-0.131	0.445	0.086	0.769	0.877	0.367	2.099
Ownership of pond	0.819	0.825	0.986	0.321	2.269	0.450	11.434
Period of operation	2.177	1.280	2.893	0.089	8.820	0.718	108.372
Sources of credit	0.456	0.232	3.841	**0.050***	1.577	1.000	2.487
Access to extension	1.607	0.822	3.822	**0.041***	4.985	0.996	24.959
Constant	-11.058	4.620	5.728	0.017	0.000		

*Significant at $p \leq 0.05$

Hypothesis 2: There is no significant relationship between Factors Affecting Fish Farming and Climate Smart Aquaculture Practices As indicated in Table 6, the results of PPMC analysis showing the relationship between constraint factors to fish production and the usage of climate smart aquaculture practices indicated (r=0.496) at $p \leq 0.01$ level of significance. This result implies that factors affecting fish farming has influence on the use of climate smart aquaculture practices among the respondents in the study area. The results further imply that the factors affecting fish farming would enhance the use of climate smart climate smart aquaculture practices. This result is in agreement with the findings of Oppong *et al.,* (2021) who reported that factors affecting farming activities were positively associated with the adaptation of CSA practices in Ghana.

Table 6: Result of PPMC analysis between the Factors affecting fish farming and the Climate Smart Climate Aquaculture Practices

Variables	**R Value**	**P Value**	**Remarks**
Factors affecting Fish Farming and Use of Climate Smart Aquaculture	0.496*	0.000	Significant

* Correlation is significant at the 0.01 level (2-tailed).

Conclusion

The study concludes that there is high level of use of climate smart aquaculture practices among the fish farmers in the study area. High cost of feeds, high cost of pond construction and theft were the main factors limiting fish farming in the study area. The determinants factors of the use of climate smart practices are type of fish pond used, source of stocked fish, sources of credit and access to extension.

Recommendations

The following recommendations were made based on the findings of the study;

1. There is need for government to continue to create awareness on effects of climate change to the fish farmers.
2. There is need for the extension service to provide information on climate smart aquaculture practices to the fish farmers with low level of usage of the climate smart practices.
3. There should be provision of credit facilities to the fish farmers so as to enhance their production.

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حالة ممارسات الاستزراع المائي الذكي مناخيًا في منطقة إيلورين ويست في ولاية كوارا، نيجيريا

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المستخلص

تناولت هذه الدراسة حالة ممارسات الاستزراع المائي الذكي مناخيًا في منطقة إيلورين بولاية كوارا في نيجيريا. تم اختيار حوالي 120 مزرعة سمكية للدراسة. تم استخدام الأدوات الإحصائية مثل عدد التكرار والنسبة المئوية ومتوسط الدرجة والانحدار الثنائي والارتباط اللحظي لتحليل البيانات. وأظهرت النتائج أن متوسط عمر المزارعين (اصحاب المزارع المدروسة) 45 سنة، 79.2٪ منهم ذكور. حوالي 65٪ منهم حصلوا على تعليم جامعي بمتوسط 6 سنوات خبرة في تربية الأسماك. كان متوسط الدخل السنوي للمزارعين حوالي 725.00،291 نيرة (عملة نقدية نايجيرية) وكان متوسط حجم الأسرة 5 أفراد. كما أظهرت النتائج أن حوالي 65٪ من المبحوثين استخدموا الأحواض الترابية للصيد بمعدل 8 أحواض صيد لكل مزارع. وكان السلور او القرموط أكثر أنواع الأسماك مخزونا (79.2٪). غالبية المبحوثين (88.3٪) يمتلكون الأحواض المستخدمة ونحو 90.8٪ أفادوا أنهم يزرعون البرك على مدار العام. وحوالي 87.5٪ منهم يتمتعون بمكانة عالية في استخدام ممارسات الاستزراع المائي الذكية مناخيا. أظهرت نتيجة الانحدار الثنائي أن نوع الحوض (b = 1.350) ، ومصدر الأسماك المخزونة (b = 0.850) ، ومصادر الائتمان (b = 0.456) والوصول إلى خدمات الإرشاد (B = 1.607) كانت من العوامل المحددة لاستخدام الاستزراع المائي الذكي مناخيًا. وخلصت الدراسة إلى أن أهم ممارسات الاستزراع المائي الذكي مناخيًا المستخدمة من قبل مزارعي الأسماك كانت تخزين الأسماك، وتجبير الأحواض وتغذية الأسماك وتوفير الإجراءات وفرز الأسماك وشفافية المياه للمزارعين.

الكلمات المفتاحية: الحالة، ممارسات تربية الأحياء المائية الذكية مناخياً، مشروع تربية الأسماك، تغير المناخ، ولاية كوارا، نيجيريا.

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