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Research Article

Impact Assessment of Capture Fishery Production on the Household Income around Gilgel Gibe Reservoir I of Oromia National Regional State, Ethiopia

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Article Info

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Abstract

This research was conducted to investigate the determinants and impact of participating in fishery production activities on households' income around Gilgel Gibe Reservoir I in Ethiopia. The studied districts were selected using purposive sam pling techniques.The two stage sampling technique was used to s elect 167 target respondents. The primary data were collected usi ng an interview schedule, conducting focus group discussions, an d key informant interviews. The logit model was employed to ide ntify the determinants of participation in the fishery production a ctivities while propensity score matching techniques were used to quantify the impact. The result of the Logit model shows that five variables (education level of household head, access to extension services, access to credit services, having secondary occupation and annual income level of household head) have a strong significant effect on the variable of interest at 1% and 5% significance level. The impact of participation in fishery production and its` technological intervention were quanti fied using propensity scorematching. The Propensity score matching result revealed th at involvement in fishery production activities had a significant e ffect (18410 ETB) on household income at 1% significance level. Major constraints of participation in fishery production and its 'technology usage like illegal fishing, poor extension contact, Lack of fishing equipment and training for fishing communities, catchment degradation and inadequate storage facilities were identified in the study area

Keywords: Fishery contribution, determinants, intervention, and participation

Introduction

In the developing world, there are a large number of populations who are farmers and considered as a main source of labor employment (Carruth, 2007. Among African leaders (in Mozambique and Maputo) it was indicated that agriculture was considered as a sector to reduce poverty and they agreed to increase spending on agriculture up to 10% of the national budget.

Ethiopia has an area of 1,127,127 km^2, and its water bodies cover approximately 7400 km^2. Gilgel Gibe Reservoir I am located in the Oromia regional state, Jimma Zone about 260 km South West of Addis Ababa and 60 km North-East of Jimma town. The area coverage of the reservoir is 62 km^2.This reservoir has huge fish potential and is well known in Barbus intermediary, Oreochromis niloticus and Labeo barbus fish species. To promote fishery production as an alternative source of income generation, by realizing the reservoir`s fishery production potential, the government and non-government organizations have been disseminated different fishing equipment in this area. However, the contribution of fisheries to household`s livelihood to the market has not been assessed in this area. Therefore, this study will assess the households' income contribution as a result of participation in fishery production. [5-9]

Objectives of the study

I. To identify the determinants that drive households to fisheries production in the study area

II. To analyze the economic contribution of fishery production to the fishers communities around Gilgel Gibe Reservoir I

III. To identify the major challenges of the fishing communities in a selected water body

Research Methodology

Description of the study area

Gilgel gibe reservoir I is enclosed with four Woredas namely Sekoru, Omo Nada, Kersa and Nadhigibe and it has been operational since February 2004. It was created by impounding the water of the Gilgel-Gibe River for the production of hydroelectric power in south-western Ethiopia. Study approved by the Institutional Ethics committee, and written consent collected from the participants.

Sampling technique

Three-stage sampling procedures were used for the selection of sample household heads. In the first stage, representative capture fishery potential districts namely Sokoru, Nadhigibe, Qarsa and Omonada were selected purposively from the around Gilgelgibe Reservoir I. In the second stage, two kebeles were selected purposively from each selected district. In the last stage, by stratifying the households into users and non-users of capture fishery technologies in the area, 167 sample household heads` were selected purposively.

Cochran [7] formulas have been used to determine sample size.

$$n = \frac{Z^2 * (p)(q)}{d^2} \text{--} (1)$$

n -is the sample size, Z is the standard normal deviation (1.81 for 93% confidence level)

p is 0.5 (The proportion of the population participating in aquaculture activities that is 50% due to unknown variability), q is 1-p = 0.5 (50%), d is desired degree of precision level, which is 0.07 in this case. Proportional sampling method has been used to select the sample from each kebeles, N – Total sample size

$$n_i = \frac{N_i\ (n)}{\sum N_i} \text{— — — — — — — — — — — — — — — — —} (2)$$

Where n_i – the sample to be selected from i`s kebele, Ni – the total population living in the selected i`s kebele, ∑ - the summation sign, ∑ Ni – the sum of the total population in the selected kebeles

Table 1: Distribution of sample selected from the selected study area

Name of District	Name of kebele	Total number of households (dis-aggregated)	Sample selected (participant/non-participant)	Proportion
Qarsa	Dogoso	1251	22(10/12)	13.17
	Siba	958	16(7/9)	9.6
Omonada	Gudata Bulaa	1180	20(9/11)	11.97
	Tuuree	1307	23(10/13)	13.77
Sokoru	Unkure	1095	19(10/9)	11.37
	Bore	1322	23(10/13)	13.77
Nadhigibe	Ayino	1180	20(8/12)	11.97
	Dachaa Gibee	1402	24(11/13)	14.37
Total		9695	167(75/92)	100%

Source: Own survey data, 2023

Types and methods of data collection

For this study, both primary and secondary data were used. The secondary data were collected from different sources. Checklists and questionnaires were prepared and employed to collect primary data from key informants, focus group discussants and fishermen.

Method of data analysis

Descriptive statistics and econometric model were used to analyse the data.

Econometric Models for determinants and impacts of fishery production on the household's income in the study area

The Probit model can be expressed in probability thus:-

$$prob(D=1)=1-F\left[-\sum_{K=1}^{K}\beta_K b\right]=F\left[\sum_{K=1}^{K}\beta_k b_k\right]=\varphi\left[\sum_{K=1}^{K}\beta_K b_K\right]$$

The equation for probability of non-event is then:- $\Pr ob(D=0)=1-\varphi\left[\sum_{K=1}^{K}\beta_K b_K\right]$

The farmer's decision to use fishery technologies depends on the criterion function:-

$D^*=\gamma Z_i+U_i$, Where D_i^* is a latent variable that takes the value of 1 if the farmer uses fishery technology or post-harvest technologies and zero otherwise, Z is a vector of household characteristics and γ is a vector of parameters and U is Standard Normally Distributed Error Term.

In practice, D_i^* is unobservable. Its counterpart is D_i,which is defined by;- $D_i=1 if\ D_i^*>0$,(Farmer I used fishery technologies, and $D_i=0$, If otherwise

In the case of normal distribution function, the model to estimate the probability of observing a farmer using an input can be stated as:-

$P(D_i=\frac{1}{X})=\varphi(X\beta)=\int_{-\alpha}^{X\beta}\frac{1}{\sqrt{2\pi}}\exp(\frac{-z^2}{z})dz$, Where, P=Probability that the ith farmer adopt technologies and 0 otherwise X=K by 1 Vector of the explanatory Variables.

Z=Standard Normal Variable (i.e $Z\sim N(0,\delta^2)$ and $\beta=K$ by 1 Vector of the Coefficients estimated.

For a non-dichotomous variable, the marginal probability is defined by the partial derivative of the probability that Di=1 with respect to that variable. For the jth explanatory variable, the marginal probability is defined by:- $\frac{\partial P}{\partial X_{ij}} = \varphi(x_{ij}\beta)\beta_j$, Where, $\varphi(.)$ =Distribution function for the standard normal random variable

β_j =Coefficient of jth explanatory Variable. The Probit moel specification in this analysis can be written as:-

$D_I^* = X_i\beta + \varepsilon_i$, $D_i = \begin{cases} 1 if\ D_i^* \geq 0 \\ 0 if\ D_i^* \leq 0 \end{cases}$ Where, D_i =Observed Dichotomous Dependent Variable takes the value of 1 if the farmer uses fishery technology and 0, otherwise. D_i^* = Underlying Latent Variable that indexes the adoption of fishery technologies. X_i =Row Vector of Values of K Regressors for the ith fishermen.

β =Vector of Parameters to be estimated, ε_i =Error term

Impact of a treatment for an individual, i noted, T_i is defined as the difference between the potential outcome in case of treatment and the potential outcome in absence of it is given by equation (1);

$T_i = Y_i(1) - Y_i(0)$ --- (1)

ATT, which measures the impact of the participation in fishery production on those individuals who participated:

$T^{ATT} = E[(T)D = 1] = E[Y(1)D = 1] - E[Y(0)D = 1]$ --- (2)

But, $E[Y(0)D = 1]$ is not observed, we do observe $E[Y(0)D = 0]$

Results and Discussion

Demographic and Socio-economic characteristics of sampled respondents

Age of household head (Age): It is one of the variables used in the analysis of the characteristics of the farm household in the study area related to the fishing activities in the area. The mean age of non-participants was 48.60 years with minimum and maximum ages of 22 and 60 years, respectively, and that of participants was 40.80 years, with minimum and maximum values of 22 and 50 years, respectively. It revealed that there is a significant difference in the age of household heads between participants and non-participants in fishing activities in the area.

Education level of Household head: The mean education level of the total household heads in the study area was 7.81 in terms of years of schooling, whereas the non-users and users of the technologies had a mean education level of 6.89 and 8.94 years of schooling, respectively (Table 3). There was a significant difference in the education level between users and non-users household heads at 1% level of significance.

Fishing Experience the respondents: The mean fishing experience of the total household heads in the study area was 7.01 years, with minimum and maximum experience of 0 and 15 years, respectively. But the mean fishing experience of the non-user was 4.3 with the minimum and maximum experience of 0 and 8 years respectively, whereas that of the users was 8.82, 1 and 15 respectively (Table 2). The mean difference in fishing practices between the non-users and users was positive and it was highly significant at 1%. This implies that the experience of the users was higher as compared to non-users of fishery technologies. Someone may assume that the fish experience of non-users would be zero, but in this particular case of study, the experience of non-users on average was different from zero because they were participating in the fishery activities some years ago, but not practicing currently.

Annual income level (AinL): This variable was analyzed as characterizing the farm households in the study area related to the participation in fishery activities. The mean annual income of the sampled households in the study area was Birr 11,250 with minimum and maximum annual income of Birr 4700 and 28000, respectively. But the mean annual income of the non-users was Birr 5300 with minimum and maximum annual income of Birr 4700 and 9000 respectively, whereas that of the users is Birr 17400, with minimum and maximum annual income of Birr 13500 and 28000 respectively.

Cultivable land size: The mean cultivable land size of the household for non-participants was found to be 2.32 ha, with the minimum and maximum cultivable land size of 0.25 ha and 5 ha, respectively, whereas that of the participant in fishery production activities is 1.92 ha, with minimum and maximum of 0.25 ha and 3.5 ha, respectively. The descriptive analysis revealed that there was a significant difference in the cultivable land size of households between participants and non-participants in fishing activities at 5% level of significance.

Table 2: Summary statistics of continuous variables included in the study

	For total observation 167				Users (use uniformly Users/participants in all tables and discussion)=75				Non-users (the same) =92				Mean dif f.
Variable	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	max	
Educ	7.8	3.50	0	13	8.94	3.11	1	13	6.89	3.5	0	13	3.9***
Age	45	15.5	22	60	40.8	12.9	22	50	48.60	16.6	22	60	
FarmS	2.14	1.1	0.25	5	1.92	1.1	0.25	3.2	2.32	1.0	0.25	5	2.36**
AInc(000)	11.25	3.95	4.7	28	17.4	5.75	135	28	5.3	1.25	4.7	9.0	5.75**
FishEx	7.10	6.4	0	15	8.82	7.6	1	15	4.3	2.4	0	8	3.1***

****** and *****,** shows significance at 5% and 1% levels of significance

Source: own computation result from survey data, 2023

Institutional characteristics of sampled respondents in the study area

Household heads` access to credit facilities (Credit): About 93.33% and 77.17% of credit-accessed households were users and non-users respectively. Household heads that obtained access to credit were 6.67% of users and 22.83% of nonusers (Table 3).

Access to extension services (Ext): For the total observation about 36.53% of households did not obtain extension services on the fishing activities. About 47.83% of the non-users and 22.67% of the users had not obtained access to extension services for fishing activities. The result of this variable indicates that fishery technology user households had obtained extension services on fishing activities more than the nonuser households.

Secondary occupation of household head (Yes/No): For the total observation about 44.31% of households did not have secondary occupation. About 76.09 % of the non-users and 5.33% of the users had not secondary occupation in the area (Table 3).

Access to training on fishery production activities (Training): The proportion of households that do not have access to aquaculture training was about 51.50 % for the total sampled households. The proportion of households that Have access to fishery training for non-users was about 51.09% whereas that of users was about 48.00.

Household head`s membership in the fishery cooperative (Yes/No Answer): In the study area, Out of 167 sample respondents, 59.88% of them said yes whereas 40.11% of them had gave No response whether they were a member of fishery cooperatives or not in the study area as a whole.

Table 3: Distribution of the categorical variables across users and non-users of technologies

		For total observation 167	Users (75)	Non-users (92)	Chi^2 value
Explanatory variables		Frequency (Proportion/%)	Frequency (Proportion/%)	Frequency (Proportion/%)	
Credit	Accessed	141 (84.43)	70 (93.33)	71(77.17)	8.2***
	No access	26 (15.57)	5 (6.67)	21 (22.83)	
MemFCoop	Yes	100(59.88)	65(86.66)	70(76.08)	0.03
	No	67(40.11)	10(13.33)	22(23.91)	
AfEq	Yes	80 (47.9)	50(66.66)	45(48.91)	5.1***
	No	87(52.09)	25(33.33)	47(51.08)	
Ext	Accessed	106 (63.47)	58 (77.33)	48 (52.17)	11.2***
	No access	61(36.53)	17 (22.67)	44 (47.83)	
OtherOc	Yes	93 (55.69)	71 (94.67)	22 (23.91)	8.8***
	No	74 (44.31)	4 (5.33)	70 (76.09)	
Training	Trained	81 (48.50)	36 (48.00)	45 (48.91)	0.01
	Not trained	86 (51.50)	39 (52.00)	47 (51.09)	

*** shows significance at 1% significance level

Livelihood activities of the sampled respondents in the study area

Crop production

Accordingly, maize (40.11%), Teff (37.72%), Sorghum (33.53%), and wheat (31.73) were the major crops that household heads produce for consumption and as a source of cash (Table 4 below).

Table 4: Type of crop produced by the selected respondents in the study area

Crop type		Frequency	Percent (%)
Maize	Yes	67	40.11
	No	100	59.89
Sorghum	Yes	56	33.53
	No	111	66.46
Teff	Yes	63	37.72
	No	104	62.27
Wheat	Yes	53	31.73
	No	114	68.26

Livestock production of the sampled respondents in the study area

Table 5: Livestock type and average number of livestock heads owned by the respondents

Livestock type	Mean	SD
Oxen	1.05	1.05
Cow	2.01	1.45
Heifer	1.9	1.18
Sheep	3.92	2.85
Horse	1.07	0.51
Poultry	7.25	3.55

Fish production and fishing frequency in the study area

In this reservoir, four fish species, namely, Barbus intermediary, Oreochromis niloticus, Labeo Barbus and Tilapia Zilli are adapted well. The fishing equipment that the producers used were: gillnets, beach scene, long line, hook line, monofilament fishing net which is imported from Abudabi and wodden boats were the main fish production equipment in the area. From this reservoir from the total of target respondents, the average fishing day's frequencies per week of individual fish producers were 4 days per week with the minimum and maximum of 2 and 6 days per week respectively.

Determinants of participation of respondents in fishery production in the study area

The probit regression model result, given in table 6, reveals that out of 10 explanatory variables included in the model, five were found to be significantly determined the participation decision of household head in the fishery production.

Household head education level (EducL): This variable is found significant at 5% significance level and positively related to household head participation decision of fishery production and its technology usage. When coming to the marginal effect of this variable, 0.0146 indicates that a unit increase in the year of schooling of household heads leads to an increase in the probability of adopting fishery technologies by 1.46%, holding other factors constant at their mean level. This finding is in line with previous findings showing that when an individual has a good formal education, it is likely that such an individual will adopt modern technologies [4].

Other income-generating activities (Yes/No): It significantly influences the participation decision of the household head in fishery production, as it was hypothesized. It was found significantly and positively related to the adoption of fishery technologies at 1% level of significance. The result of the logit model, indicates that the predicted probability of participation in fishery production increases by 34.65% for the discrete change in this variable from 0 to 1 The finding of this study is also in line with the findings of Olalekan et al., [10].

Annual income level of household head (AIncL): This variable was significant at 1% level of significance and has a positive relationship with household head participation decisions in fishery production. It indicates that as the annual income level of household heads increases by 1000 Birr, the probability of participating in fishing production activities increases by 8.14%, holding another factors constant. The findings of this study are similar to the result of [1].

Access to extension services (Ext): This variable was found significant at 5% significance level and positively related to the household heads adoption decision fishery production activities. The result of the marginal effect of this variable, 0.1805 reveals that the predicted probability of adopting fishery technologies increases by 18.05% for the farmers having access to the extension services as compared to the farmers who do not have access to the extension services. This finding is in line with the results of [11].

Household heads` access to credit facilities (Credit): This variable was significantly determining the adoption decision of the farmers in fishery production at 1% probability level. It positively influenced the adoption decision of the sample respondents in fishery production. The result of the marginal effect of this variable, 0.2301 reveals that the predicted probability of participating in fishing activities by 23.01% for the respondents having access to credit services as compared to the respondents who do not access to the credit services (Table 6 below). This finding is in line with the results of [2,3].

Table 6: Determinants of participation decision of respondents in fishery production

Variables	Coefficient	Robust Std. Err.	Z	Marginal effect
Education	0.0564**	0.0242	2.32	0.0146
FarmS	0.2207	0.3168	0.70	0.0580
AInc	0.3138***	0.1163	2.70	0.0814
FeqA	0.0631	0.0542	1.16	0.0163
FishExp	0.0004	0.0224	0.02	0.0001

Credit	0.8893***	0.3168	2.81	0.2301
Extension	0.7695**	0.3497	2.20	0.1805
OtherOc	1.4504***	0.4246	3.42	0.3465
Training	0.0923	0.2338	0.39	0.0239
Constant	-2.1056	1.0767	-1.96	
		Wald chi2 (11) = 98.96, Prob > chi^2 =0.000		
Log pseudo likelihood = -38.6000		Pseudo R^2 = 0.6640, Observation No= 167		

****** and ******* indicates significant at 5% and 1% level of significance respectively

Source: Own computation result from survey data, 2023

Impact of fishery production on the household income and estimation of common support in the study area

The impact evaluation in this particular case of study was conducted by the use of propensity (PSM) method of impact evaluation mainly because of the absence of baseline data.

The common support region for the estimated propensity score is constructed based on the summary statistics of the user and non-user. Therefore, it was determined by taking the maximum of the minimums and minimum of the maximums for the two groups' propensity scores. It was found to be between the value of propensity score of 0.2562 and 0.6267 (Table 7). As a result of the overlap condition, 19 observations were found to be out of the common support.

Table 7: Summary of common support region for the estimated propensity score

Variable		Observation	Mean	Std. Dev	Min	Max
Propensity score	Common support	148	0.4417	0.0930	0.2562	0.6267
	Non-participants	92	0.4247	0.1078	0.1621	0.6267
	Participants	75	0.4790	0.1223	0.2562	0.8182

Matching Algorithm Selection

Once the propensity scores are estimated, units in the treatment group are then matched with non-user with similar propensity scores. There are some matching algorithms that can be employed in undertaking the impact evaluation to get the effect of the treatment. The most common matching algorithms used in PSM include kernel matching, nearest-neighbor matching, and radius matching.

Table 8: Test on the propensity score matching algorithms

Matching algorithm	Mean bias	Pseudo R square	No. of matched observations	No. of balanced covariates
Nearest neighbor	5.9	0.028	148	10
Radius matching	12.5	0.071	148	10
Kernel matching	3.7	0.003	148	10

Matching Quality

Another important step in investigating the validity or performance of the PSM estimation is the verification of the overlap condition. By choosing kernel matching, we restrict ourselves to an area of common support which is defined by the bandwidth set to 0.5 of the standard deviation of the balancing score.

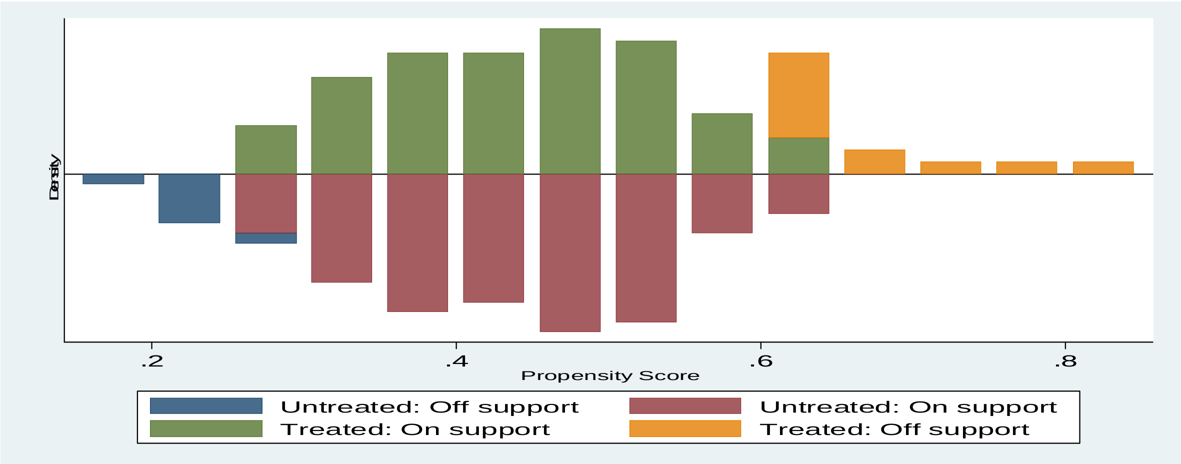

Figure 1: The distribution of estimated propensity scores and overlap between participants and nonparticipants

Checking for Balance

Once units are matched, the characteristics of the constructed treatment and comparison groups should not be significantly different. Balance is tested using a t-test to compare the means of all covariates included in the propensity score to determine if the means are statistically similar in the treatment and comparison groups.

Table 9: Test of balance of covariates after matching

Variables	Unmatched Matched	Mean Treated	Mean Control	% Bias -0.80	%reduct |bias|	t-test T	t-test P > t
AInc	U	42.240	44.60	-12.5		-0.80	0.423
	M	43.444	43.97	-3.6	71.1	-0.20	0.839
Credit access	U	0.560	0.56	-1.0		-0.07	0.947
	M	0.571	0.57	-0.7	33.1	-0.04	0.969
Education	U	8.013	7.65	10.3		0.66	0.510
	M	7.746	7.57	4.7	54.0	0.26	0.793
Extension	U	0.626	0.64	-3.0		-0.19	0.846
	M	0.650	0.63	2.5	16.9	0.14	0.888
Fishing	U	6.133	5.98	4.5		0.29	0.770
experience	M	6.095	6.08	0.2	95.1	0.01	0.990
Farm size	U	2.211	2.08	11.0		0.71	0.480
	M	2.157	2.15	0.5	95.1	0.03	0.976
Ac	U	0.613	0.59	3.2		0.20	0.840
Other activity	M	0.603	0.59	1.3	60.3	0.07	0.944
Training access	U	0.533	0.57	-8.6		-0.55	0.583
	M	0.587	0.55	6.8	20.7	0.38	0.704

Overall balance indicators of covariates

Sample	Pseudo R^2	LR chi^2	p > chi^2	Mean Bias	Median Bias
Unmatched	0.042	9.59	0.0845	10.0	10.3
Matched	0.003	0.57	1.000	3.7	3.6

Estimation of the Effect of Treatment and Interpretation of Results

The estimation of the impact of a certain technology intervention is based on the above-mentioned steps of PSM when we do not have the baseline data. Following the estimation of propensity scores, the implementation of a matching algorithm, and the achievement of balance, the intervention's impact may be estimated by averaging the differences in outcome between each treated unit and its neighbour/s from the constructed comparison group. The average treatment effect on the treated is about ETB 18,410 and it is significant at a 1% significance level. This finding is consistent with certain studies conducted on the impact of participation in fishery activities on the household`s income using PSM [3]. Therefore, participation in fishery production should be encouraged by the government and any other stakeholders.

Table 10: Impact of fishery production intervention on the household`s income

Variable	**Sample**	**Treated**	**Control**	**Differen -ce**	**Std. Error (boo tstrapped**	**T-stat**
Household income	Unmatched	61844.1	49137.5	12,706.6	4254.05	2.01
	ATT	71985.3	53575.2	18,410	4639.56	2.57***

Note: * indicates significance at 10% significance level, **ATT**: Average treatment effect on the treated
Source: Own estimation using kernel matching from survey data, 2023

Major constraints for fishery production in the study area

Table 11: Major Constraints along the Adoption of aquaculture technologies and its` practices

Constraints	Frequency	Percentage (%)	Rank
Overfishing	35	20.96	1st
Illegal fishing activities	31	18.56	2nd
Lack of access to credit & inadequate storage facilities	26	15.59	3rd
Catchment degradation of water bodies and sedimentation	23	13.77	4th
Poor extension contacts and lack of technical knowledge	19	11.4	5th

Source: Own computation from survey data, 2023

Summary and Recommendation

The study concluded that capture fishery production and its technologies usage in the selected water body are well adapted and primarily operated for home consumption and marketing purposes in the area. Adoptions of capture fishery technologies were dynamic and highly influenced by demographic, socioeconomic, environmental and institutional factors of the fishing communities which can be changed with time.

The impact of participation in fishery production and its` technological intervention was quantified using PSM. Major constraints of participation in fishery production were identified in the study area.

Recommendation

Based on the findings of this study the following recommendations have been given:

-Hiring appropriate and knowledgeable fishery professionals in each kebele, district and Zone from the start of fishing activities to the consumption of fishery products in the study area to overcome the problem of poor coordination between stakeholders.

-Establishment of an improved fingerling multiplication site in Jima zone for fishery and aquaculture development in the area

-Re- stoking of productive fish species and waiting for some months without production in the selected water bodies to overcome the problem of overfishing in the area

-Enforcement and implementation of fisheries development proclamation and policies to sustain fishery resources and to control illegal fishing activities in the study area

-Implementing area closure practices to overcome the problem of Catchment degradation of water bodies and sedimentation.

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Conflict of interest

The author has not declared any conflict of interest

References

1. Abdulhakim and Addisu, 2022. Fishers' perceptions and adaptation strategies to climate change and their determinants: The case of Koka reservoir, Ethiopia. International Journal of Fisheries and Aquatic Studies 2022; 10(2): 63-71.
2. Abdulhakim and Addisu, 2024. Determinants of adoption of fishery technologies in the Oromia national regional state . Journal of Zoological and Entomological Letters 2024; 4(1): 111-119
3. Akua S. Akuffo and Kwamena K. Quagrainie , 2019. Assessment of Household Food Security in Fish Farming Communities in Ghana, journal of Sustainability 2019, 11, 2807; doi:10.3390/su11102807
4. Amankwah A, Akuffo. Subsidies, aquaculture technology adoption, and welfare impacts in Ghana and Kenya. Open Access Dissertations; c2016. Available from: https://docs.lib.purdue.edu/open_access_dissertations/9 02.
5. Apata OM. Adoption of Fish Production Technologies in South-Western, Nigeria. Journal of Emerging Trends in Engineering and Applied Sciences. 2012;3(5):819- 822Cochran WG. Sampling Techniques. 3rd Ed. New York: John Wiley and Sons, Inc.; c1977
6. Birara E, Melese Z, Workneh Y, Zemen A. Determinants of farm households' participation in fish production in Southwest Ethiopia. Cogent Food and Agriculture 2020;6(1):1728107.
7. Cochran WG. Sampling Techniques. 3rd Ed. New York: John Wiley and Sons, Inc.; c1977
8. Dawit Garoma, Asefa Admassie, Gezahegn Ayele and Fekadu Beyene, 2014. Analysis of the Impact of Fishery Cooperatives on Fishing Activity of Rural Households Around Lake Ziway and Lagano in Ethiopia, Middle-East Journal of Scientific Research 19 (2): 144-162, 2014, DOI: 10.5829/idosi.mejsr.2014.19.2.11740
9. Neupane S, Gharti K. Status of Adoption of Improved Fish Production Technology in Rupandehi, Nepal. International Journal of Applied Sciences and Biotechnology. 2018;6(4):302-307.
10. Olaoye OJ, Ezeri GNO, Akegbejo-Samsons Y, Awotunde JM, Ojebiyi WG. Dynamics of the adoption of aquaculture technologies among fish farmers in Lagos State, Nigeria. Croatian Journal of Fisheries. 2016;74:56-70. DOI: 10.1515/cjf-2016-0012.
11. Salau E, Lawee A, Luka G, Bello. Adoption of fisheries technologies by fish farmers in southern agricultural zone of Nasarawa State, Nigeria. Journal of Agricultural Extension and Rural Development. 2014;6(11):339-346.