Middle-East Journal of Scientific Research 19 (2): 144-162, 2014
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2014.19.2.11740

Analysis of the Impact of Fishery Cooperatives on Fishing Activity of Rural Households Around Lake Ziway and Lagano in Ethiopia

[1]Dawit Garoma, [2]Asefa Admassie, [3]Gezahegn Ayele and [1]Fekadu Beyene

[1]Collage of Agriculture, School of Agricultural Economics and Agricultural Business, Haramaya University, Dire Dawa, Ethiopia
[2]Principal Researcher IFPRI, Ethiopian Economics Association, Addis Ababa, Ethiopia
[3]Capacity building, USAID, Addis Ababa, Ethiopia

Abstract: This research work was conducted to investigate the impact of fishery cooperatives on fishing activity of rural households around Lake Ziway and Lagano in Ethiopia. The studied districts were selected using purposive sampling, as they are adjacent to the two lakes. Simple random sampling was employed to select 179 fishing household with whom the survey questionnaire was administered. The respondnets were further classified into fishery cooperative member and non-member households in the proportion of 48% and 52%, respectively. The range of data collected on cooperative performance and household socioeconomic characteristics were comprised of fishery cooperatives performance, fishing materials, fish output, fish income, gender, age, fishing experience, level of education, household size, credit use, fishing expense, nature of involvement, etc. Data analysis were made using descriptive statistics, budgetary analysis and the propensity score matching. Descriptive statistics cover distribution of fishery cooperatives, institutions working with the cooperatives and fishing households, socioeconomic characteristics of the respondents examined using frequency distribution tables. The study noted, weak performance of fishery cooperatives to serve its purpose to the members. The result of budgetary analysis shows positive fish gross margin income (GMI) of ETB 3,023.40 and net fish income (NI) of ETB 1899.00 for the studied year for a given fisherman, partly because of the legal right given to cooperative members to use the lakes to harvest fish. To examine the impact of fishery cooperatives on fish income of a household, the propensity score matching method was employed. We used the propensity score estimation to balance the observed distribution of covariate across the member and non-member household. Balancing test was made after matching that ascertained absence of significant differences in covariate between members and non-members in the matched sample. Thus, the matched comparison groups were considered to be a plausible counterfactual. Accordingly, the result of impact analysis verified the significancy of fishery cooperatives on fish income of average household using the matched samples. In this regards, a household who operate under the fishery cooperatives guidance were able to earn extra income from fish catch as compared to the non-member counterpart indicating ATT of ETB4,624.70 and ETB4,585.30, taking the NNM and KBM algorithms, respectively. The results were statistically significant at 5% level. The stability of the findings was tested using Wilcoxon Signed Rank P-value and Hodges-Lehmann (HL) point estimate that confirmed absence of hidden bias due to unobserved cofounder, thus supporting the positive treatment effect of fishery cooperatives. Despite the income gain to the fishing households, there was increased pressure over the fish resources. Involvement of 'illegal fishermen' were rampant. Thus, memeber households were having an attitude to join back the non-members. Hence to convince them to work under the fishery cooperatives, massive awareness raising on the practical constribution of cooperatives and strict monitoring of the fishing efforts to administer illegal fishers, boundary setting for fish catch, scheduling the fishing dates and season, legal enforcement mechanisms, creation of an enabling ground to local institutions involvement and others were among the measures cited to promote optimal fishing pactice in the area. In this regards; detail investigation of the respective fishery cooperatives situation, consistent followup on the activities of various development partners working in the area and detail evaluation of the livelihood of the fishing community were suggested.

Key words: Lake Ziway · Lake Langano · Fishery Cooperatives · Gross margin income · ATT · PSM · Ethiopia

Corresponding Author: Dawit Garoma, Collage of Agriculture, School of Agricultural Economics and Agricultural Business, Haramaya University, Dire Dawa, Ethiopia.

INTRODUCTION

Cooperative as a business organization is owned and operated by a group of individuals for their mutual benefits. A cooperative may be owned and controlled equally by the people who use its service or by the people who work with cooperative enterprise

Policy makers and community developers are increasingly interested in alternative models for local businesses that will be both responsive to community needs as well as stimulate local economic growth. The cooperative form of business should be an obvious choice. Cooperatives have the potential to foster economic growth in the community and regional level, building on the spirit of cooperation that is already prevalent in rural areas [1].

Study held in Nigeria reflected, a farmer's cooperative to be a viable tool towards improving farmers' productivity. It noted also, farmers' participation and attitude toward farmers' cooperative can lead to increased productivity [2].

Fisheries Cooperatives are to provide employment to the fishing community through the fishing and marketing of fish. They have the mandate of preserving and developing the indigenous fish varieties and go for exotic varieties without affecting the ecological balance. They operate on a small scale and need the support of other development interventionists to go for large scale production, processing and marketing of fish and fish products. Wherever we have natural and artificial water reservoirs, we can go for fisheries cooperatives. Fisheries Cooperatives create employment, ensure food security and provide a better way for the preservation and use of precious water resources for multiple purposes [3].

Coops commonly adopt restrictions on gear and fishing seasons and impose and enforce codified penalties for violations, particularly in developing countries. Coops sometimes adopt direct limits on catch quantity or size, but these actions are fairly rare [4]. In a fishery a government regulator may control the total catch, a fishermen's coop may decide what gear will be used to harvest it and individual co-op members may decide how and where effort is deployed. In general, the incentive to manage a resource to maximize its return is strongest when the return accrues to the party who makes management decisions. Fishers who join a cooperative cede rights over how their effort will be deployed in return for benefits the cooperative can provide by taking collective actions. To a large degree these collective action benefits stem from the coop's ability to manage fishing effort in a coordinated way to achieve the group's collective goals.

It is against this background that the research sets out to examine the contribution of fishery cooperatives to its members as opposed to the non- members around lake Ziway and Lake Langano of Ethiopia. In particular, the research objectives were to examine fishery cooperative's performance, to assess the range of support made to members and to determine the impact of fishery cooperative on the income of its members as compared to the non- members.

Consequently, the findings of the research can assist in identifying the significance of fishery cooperatives and to guide policymakers and development actors in identifying priority areas of intervention to improve performance of fishery cooperatives.

We begin this paper by analysisng previousely had emprical studies on fish, thereby briefly describe methodologies employed to generate data and analyze the data. Consequently, the result and discussion part makes detail elaboration of the findings of the study that shows the significant contribution of fishery cooperatives memebership to earn better income from fishing as compared to the non-member households. Finally, the summary and conclusion session will extract on major findings of the resaerch and outline the possible policy implications for further interventions to adequately serve the fishing community.

Literature Review: Millions of people around the world depend on fisheries and aquaculture, directly or indirectly, for their livelihoods. During the past three decades, the number of fishers and aqua culturists has grown faster than the world's population and employment in the fisheries sector has grown faster than employment in traditional agriculture. The great majority of fishers and fish farmers are in developing countries, principally in Asia. Significant increases over recent decades, in particular in Asia, reflect the strong expansion of aquaculture activities [5].

There is a need to promote responsible fisheries, to increase the resilience and adaptive capacities of aquatic ecosystems, fisheries and aquaculture production systems and of aquatic resource-dependent communities. Policy, legal and implementation frameworks should be developed at national, regional and international level to address the complexities of climate change interactions and their possible scale of impacts. A challenge at policy

level remains to link the disaster risk reduction and management and climate change mitigation and adaptation into fisheries and aquaculture planning and to mainstream fisheries and aquaculture into disaster risk management planning [5].

A lack of well-defined property rights can have a variety of harmful effects on a fishery. One common repercussion is the presence of excess fishing capacity. Excess capacity arises because the incentives inherent to open-access (or restricted open-access) fisheries are different than those that would exist in a rationalized fishery [6]. If exclusive rights to harvest a particular amount of fish are not defined, an excessive number of vessels will enter a fishery- dissipating economic rents. In order to compete with other vessels for the increasingly scarce catch, fishermen will often operate increasingly large vessels, further exacerbating excess capacity in the fishery. [7] While this strategy may temporarily afford one a larger share of the catch, the collective effect is a further decrease in overall rents and may result in vessels sitting idle for much of the year [8]. It is clear that the costs of this type of regime exceed those that would prevail in a rationalized fishery. With private ownership, marginal costs are typically equated with price. In open access, however, average costs are equated with price and profits are driven to zero [9]. The broader question is whether the institutional structure is answered by the degree to which the efficiency and sustainability objectives are met across the board. As a cross check of performance result is; what is the logical basis for the rules? Are rules appearing in principle to set up incentives for users to work efficiently? Did rules are enforced effectively and in a cost effective manner? A fishery with well defined and enforced right of access is more likely to be efficient than one with poorly defined rights. Developing indicators of the impact of management induced biases in fisher behavior may provide a useful qualification to simple measures of net return. Individual transferable quota and managing by controlling some inputs are some of the tools to shape the behavior of fishers [10].

The impact of a program or policy intervention that targets a certain group of people could be measured and considered as an Average Treatment Effect (ATE). ATE is an average partial effect for a binary explanatory variable. Estimation of ATE can be done either by use of the assumption of ignorablity of the treatment by regression Methods with ignorability of Treatments using OLS, or through relying on the availability of instrumental variable (IV) named as instrumental variable estimation [11-13], in the effort to analyze the impact of cooperatives in Ethiopia has identified and elaborated the potential self-selection biases that emerge from simple comparisons of members with non-members. The study has shown how one might use the propensity-matching method to evaluate the impact of cooperatives. This careful selection and matching process ensure a relatively unbiased estimate of the true impacts of cooperatives on household commercialization behavior. A key feature of the Ethiopian context that enables such a methodology to be relevant is the fact that the cooperative establishment is not indigenous to the members themselves but is largely exogenous, in the sense that it is part of a national and therefore externally driven, plan to spread cooperatives in rural areas.

The basic idea of the PSM method is to match observations of adopters and non-adopters according. With the predicted propensity of adopting a superior technology [14].

The propensity score matching method is one of the non-parametric estimation techniques that do not depend on functional form and distributional assumptions. The method is intuitively attractive as it helps in comparing the observed outcomes of technology adopters with the outcomes of counterfactual non-adopters [15]. Using panel data, [16], applied both regression analysis and propensity score matching to evaluate the impact of PSNP on livestock and tree holding in Ethiopia. The result showed no indication that participation in PSNP induces households to disinvest in livestock or trees. Households that participated in the program increased the number of trees planted, but there was no increase in their livestock holdings. The result found no evidence that the PSNP protects livestock in times of shock. Shocks appear to lead households to disinvest in livestock, but not in trees.

Hence, the rationale to employ propensity score matching has made the researcher to employ such tool to analyze the impact of institutional supports to the performance of fishing households in the study area.

MATERIALS AND METHODS

The Study Area: This study was conducted in the communities residing in four districts around Lake Ziway and Langano in the Oromia national regional state, in Ethiopia.

Lake Ziway and Lake Langano are found in the South- eastern direction of Addis Ababa at a distance of 175km and 190 km, respectively.

Agra- climatically, the study area is classified into midland (1500 - 2500 meter above sea level) that account for 30% and lowland (500 - 1500 meter above sea level) with a proportion of 70% (CSA, 2007). Both lakes are situated in the midland agro- climatic zone. Topographically, the area is characterized by plain land features.

The two lakes are found in the Great East African Rift Valley and located between 7°51'N to 8° 57'N and 38°43'E to 38° 57'E. Lake Ziway is situated at altitude of 1636 meter above sea level having a water surface of 440km^2 with a maximum depth of 8.95meters and average depth of 2.5meters. Lake Langano is situated at altitude of 1582 meters above sea level, owning water surface of 241km^2 with a maximum depth of 47.9meters and average depth of 17meter. The salinity and conductivity level of Lake Ziway is 0.35g/l and 410 ms/cm, respectively. While, lake Langano has a salinity of 1.88g/l and conductivity of 1770ms/cm. Consequently, the annual fish potential of Lake Ziway and Langano is estimated to be 2941tons and 1000tons, respectively. The catchment area of lake Ziway and Lake Langano is 7025km^2 and 1600km^2, respectively.

The study area enjoys bi-modal rainfall. *Belg*[1] rain usually commences in March & ends in April. The rainfall received during this season is commonly used as supplementary sources of precipitation for irrigated crops and to shower grazing land and vegetation for livestock population. Meher[2] season usually takes place from June-August is considered to be the long rainy season during which major crops like cereals, pulses, oil crops and the like are cultivated. This season serve to cultivate the available farmland to grow annual crops for consumption as well as marketing.

The average annual rainfall of the area ranges from 800mm to 1100mm while the mean annual temperature varies between 11°C and 29°C.

Lake Ziway is bordered with East Shoa zone in the west and Arsi zone in the East. While, lake Langano is bordered with East Shoa zone in the North and West Arsi zone in the south. The total population of the three zones is estimated at 6,679,819 of which 23% accounts to East Shoa, 44% Arsi and 33% West Arsi zone.

The human population of the study area is 770,799. Accordingly, 22% are found in Dugda, 21% in Adami Tulu Jido Kombolcha, 39% in Arsi Negelle and 18% in the Ziway Dugda district. Population density 138persons per km^2 with an average family size of 6.01. Mixed farming of crop cultivation and livestock production constitutes the major occupation of a household, with fishing activity practiced as a source of finance to support immediate cash needs of a household. Fishing is carried out by households that reside around the two lakes.

The average land holding is 1.5 hectares per household. Due to recurrent drought, increase in population farming is reclaiming the lake compound as well as expanding to vegetation and communal land. Livelihood strategies within the basin include farming, fishing and fish trading, livestock rearing, wage labor and self employment. The fish population in Ziway and Langano lakes continually deplete partly due to farmland expansion to the lake compound, recurrent drought, overfishing due to increased number of fishers, food insecurity and other factors. The underlying factors are significantly influencing, the magnitude of marginal income derived to the fishing households in the lake basin. One of the major constraints stated by fishers was that the buyers offer very low prices while buyers complained about very high prices of fish charged by fishers. This is mainly due to information asymmetry between buyers and fishers, which is common in African small-scale fisheries (Chiwaula, 2012).

Lake Ziway basin covers three administrative districts: Dugda, Adami Tulu Jido Kombolcha and Ziway Dugda. Its catchment is bounded to the west by Dugda & Adami Tulu Jido Kombolcha districts and to the east by Ziway Dugda district. On the other hand, the lake Langano basin covers two administrative districts: Adami Tulu Jido Kombolcha and Arsi Negelle and its catchment is bounded by Adami Tulu Jido Kombolcha in the North and Arsi Negelle in the south.

A total of 38kebeles is bordering the two lakes, of which 25 are adjacent to Lake Ziway and 13 are adjacent to Lake Langano. Accordingly, 9 *kebeles* are in Dugda district, 11 *kebeles* are in Adami Tulu Jido Komkbolcha district, 10 *kebeles* are in Arsi Negelle district and 8 are found in Ziway Dugda district.

There are 20 fishery cooperatives in the study area comprises of 851 fisher members, of which 98% are male and the remaining 2% are female household. Accordingly, the distribution of coops across the studied districts shows 30% in Dugda, 30% in Adami Tulu Jido Kombolcha, 20% in Arsi Negelle and 20% in Ziway Dugda. Of the total number of households who are cooperative members, 22_% are found in Dugda, 29% in Adami Tulu Jido Kombolcha, 17% in Arsi Negelle and 31% in Ziway Dugda.

[1]Belg season represents the shorter rainy season usually from March-April in the study area.

[2]Meher season represents the longer rainy season usually from June_August in the study area.

Data Set: Purposive sampling was used to initially identify the four districts that are bordering the two lakes and having communities that involve in fishing activities. In the second stage, random sampling was used to select households from the respective district with whom detail interview was conducted.

The data for the research was obtained from a survey of 179 farm households in the four districts of the three zones that emphasis on 2011/2012 production year. The districts include Dugda, Adami Tulu Jido Kombolcha, Arsi Negelle and Ziway Dugda. The specific study sites within the districts were selected based on a multistage random sampling procedure. Accordingly, 38 Kebeles were selected from which the sample households drawn randomly proportional to population size. The sampled households were further decomposed into 86 fishing households who are cooperative members, 93 fishery households who are non- cooperative members. Hence, this particular study has considered only the fishing households to examine the impact of coops on fishing activity (income) of households.

A structured questionnaire was used to interview the households. Data collected from the households include household general characteristics, fishing participation, fishing cooperative membership status, asset holding, farmland holding, crops and livestock production, food consumption, availability of social infrastructure services and other relevant information.

In addition, secondary data relevant for this analysis was obtained from Federal Ministry, Zonal and district cooperative offices. In order to understand the research questions at community level, qualitative data were collected through focused group discussion using checklist prepared for the purpose.

Data Analysis: The tools used in this study were descriptive statistics and econometric method in institutional (cooperatives) impact analysis. The econometric analysis employs the Propensity score matching to understand to what extent can the net difference observed in outcomes between coops member and non- members attributed to institutional support, given that all other things are held constant?

Descriptive Statistics: In this regards, statistical tools such as mean, frequency, percentage and the like were considered to characterize variables used in this research,.

The Propensity Score Matching Methods: Fishermen are likely to select cooperative membership, based on the awareness, contribution of cooperative and legal enforcement mechanism (both observable and unobservable). Given this, simple comparisons of mean differences in fish income of fishermen with and without cooperative membership are likely to give biased estimates of the impacts of institutional support when observational data are used. Estimation of the effects of these supports on fish income requires a solution to the counterfactual question of how fish income would have performed had the fishermen not been subjected to cooperative membership. We used propensity score matching methods to overcome this and other econometric problems and ensure robust results.

We adopt the semi-parametric matching methods as an estimation technique to construct the counterfactual and reduce problems arising from selection biases. The main purpose of using matching is to find a group of non-cooperative members (non-treated) similar to the cooperative members (treated) in all relevant observable characteristics; the only difference is that one group is fishery cooperative member and the other does not.

The propensity score is the probability of participation rather than nonparticipation of an individual in a treatment group. In the treatment- effect literature, this predictor given observable variables is an important intermediate step, even though ultimate interest lies in outcomes of that treatment [17].

After estimating the propensity scores, the average treatment effect for the treated (ATT) can then be estimated. Several matching methods have been developed to match members with non-members of similar propensity scores. Asymptotically, all matching methods should yield the same results. However, in practice, there are tradeoffs in terms of bias and efficiency with each method [18].

The seminal explanation of the PSM method is available in [12] and its strengths and weaknesses are elaborated, for example, by [19],[15], [18] Caliendo and Kopeinig (2008) and [20].

The main purpose of the propensity score estimation is to balance the observed distribution of covariates across the treated fishermen and non-treated fishermen. The balancing test is normally required after matching to ascertain whether the differences in covariates between the two groups in the matched sample have been eliminated, in which case the matched comparison group can be considered as a plausible counterfactual [21].

Although several versions of balancing tests exist in the literature, the most widely used is the standardized mean difference between treatment and control groups

suggested by Rosenbaum and [22] in which they recommended that a standardized difference of greater than 20 percent should be considered too large and thus an indicator of failure of the matching process.

Additionally, [23] proposed a comparison of the pseudo-R^2 and the p-values of the likelihood ratio tests obtained from the largest analysis before and after matching the samples. After matching, there should be no systematic differences in the distribution of covariate between the groups. As a result, the pseudo-R^2 should be lower and the joint significance of covariate should be rejected (or the p-values of the likelihood ratio should be insignificant).

If there are unobserved variables that simultaneously affect the membership decision and the outcome variable, a selection or hidden bias problem due to unobserved variables might arise, to which matching estimators are not robust. While we controlled for many observable, we checked the sensitivity of the estimated average membership effects to hidden bias, using the Rosenbaum (2002) bounds sensitivity approach. The purpose of the sensitivity analysis is to investigate whether inferences about membership effects may be changed by unobserved variables. It is not possible to estimate the magnitude of such selection bias using observational data. Instead, the sensitivity analysis involves calculating upper and lower bounds with a Wilcoxon sign-rank test to test the null hypothesis of no-membership effect of different hypothesized values of unobserved selection bias.

To study how fishery cooperative membership affects fish income, we needed to address the potential problem of selection bias. Selection bias stems from the fact that we cannot know what the outcome for a "treated" (i.e., Cooperative membership) household will be if it does not participate in the cooperatives. If membership is randomly assigned, the outcome of non-member individuals serve as a good estimate of the counterfactual. However, if households that are cooperative members have characteristics that differ from the ones that are non- members, comparison of the outcome between the two groups will yield biased estimates. Formally, this reasoning can be summarized as follows. Our main parameter of interest was the average treatment effect on the members, which is given by:

$$ATT = E\left(Y_1 - Y_0 \middle| D = 1\right) = E\left(Y_1 \middle| D = 1\right) - E\left(Y_0 \middle| D = 1\right) \quad (1)$$

Where Y_1 is the treated outcome, Y_0 is the untreated outcome, D indicates treatment status and is equal to 1 if the individual receives treatment and 0 otherwise. The evaluation problem arises from the fact that the untreated outcome for a treated individual, $E(Y_0 \mid D = 1)$, can never be observed. Using the outcome for untreated individuals as an estimate of the counter fact will generate bias equal to:

$$b = E\left(Y_0 \middle| D = 1\right) - E\left(Y_0 \middle| D = 0\right) \quad (2)$$

If the selection is based on variables that are observable to the analyst, the problem of selection bias can be solved by controlling for these variables in a regression analysis or the propensity score matching method. However, if the selection is based on variables that are unknown to the analyst, other methods need to be applied. In the impact analysis, treatment is largely based on household structure and asset holding that are observable both to the community and to the analyst; we therefore applied propensity score matching in this paper.

To check the robustness of the effect on coop membership on fish income, we also used propensity score matching [14-15]. The advantage of using propensity score matching, compared to regression analysis, is that it is a non-parametric approach in which the functional relationship between the dependent and independent variables is not specified and in which no distributional assumptions are made for the outcome variable. Propensity score matching on observable also ensures that treated and untreated households are comparable on observable variables, something that is not guaranteed in the regression analysis. In this case, we used level of fish income, as the dependent variable. This removed the problem of selection on unobservables that affects the levels of fish income. There is, of course, still a risk that selection is based on unobservable variables that affect not only membership but also level of fish income. This is an unavoidable limitation of any type of study that is not based on experimental data.

As we assumed that selection is based on variables that are observable to the analyst, it is important to control for variables that govern eligibility to the membership. It is also important to control for other variables that affect the amount of fish income.

Propensity score matching (PSM) relies heavily on two assumptions that formally can be written as:
Assumption 1 (conditional independence)

$$Y_0 \perp D / X \quad (3)$$

Where ? indicates stochastic independence and X is a set of observable characteristics; and
Assumption 2 (common support)

$$\Pr\left(D = 1 \middle| X\right) < 1 \quad (4)$$

Assumption 1 means that, conditional on a set of observed characteristics, the untreated outcome is independent of treatment status, i.e., $E(Y_0|D=1)=E(Y_0|D=0)$. This implies that the untreated outcome can be used as an unbiased estimation of the counterfactual outcome for treated individuals, which solves the evaluation problem described in the previous section.

[14] were the first to show that matching on the probability of treatment p(x) = Pr(D=1|X), referred to as the propensity score, is valid.

Assumption 2 means that no explanatory variable is allowed to perfectly predict treatment. In order to control for time invariant unobserved heterogeneity, we followed the approach suggested by [24] and used change in Y as the outcome variable.

When estimating the propensity score, it is important that the variables used to predict the probability of treatment are unaffected by treatment, i.e., they should be measured before fishermen registration into cooperatives. The outcome is defined as the income earned from fish catch in 2011/12 production year. To apply the PSM analysis, a fisherman is considered treated if working under the cooperative membership. For the conditional independence assumption to be fulfilled, the variables included in the matching procedure needed to be correlated with both treatment and outcome. There are no general rules for what variables to include in the model. We included all the variables described in the descriptive statistics session.

There are a number of different algorithms that can be used to find one (or more) comparable untreated individual to each treated individual. In this paper, we used single nearest neighbor matching with replacement [16]. Single nearest neighbor matching has the advantage that it is straightforward and, compared to the use of multiple neighbor matching, it has lower bias, although at the expense of higher variance. Common support is imposed by dropping those treatment observations with propensity scores outside of the range of the control observations. To test how well the PSM performed, we considered two different indicators. First, we tested differences in means for each specific variable used in the logit model. Second, we performed a likelihood-ratio test of the joint insignificance of all the regressors.

RESULT AND DISCUSSION

This section presents the result and discussion of the study. Accordingly; household socio- economic characteristics were dealt using the tools of descriptive statistics. Consequently, the impact of fishery cooperatives on fish income of household were analyzed using the propensity score matching method. The section also dealt with the challenges faced by the fishing households to perform fishing activity.

Descriptive Analysis

Sample Distribution: For this study, the fishing households were drawn from four districts found around Lake Ziway and Lake Langano (Table 1). Respondents were classified asfishery cooperative member and non- members, which constitutes 48% and 52%, respectively.

Lake Ziway is accessed by 77.1% of fishing households found in the three districts namely; Dugda, Adami Tulu Jido Kombolch and Ziway Dugda. The three districts are located around Lake Ziway owning 25 peasant associations.

On the other hand, households in the Arsi Negelle district (22.9%) perform fishing using Lake Langano. Since, the highest proportion of lake Langano is situated in the Arsi Nekgelle district, only 25 households from three peasant associations of Adami Tulu Jiddo Kombolcha district were using the lake to catch fish.

In general, the fishing households were drawn from 38 peasant associations that are adjacent to the two lakes. Accordingly, 66% of peasant associations were directly connected to Lake Ziway and 34% were connected to Lake Langano.

Institutional Support: Institutions that were believed to influence the performance of fishing households in one way or the other were identified based on the survey result, which are discussed as follows.

Performance of Fishery Cooperatives: There were 20 fishery cooperatives owned by 851 members. Accordingly, the distribution of fishery cooperatives was 30% in Dugda, 30% in Adami Tulu Jido Kombolcha, 20% in Arsi Negele and 20% in Ziway Dugda.

Of the respondents, 35% have recognized fishery cooperatives support by involving in fish output collection at the landing site, awareness promotion and legal enforcement instrument to deter overfishing, to monitor fishing efforts etc[3]. In general its business performance was quite poor to attract members to uphold the cooperative service on a sustainable basis.

[3]The response of fishing households on institutional support are available from the authors upon request.

Table 1: Distribution of sampled households

Districts	Fishery coops member	Non-members	Total
Dugda	8	29	37
Adami Tulu Jido Kombolcha	28	33	61
Arsi Negelle	26	15	41
Ziway Dugda	24	16	40
Total	86	93	179
Percentage	48	52	100

Source: Computed from data of 2011/12 household survey

Table 2: Fishery cooperatives and its members

			No. of members			
No.	District	No. of fishery cooperatives	Male	Female	Total	Percentage
1	Dugda	6	189	2	191	22
2	Adami Tulu Jido Kombolcha	6	241	10	251	30
3	Arsi Negelle	4	136	8	144	17
4	Ziway Dugda	4	265	-	265	31
	Total	20	831	20	851	100

Source: The respective district level agriculture office, 2011/12

With regards to income collection from fish sales, 64% of the respondents noted the possibility of receiving cash as soon as the catch is handed to the fishery cooperatives, while 36% reported cash collection after the catch is sold to customers.

Institutional Services to the Fishing Households: Several institutions were cited to offer their respective services to the fishery cooperatives as well as fishing households. Accordingly, 24% of the respondents were getting technical support and extension service through Agriculture office. These services were coprises of training on fish resources use, fishing net distribution, natural resources conservation, fish processing etc. Trade office has been cited as a licensing and regulating organ by 12% of the respondents, while the support of fish product marketing corporations were cited only by 10% that limit its service to fish output collection. Only 2% of respondents were having knowledge of the research support.

In general, the study result showed the minimum institutional intervention in the fishing activity. Limited number of respondents were able to identify type of services provided by the respective institutions working in the area with Ziway Dugda (18%), Arsi Negelle (20%), Dugda (22%) and Adami Tullu Jido Kombolcha (39%) of the respondents.

The study noticed heterogeneity of fishing frequency among the responders. Accordingly, 44% of respondents involve in fish search on a daily basis, 31% carry out based on the schedule adopted by fishery cooperatives, 14% constrained by availability of labor to perform regularly, 12% harvest on a weekly basis and 9% handle during their slack time.

Among the respondents, 18% were delivering an executive service in the fishery cooperatives and 82% were ordinary members. As noticed, the respondents' attitude to serve at executive position were loose partly explained by practical challenges associated with fishing administration, conflict with irrigation users in the lake territory, illegal fishers who are non- members of the cooperatives who were considered to gain better income from fishing due to flexible market channels etc.

In managing conflicting interests of the various agents involve in fishing, awareness raising was cited to be the selected option by 33% of the respondents, followed by boundary setting to the fishers (33%) and scheduling of members fishing date/ season (23%). Involvement of locally recognized social institutions like youth, elders and religious group were cited by 5% of the respondent and only 3% were recognized the application of legal enforcement mechanisms.

To enrich the lake resources, respondents were involved in plantation (43%), conserving the existing natural resources and wetland (42%). Respondents also reflected, the sustainability of such interventions was demanding of regular follow up particularly from the agriculture office.

Table 3: Average costs and revenue of fishing household in the study period

Items	Mean value (ETB)
Fish output revenue	
Fish catches (KG)	647.10
Price (ETB/KG)	8.50
Gross revenue	5,500.10
Variable cost	
Labor	962.3
Fuel & lubricant	209.1
Motor boat repair & maintenance	461.4
Local boat repair & maintenance	230.1
Gillnet repair & maintenance	247.6
Fish processing sanitation	177.8
Transportation & marketing	188.2
Total variable cost	2,476.70
Gross margin	3,023.40
Fixed cost (Fishing asset depreciation)	
Motorized boat*	337.30
Local boat (reed boat)	224.90
Gill nets	188.70
Processing equipments	224.90
Refrigerators & accessories	148.70
Total fixed cost	1,124.5
Net fish income	1,899.00

Source: Computed from data of 2011/12 household survey

*Motorized boat was donated to the fishing cooperative by an NGO (Catholic church, EU through MOA)

As noted, most of the respondents (91%) were participating in the general meeting, workshops, trainings and awareness raising sessions with regard to fishing activities in the study period, which made an average of 16 days attendance in the year. The issues entertained in these sessions were diverse emphasizing on fishery cooperatives performance (53% respondents), fish catch revenue share & market access (40% of respondents), lake and fish management (17% of respondents) and executive role and responsibility share (26% respondents). It was noted, issues of generality were dominating the sessions, lacking specificity to deal on particular issues for action.

Despite the limitations observed in the fishery cooperativess, most of the respondents (78%) are still supporting to carry out fishing under the cooperatives administration and support, provided principles are strictly adhered to.

Variables Used in the Empirical Analysis

Fish Income Analysis (Gross Margin Analysis): As presented in Table 3, costs incurred by fishermen to undertake fishing were grouped as either variable or fixed costs. The variable cost items considered include the expenses of labor, fuel lubricant, repair and maintenance, fish processing sanitation and transportation, food & drink or entertainment and the like. The fixed cost items were depreciation on equipment used such as fishing boats, processing equipments, refrigerator and fishing net. Straight-line depreciation method was used. It could be noticed that the variable cost made up the bulk of the total cost of fish catch (68.8%).

This high level of the variable cost shows the association of fish output to the amount of operating costs incurred in the fishing process. In Table 3, the labor cost accounted for about 38.9% of the variable costs for the fishing household. This is followed by the expenditure on boat repair and maintenance. The variable cost is directly associated to the amount of fish caught by fishing household, thus vary with the level of output obtained.

Fish Revenue: the revenue that accrued to the individual fishing household during the survey year was calculated by multiplying their respective fish output with the market price. On the average, the selling price was ETB 8.50 per kg. Table 3 shows the average fish caught and revenue per household. The total fish caught in the study year was 115,825.3kg. Accordingly, the total revenue from the sales of fish caught was ETB 984,515.20. The study reveals that the fishing household has realized an average gross revenue of ETB 5500.10.

Gross margin and net income-the gross margin for each fisher was calculated as the difference between the gross revenue and variable costs. The average gross margin of catch by fishing household was ETB 3,023.40. The net income is the difference between the gross revenue and total costs. The average net income of fishing household was ETB 1,899.00. The result of the study revealed that fishing household gets less income from fishing taking the average family size. This could be partly explained by the lower price offered in the local market and at the landing site and less quantity of fish catch as compared to the fishery potential of the two lakes due to increased number of fishermen.

Gender Distribution of Fishing Household: The result presented in Table 4 shows that the majority (90.5%) of the respondents were male while the female constitute 9.5%. This reflects the extent of gender sensitivity on occupation (Agboola, 2011). The result might be attributed to high energy, labor demand of fishing which female fisher folks could not provide.

Table 4: Sample fishing household distribution

	Household distribution by District				
Gender composition	Dugda	Adami Tulu Jido Kombolcha	Arsi Negelle	Ziway Dugda	Total
Male	32	52	39	39	162
Female	5	9	2	1	17
Total	37	61	41	40	179
Percentage	20.7	34.1	22.9	22.3	100
Peasant Association	9	11	10	8	38
Fish shop[4]	1	1	1	0	3

Table 5: Age of fishing households

Age category (years)	Frequency	Percentage
20-29	41	22.9
30-45	106	59.2
46-60	29	16.2
>60	3	1.7
Total	179	100

Source: Computed from data of 2011/12 household survey

Table 6: Household family size and source of fishing labor

Variable	Frequency	Percentage
Family size		
Less than 5.6	135	75.3
5.6 & above	44	24.7
Total	179	100
Source of fishing labor		
Family labor	175	98
Shared Labor	4	2
Total	179	100

Source: Computed from data of 2011/12 household survey

Fishing is conducted away from home, which also demand time and energy to travel on water body to search and catch the fish. It also requires physical work to operate gears and nets and difficult to set time bound that guarantee the possibility to harvest the required quantity of fish. Uncertainty is inherent in this business largely to get the intended quantity by safely traveling on water body, as a result women involvement is limited to the fish processing service and marketing task to deliver the product to collectors and customers in the nearby market and along the highway roads. This result is also in agreement with the traditional gender pattern of fishing (Williams and Awoyomi, 1998).

Age of Fishing Households: As indicated in Table 5, most of (59.2%) the respondents were in the age of 30-45 years, while 22.9% were in the range of 20-29 years. Fishing households whose age fall between 46-60 years constitute 16.2%. The result showed the minimum participation of older households (age>60 years), which accounts for 1.7%. As the fishermen grow older, their performance drops and so does the general fish catch levels. These results are, however, in agreement with the findings of (Olomola, 1991) and (Mabawonku *et al*., 1984).

The result shows, the largest proportion of households are in the active age category (less than 45years) that account for 82.1% of the respondents. As compared to the younger group, the aged ones have a minimum tendency to stay in fishing activities. This could be partly explained by fishing activity's demand for energy and time to travel on water body to search fish, processing services and transport to the local collectors and consumers which are easily performed by the active age groups.

Family Size and Source of Fishing Labor: The average family size of fishing households was 5.6 with the minimum of 2 and maximum members of 12. Accordingly, 75.3% of fishing households were having less than the average. As presented in Table 6, family labor constitutes the highest proportion (98%) of labor sources to the fishing households. The higher percentage of family labor above hired labor indicates that most farmers operate small-scale business (Agboola, 2011).

Only 2% of the households were reported to use labor from external sources in the form of labor sharing. This arrangement was made mostly by the aged households and the female headed ones. Such arrangement requires, households to provide fishing equipments such as gillnet, hooks, reed boat and processing equipments to support fishing labor.

Consequently, the total adult equivalence (AE) of fishing households is worked out to be 33,362.85. On average, a given household has 186 AE that serve as a proxy indicator of family size.

[4]Fish shop that are owned by members of the fishery cooperatives. There were traders who collect the fish catch directly at the landing site.

Table 7: Adult equivalent of household

HH Adult equivalence	Adult equivalent	Percentage
Age less than 10 years	725.7	2
Age 10-13 years	17,038.4	51
Age greater than 13 years	15,598.75	47
Total	33,362.85	100
Observations	179	100

Source: Computed from data of 2011/12 household survey

Table 8: Education level of fishing households

Education level	Frequency	Percentage
No formal (illiterate)	25	14
Grade 1-4	141	78.7
Grade 5-8	12	6.7
Grade 9-10	1	0.6
Total	179	100

Source: Computed from data of 2011/12 household survey

As shown in Table 7, the largest proportion of AE is associated to age group of 10-13 years followed by age group above 13 years. Accordingly, the lowest AE is assumed by household members whose age less than 10 years. The lowest proportion could be attributed to the minimum value attached to age group less than 10 years in the adult equivalence scale (Storck *et al*., 1991).

Education Level of Fishing Households: Education is an important factor influencing management and the adoption of any technology. Table 8 shows that respondents were found to be distributed over a wide range of educational backgrounds consisting of 14% who did no access formal education (illiterate), 85.4% had primary education and 0.6% had secondary education.

In the study, it was realized that people who have attained secondary levels opt for other off-farm activities elsewhere than involving in the fishing activities. They usually move to towns to work on a permanent basis or on daily wage basis. They give less priority to fishing activities as the sector didn't guarantee a regular income due to the fact that many people are involved in the business being legal and/ or illegal fishermen. The sector is prone to the overfishing problem due to open access. The sector is largely meant to generate cash to overcome immediate financial constraint rather than serving as a means of occupation to earn income on a sustainable basis.

Livestock Holding (TLU): In this study, an average household owns 4.6 TLU of livestock. As presented in Table 9 below, about 25.1% of the respondents did not own livestock. On the other hand, 28.5% own below the average and 46.4% were having more than 4.6 TLU. This being the case, the composition of livestock is were dominated by small ruminants.

Table 9: Livestock holding (TLU)

TLU	Frequency	Percentage
None	45	25.1
Between 0 & 4.6	51	28.5
Above 4.6	83	46.4
Total	179	100

Source: Computed from data of 2011/12 household survey

Table 10: Farmland holding

Farmland (ha)	Frequency	Percentage
Less than 2.02	117	65
2.02 & above	62	35
Total	179	100

Source: Computed from data of 2011/12 household survey

Farmland Holding: In the study area, the average farmland holding is 2.02 hectares to cultivate crops. As presented in Table 10 below, 65% of the respondents owns less than the average holding. While, 35% of the fishing households owned above the average. The minimum and maximum farmland holding is zero and five hectares, respectively. The maximum holding is recorded in Ziway Dugda district, which have a relatively less human population.

The available land was wholly used for crop cultivation in the long rainy season (June-August). On the other hand, about 42% of the fishing households were using part of their farmland for irrigation in the dry season mainly to cultivate vegetables such as onion, tomato, potatoes and the like.

In Ethiopia there has been a great increase in the extent of irrigation schemes in recent years (Getahun and Stiassny, 1998; Getahun *et al*., 2008). Water is being removed directly from the lakes and/or diverted from rivers that feed the lakes. This has created considerable water level declines in several Rift Valley Lakes (e.g. L. Ziway, L. Abijata) which damaged the breeding grounds of fish species that spawn in shallow parts of the lakes, such as Nile tilapia (O. niloticus) (Gebre-Mariam and Dadebo, 1989) and this has caused reduced tilapia stocks in L. Ziway (Gebre-Mariam, 2002).

Only 4.5% of the fishing households were cultivated their farmland in the *belg* season, the short rainy season (February-April). Less emphasis is given to *belg* season to avoid competition with the crops grown in the longer

Table 11: Household original place and fishing experience

Variables	Frequency	Percentage
Origin		
This locality	170	95
Other locality	9	5
Total	179	100
Fishing experience (years)		
Less than 6	37	20.7
6-15 108	60.3	
16-30	34	19
Total	179	100

Source: Computed from data of 2011/12 household survey

Table 12: Household access to formal financing

Credit exprience	Frequency	Percentage
Yes 96	54	
No 83	46	
Total	179	100

Source: Computed from data of 2011/12 household survey

Table 13: Respondents' access to telephone service

Owned telephone	Frequency	Percentage
Yes 109	61	
No 70	39	
Total	179	100

Source: Computed from data of 2011/12 household survey

rainy season during which major crops like Teff, Maize, Wheat, Sorghum, Barley and others were cultivated. The rain that comes in the *belg* season is inadequate and commonly used as a means to regenerate grazing land for livestock rearing.

Original Place of Households' and Their Fishing Experience: Most of the households have long years of fishing experience. Accordingly, 79.3% of respondents were involved in this activity for more than six years. This was also supported by the respondents area of origin, which show 95% of them were still found in their original place. The 5% households were coming to the area because of marriage and employment opportunity. Table 11 shows origin of the respondents and their fishing experience.

Access to Credit Finance: Despite the study result, there was minimum preference with regards to formal financing among the fishing households. Respondents underlined, presence of lengthy procedures to obtain a loan and fear of risk of defaulting were barriers to seek a loan. They perceive that failure to repay the loan leads to confiscation of privately owned basic assets by lending institution and trigger conflict with neighbors, relatives and partners. Even though, there is access to loan the amount borrowed was significantly less due to fear of risk. This agrees with the study done in Osun state of Nigeria that indicate the majority of the farmers do not have access to credit (Agboola, 2011).

Formal sources are usually accessed for other agricultural and off- farm activities other than fishing.

Access to Telephone Services: In many cases, respondents were using telephone service mainly mobile apparatus to seek information on market performance, particularly fish prices in the local as well as central markets. As presented in Table 13, about 61% of the respondents have owned telephone and they were used to seek updated market information on fish output, agricultural inputs and outputs.

Fishing Asset Holding: In most of the cases, fishermen owned Gillnet (56.1%), locally made reed boat (43%) and Hooks (41.3%) to catch the fish resources. The use of Motorized boat were limited to fishermen who were members of fishery cooperative and recognized to finance the repaire and maintenance expenses of the boat as determined by the cooperative. In general, the uses of motorized boats were insignificant.Many of the members had interest to privately own the fishing facilities such as gillnets, hooks and reed boats to overcome the administrative challenges attached to cooperatives applied to memebers and the advantages of illegal fishermen to easily find customers to collect better prices. Motorized boats were commonly used to transport passangers that cross the lakes and for travellers comming to the area for recraetion purposes. Accordingly, 3.4% of the respondnets were found to finance expenses and access the boat from the cooperative. The study realized that Motorized boats were underutiloized by the cooperatives.

The study result noted, most of the fishermen were supplying wholefish to their customers. Only 2.8% of the respodents were using processing rooms to prepare flatted fish and access refrigerator services to preserve the fish that are available within the fishery cooperatives premises. The importance of owning processing rooms with refrigerators were undermined among respondnets, due to lack of power across the landing site and in their home.

Table 14: Fishing assets holding of respondents

Respndents	Gill net	Hook	Reed boat	Motorized boat*	Processing room*	Refregirator*
Frequency	101	74	77	6	5	5
Percentage	56.4	41.3	43.0	3.4	2.8	2.8

*owned by fishery cooperatives. Are fishermen who financed repaire and maintenance costs and able to get the service.

Source: Computed from data of 2011/12 household survey

Table 15: Respondents' use of the fishing lakes

Lakes	Frequency	Percentage
Langano	50	27.9
Ziway	129	72.1
Total	179	100

Source: Computed from data of 2011/12 household survey

Table 16: Expense incurred in fish processing

Processing cost	Frequency	Percentage
None	10	5.6
ETB55.3-177.8	72	40.2
Greater than ETB 177.8	97	54.2
Total	179	100

Source: Computed from data of 2011/12 household survey

Table 17: Fishers location from big market

Distance from big market	Frequency	Percentage
Less than 1km	79	44.1
1-5km	45	25.1
5-10km	39	21.8
Above 10km	16	9
Total	179	100

Source: Computed from data of 2011/12 household survey

Lakes Used for Fishing: Most of (72.1%) the fishermen were using Lake Ziway to catch the fish. Since Lake Ziway is bounded with the three districts considered in this study, thus enabled many of the fishermen to use the lake. It covers areas along the three dsitricts with larger water body and fish potential as compared to Lake Lanagno. Table 15, presents number of fishermen who were using the lakes to harvest fish.

Fish Processing Services Expense: In the study period, the average fisherman has incurred ETB177.80 to process the fish output. The maximum expense incurred was ETB760.20 to purchase, repair and maintain processing equipments and tools for private use. The range of expenses made to process the fish output were presented in the Table 16 .

Table 18: Logit estimate of determinants of participation in the fishery coops

Covariates	Coefficient	P-value
Gender of household head	0.61	0.58
Age of household head	(0.07)	0.21
Adult equivalent of household	0.01	0.06*
Education level of hh	0.04	0.86
Livestock holding (TLU)	0.09	0.18
Irrigation area (ha)	(2.54)	0.00
Access to telephone service (1/0)	5.01	0.00***
Access to formal finance (1/0)	1.95	0.00***
Fishing experience of hh	0.28	0.01***
Farm land holding (ha)	(1.73)	0.00***
Fishing asset holding of hh (1/0)	0.91	0.11
HH using Lake Ziway for fishing (1/0)	21.59	0.00***
HH using Lake Langano for fishing (1/0)	20.84	0.00***
Cost of fish processing and sanitation (ETB)	0.0004	0.90
Location from big market (km)	0.18	0.02**
Number of obs =179	Member= 86	
	Non-member= 93	
Pseudo R^2 =0.64		
LR chi2(11) =158.4		

*Significant at 10% level, ** significant at 5% level *** significant at 1% level

Source: Computed from data of 2011/12 household survey

Access to Big Market: As presented in Table 17, about 69.2% of the respondents were found at a distance less than 5km from the nearest big market. The markets are usually located across all weather roads and believed to have customers of the fish products. On the other hand, 21.8% of the respondents are located at 5-10km and 9% are required to travel more than 10km to reach the big market.

Result: In this section, we present and discuss the empirical results, using results from the semi-parametric analysis. The impact of fishery cooperatives on fish income of average household were examined using the propensity score matching.

Estimation of the Propensity Scores: The logit model was employed to obtain the propensity score. Matching was done on 15 covariates, which were found to generate best balance between the treated and control group (coop members and non-members).

Table 19: Balancing test of matched samples

	1. Unmatched samples			2. Kernel based matching (bw03)			3. Four- Nearest Neighbour Matching (bw03)			4. Calipier matching (bw01)		
Covariates	Treatment household	Control household	Diff: p-value	Treatment household	Control household	Diff: p-value	Treatment household	Control household	Diff: p-value	Treatment household	Control household	Diff: p-value
Gender of household head	0.95	1	0.04**	0.92	0.92	0.90	0.92	0.87	0.60	0.95	1.00	0.32
Age of household head	38.36	39.34	0.48	37.54	33.78	0.87	37.54	33.57	0.15	36.43	38.05	0.61
Adult equivalent of household	202.67	208.93	0.65	204.43	161.13	0.77	204.43	158.86	0.10*	197.18	186.68	0.74
Education level of hh	2.58	2.26	0.06*	2.46	2.88	0.60	2.46	2.94	0.27	2.62	2.24	0.34
Livestock holding (TLU)	5.12	2.90	0.00***	5.32	4.33	0.23	5.32	4.74	0.71	5.39	3.37	0.07*
Irrigation area (ha)	0.24	0.22	0.73	0.42	0.61	0.30	0.42	0.60	0.26	0.33	0.19	0.30
Access to telephone service (1/0)	0.94	0.92	0.55	0.79	0.84	0.03**	0.79	0.85	0.58	0.76	0.71	0.73
Access to formal finance (1/0)	0.67	0.28	0.00***	0.54	0.62	0.52	0.54	0.61	0.65	0.62	0.33	0.07*
Fishing experience of hh	10.67	9.06	0.01***	9.46	8.14	0.99	9.46	8.03	0.28	9.19	9.57	0.80
Farm land holding (ha)	1.67	1.28	0.00***	1.95	1.73	0.47	1.95	1.74	0.28	1.95	1.58	0.12
Fishing asset holding of hh (1/0)	0.69	0.91	0.00***	0.58	0.71	0.09*	0.58	0.70	0.42	0.57	0.71	0.35
HH using Lake Ziway for fishing (1/0)	0.69	0.31	0.00***	0.71	0.82	0.45	0.71	0.83	0.34	0.71	0.48	0.12
HH using Lake Langano for fishing (1/0)	0.31	0.69	0.00***	0.29	0.18	0.45	0.29	0.17	0.34	0.29	0.52	0.12
Cost of fish processing and sanitation (ETB)	179.76	212.57	0.01***	199.05	176.17	0.31	199.05	172.84	0.41	173.01	209.11	0.08*
Location from big market (km)	2.57	1.09	0.00***	1.13	1.25	0.75	1.13	1.07	0.94	1.52	1.90	0.69

*significant at 10% level, **significant at 5% level, ***significant at 1% level

Source: Computed from data of 2011/12 household survey

The Logit estimates of the coefficients were presented in Table 18. We also report the associated p-values, although the purpose here is not to identify particular relationships, but rather to maximize the predictive power of the model. We find that the model correctly predicts 64percent of the observed membership in fishery cooperatives. These coefficients are then used to generate propensity scores for the non-member households living in the area, determining which would probably have participated had they had access to a fishery cooperative. On the basis of these propensity scores, households participating in fishery cooperatives are matched to similar ones in the area without access to such an organization.

Balancing of the Matched Samples: There are a number of different algorithms that can be used to find one (or more) comparable untreated individual to each treated individual. Here we focus on two methods, the non-parametric Kernel-regression matching and Nearest Neighbour Matchning. Using the Kernel-regression matching, each treated household is matched with the entire sample of controls. However, each control observation enters the estimate with a weight inversely proportional to its distance to the treatment observation based on the propensity score distribution. In the NNM, each treatment observation is matched with an average value of its four nearest control neighbors, again based on the propensity-score distribution. To ensure maximum comparability of the treatment and control groups, the sample is restricted to the common support region, defined as the values of propensity scores were both treated and control observations can be found.

As shown in Table 19, the unmatched sample fails to satisfy the balancing properties, in that households in the treated group are on average significantly different in several aspects from the households in the control group (Column 1). However, when we use KBM, no such significant differences appear after kernel-based weights are attributed to control observations (Column 2). Similarly, in the case of NNM there was no significant difference observed in the covariates. Overall, these results suggest that matched samples are adequate to perform an impact analysis, whereas the unmatched samples are not.

A straightforward way to test the validity of the matching procedure is to compare the characteristics of average household within the treated sample to the corresponding characteristics of the control group generated. An absence of significant differences between the treated and control groups will suggest a valid matching. We thus undertake a series of statistical tests for differences in household in the treated group compared to a subset of households in the control group with KBM and NNM.

As noted above, a major objective of propensity score estimation is to balance the distribution of relevant variables between the members and nonmembers, rather than obtaining precise prediction of selection into treatment. Table 20 presents results from covariate balancing tests before and after matching.

Table 20: Covariate balancing indicators before and after matching (cooperative membership)

		After matching		
Indicators	Before matching	NNM (4)	KBM (BW 03)	Calpier (01)
Mean standardized difference (bias)	37	23.1	21.9	28
Pseudo R^2	0.64	0.12	0.23	0.29
P-value of LR x^2	0.00	0.93	0.37	0.29

Source: Computed from data of 2011/12 household survey

Table 21: Number of obseervations within common support

Samples	NNM (4)	KBM (BW 03)	Calpier (01)
Number of treated household	24	24	21
Number of control household	93	28	93
Total	117	52	114

Note: NNM = nearest neighbor matching; KBM = kernel-based matching

Source: Computed from data of 2011/12 household survey

The NNM, KBM and Calipier matching method have resulted in to substantial reduction in absolute standardized bias through matching. The p-values of the likelihood ratio test indicate that the joint significance of covariates was always rejected after matching, whereas it was never rejected before matching. The low standardized bias, the low pseudo-R^2 and the insignificant p-values of the likelihood ratio tests suggest that there is no systematic difference in the distribution of covariates between both groups after matching. Thus, in the next section, we evaluate cooperatives membership effects on gross margin fish income between members and nonmembers with similar observed characteristics.

Matching Household: Propensity score matching methods provide a way to select control observations that are similar to individuals who received a particular treatment. One of the difficulties in applying matching methods is that there are a variety of algorithms available in the literature. The advantages and disadvantages of each method may be clear in theory and in simulation studies, but in practice there is always uncertainty about which one is the best method for a novel situation. However, propensity score matching methods are an important tool whenever there is certainty that the observed variables include most of the factors that are related to outcome and treatment participation [25]. Hence, as a result of the matching exercise, the sub-sample now includes a total of 117, 52 and 114 fishermen using NNM, KBM and Calipier radius method, respectively. Recall that the rationale for propensity-score matching is to compare households that are members of fishery cooperatives with households without cooperatives membership who would probably have been members had they had access to such an organization. In other words, we will match the household members in the fishery cooperatives, or the "treated households," to households in the control group that most resemble them. The algorithm result of the treatment assignment to the common support region were presented in the Table 21 .

Average impact of cooperative membership on gross margin fish income.

Based on the matched sample, we compute measures of cooperative membership impact on fish income of the household. The "average treatment effect on the treated" (ATT) measures the average difference between members' gross margin fish income and the fish income of their corresponding match.

As can be seen in table 22, there appear to be statistically significant difference of changes in gross margin fish income between cooperative memebers and nonmembers using the NNM and KBM.Thus, the findings of the study disclosed that there were significant increment in mean gross margin fish income of cooperative members than non-members.

Factors Influencing Treatment Effect on the Treated: With matched data, however, we might say that this p-value is valid if there are no unobserved confounders [26]. That is, if we have correctly matched the data, there should be no differences between the treated and control groups. Rosenbaum's method of sensitivity analysis provides analysts with a method to assess how robust their findings are to hidden biases due to unobserved confounder.

Table 22: Estimation of Average membership effects using propensity score matching methods

NNM	KBM	Calipier	
Average membership effect (ATT)	4,624.7**	4,585.3**	2,602.5
Standard error	2,248.8	2,248.5	1,963.4*

*Significant at 5% level

Source: Computed from data of 2011/12 household survey

Table 23: Sensitivity analysis using Wilcoxon Signed Rank P-value

Gamma (Γ) sensitivity parameter	L. Bound P-Value	U. Bound P-Value
1	0.00	0.00
1.5	0.00	0.00
2	0.00	0.00
2.5	0.00	0.00
3	0.00	0.00

Note: Gamma is Log Odds of Differential assignment to Treatment due to Unobserved Factors

Source: Computed from data of 2011/12 household survey

Table 24: Sensitivity analysis using Hodges-Lehmann point estimate

	Hodges-Lehmann (HL) point estimate	
Gamma (Γ) sensitivity parameter	L. Bound HL Est.	U. Bound HL Est.
1	2,274.10	2,274.10
1.5	2,100.74	2,454.74
2	2,001.68	2,571.30
2.5	1,925.44	2,664.53
3	1,866.19	2,734.45

Note: Gamma is Log Odds of Differential assignment to Treatment due to Unobserved Factors

Source: Computed from data of 2011/12 household survey

Hence, the sensitivity of our finding to hidden biases were examined using the Rosenbaum Sensitivity test for Wilcoxon Signed Rank P-value and Hodges-Lehmann (HL) point estimate.

The result of sensitivity test using the Wilcoxon Signed Rank P-value for the findings of the study to unobserved factors were presented in the Table 23.

When Γ= 1, the p-value is 0.00, which supports the presumption that there is no hidden bias due to an observed confounder. With an increase of 0.5 in sensitivity parameter, the p-value is still below the usual 0.05 threshold. Thus, even if the odds of one household being in the cooperative are only 1.5 times higher because of different values on unobserved covariate u, the inference we make did not changes in the short run.

The Hodges-Lehmann (HL) point estimate provides the additive effect due to treatment. This can be roughly interpreted as the difference in medians across treatment and control groups, though they are not the same estimate. We see here that the median difference in fish income if there is no hidden bias is ETB 2274.10. As we might expect, the median shift is smaller than the mean shift estimated above. We see that for Γ=3, the median shift might be as high as ETB 2734.45 or as low as ETB 1866.20. The estimate is slightly more robust as it requires larger value of sensitivity parameter before the lower bound approaches to zero. The general conclusion is then, while it would appear the cooperative membership had a positive treatment effect, in the short run the finding is less sensitive to possible hidden bias due to unobserved confounder (Table 24).

Based on these results, we can conclude that the estimates of the average membership effects reported in Table 22 are insensitive to hidden bias and thus are a reliable indicator of the effect of cooperative membership.

Conflict Management in Fishing Activities: Fishery cooperative memebers were using various instruments to handle conflicts arising in the fishing process. As indicated in Figure 1, awareness raising on potential sources of conflict and mechnaisms to handle them once such conflicts occure were aknowledged by 60% of the respondent households. Boundary setting by specifying fishing zone on water body, among the fishing agents

Table 25: Household's preference to cooperative membership

Fishing preference	Frequency	Percentage
Being cooperative membership	58	67
Being non-cooperatives membership	28	33
Total	86	100

Source: Computed from data of 2011/12 household survey

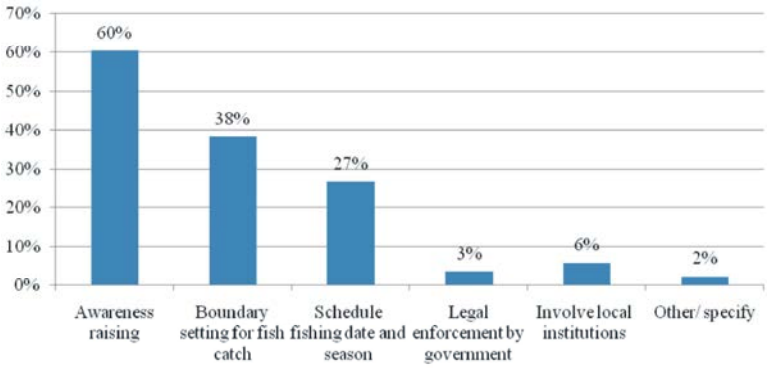

Fig. 1: Conflict management tools in fishing activities

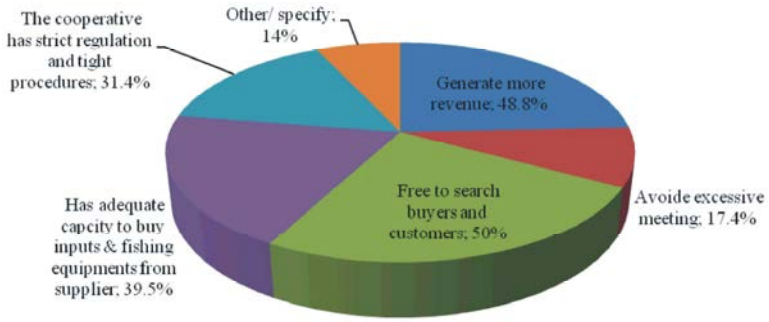

Fig. 2: Respondent's reason to fish as noncooperative memeber

were cited by 38% of the respondents to minimize conflicts. Scheduling of fishing dates with regular follow up for its application were supported by 27% of the respondnets. Consequently, the involvement of locally recognized indigenous community based orgaiztions were recognized by 6% of the respondnets to handle conflict. Finally, legal enforcement and application of strigent rules were cited by 5% of the respondnets to minimize conflicts.

Household's Perception of Fishery Cooperatives: Despite the result of the matching algorithm that indicate positive income differences to cooperative members as compared to non-member counterparts, the assessment had on a member's preference to stay in the cooperative showed mixed reflection. As presented in Table 25, 33% of the respondents had preference to be non-member of the fishery cooperatives.

As presented in figure 2, several reasons were identified with regards to cooperative member's preference to be a non-member. Almost half of the respondents (50%) explained nonmembers had the opportunity to freely access customers of fish output in any marketing places convenient to them. They get better prices by selling the fish product to passengers and travelers along main roads, local restaurants and hotels and private dealers at the landing site. Likewise, 48.8% of the respondents noted better income to nonmembers due to flexible sales location and associated competitive prices to the fish output. Consequently, 39.5% of the respondents also refrain to perform as a cooperative member because of adequate capacity to command fishing equipments and tools without seeking external support. Application of strict regulations and tight procedures for member involvement in fish catch were the other factor cited by 31.4% of respondent households to prefer to being nonmember. Members were highly required to adhere to operational guidelines issued to them from local authorities, to attend meetings, as well as their fishing

efforts are easily monitored as opposed to the nonmembers counterpart. Accordingly, 17.4% of the respondents noted non-membership could release them to participate in the meeting organized at cooperatives office as well as district offices. Some respondents (14%), also noted the difficulties of open access to the fish resources that induce illegal fishers and the benefit accrued to them because of diverse marketing channels they were using. Hence, from the study result we can infer non-cooperative memebers were in a position to gain from fishing as compared to their coopeartive memebers counterpart in the study period.

CONCLUSION

In this paper, we used both descriptive analysis and propensity score matching to evaluate the impacts of fishery cooperatives on fish income of an average household. We used cross sectional data collected in the production year 2011/12.

Despite the existence of fishery cooperatives, its performance was weak to serve members to gain income from the fishing activities. Consequently, the support of various institutions working in the area were considered to be insignificant attributed to the cooperatives weakness to serve as an active partner to link such institutions with the fishing households. Often times, nonmember households were considered to earn better income as opposed to the member ones due to the possibility of using different market channels to find customers. This being the case, cooperative members were recognized to own legal right to access fish resources with the knowledge of cooperatives for which the non-members are losing the right to freely involve in fishing. These make the cooperative members to have an exclusive right over the non-member counterparts to benefit from the fishing business.

In the effort to analyze the impact of fishery cooperatives in the area, this study has identified and elaborated the potential self-selection biases that emerge from simple comparisons of members with non-members. These biases have to do with the attributes of the study area as well as the attributes of the households themselves. Thus, the research has shown how one might use the propensity-matching method to evaluate the impact of fishery cooperatives. The matching was undertaken between fishery cooperative members and non-memeber fishermen, according to specific household characteristics. This careful selection and matching process ensures a relatively unbiased estimate of the true impacts of fishery cooperatives on household fish income.

Accordingly, the result of impact analysis verified the significancy of fishery cooperatives on fish income of average household using the matched samples. The stablity of the matching result were tested usining the Rosenbaum Sensitivity test for Wilcoxon Signed Rank P-value and Hodges-Lehmann (HL) point estimate. In both cases, the finding has confirmed an absence of hidden bias due to unobserved cofounder that support the positive treatment effect of cooperative membership.

Accordingly, based on the study results the following conclusions were drawn;

- Cooperatives are effective at providing marketing services to their members: the significant impact of fishery cooperatives on fish income reveals that cooperatives do serve their purpose on income improvement through monitoring of fishing efforts, by creating better market opportunities, making higher bargaining power, or reduced transaction costs.
- These results, when combined with lower cooperative membership rates among smaller farmers, suggest that cooperatives alone may not be sufficient to effectively promote fish income. If it is true that cooperatives enhances productivity and income in the long run, complementary institutions need to be designed to address the specific needs of the fishermen.
- Beyond location and household profile, there are particular characteristics of cooperatives themselves that may constrain their capacity to affect their members' fish income gain. This latter issue, on the determinants of fishery cooperative performance, needs further investigation.

REFERENCE

1. Zeuli, K., 2002. The role of cooperatives in community development. Center for cooperatives, Bulletin no. 3. University of Wisconsin.
2. Toluwase, S. and O.M. Apata, 2013. Impact of Farmers' Cooperative on Agricultural Productivity in Ekiti State, Nigeria. Greener J. of Agricultural Sciences, 3 (1): 063-067. www. gjournals. Org.
3. Veerakumaran, G., 2007. Ethiopian Cooperative Movement-An Explorative Study. Mekele University, Ethiopia.

4. Deacon, R.T. and D.A. Ovando, 2012. Fishery Cooperatives as a Management Institution.
5. Food and Agriculture Organization, FAO., 2006. Fishing and climate change Italy, Rome Dec. 19/2012. www.rff.org.
6. Felthoven, R., 2002. Effects of the American fisheries Act on capacity, utilization and technical efficiency. Marine resource economics. Marine Resources Foundation. Jan. 14/2012. http://www.en.wikipedia.org/wiki/Marine,17:181-205.
7. Anatoliy Viktorovich Molodchik, 2013. Leadership Development. A Case of a Russian Business School, Middle-East Journal of Scientific Research, 15(2): 222-228.
8. Meruert Kylyshbaevna Bissenova and Ermek Talantuly Nurmaganbet. The Notion of Guilt and Problems of Legislative Regulations of its Forms. The Notion of Guilt in the Criminal Law of Kazakstan, Middle-East Journal of Scientific Research, 15(2): 229-236.
9. Ray, S., 1991. Resource-use efficiency in public schools. A Study of Connecticut, Lond on press.
10. Rose, R., P. Stubbs, A. Gooday and W. Shafron, 2000. Indicators of the economic performance of Australian fisheries. ABARE report to the fisheries resources research fund. Canberra. Australian Bureau of Agriculture and Resources Economics. Commonwealth Australia.
11. Wooldridge, J., 2002. Econometric analysis of cross section and panel data. The MIT press (Chapters 16, 17, 18).
12. Greene, W., 2008. Econometric analysis. Pearson international Edition, 6th edt. Cambridge press, pp: 9.
13. Bernard, T., E. Gebre-Medhin and A. Siyum, 2007. Smallholders' Commercialization through Cooperatives. A Diagnostic for Ethiopia. IFPRI Discussion Paper 00722. www.ifpri.org/pubs/pubs.htmdp.
14. Rosenbaum, P.R. and D.B. Rubin, 1983. The central role of the propensity score in observational Studies for causal effects. Biometrika, 70(1): 41-55.
15. Heckman, J., H. Ichimura, J. Smith and P. Todd, 1998. Characterizing Selection Bias Using Experimental Data. Econometrica, 66(5): 1017-1098.
16. Andersson, C., M. Alemu and J. Stage, 2009. Impacts of the Productive Safety Net Program in Ethiopia on Livestock and Tree Holdings of Rural Households. Environment for Development, Discussion Paper Series, www.efdinitiative.org.
17. Cameron, A.C. and P.K. Trivedi, 2009. Microeconometrics using Stata. Published by Stata press, USA.
18. Caliendo, M. and S. Kopeinig, 2008. Some Practical Guidance for the Implementation of Propensity Score Matching, Journal of Economic Surveys, 22(1): 31-72.
19. Dehejia, H.R. and S. Wahba, 2002. Propensity Score Matching Methods for Non-experimental Causal Studies, Review of Economics Statistics, 84: 151-61.
20. Smith, J. and P. Todd, 2005. Does Matching Overcome LaLonde's Critique of Non-experimental Estimators? Journal of Econometrics, 125(1-2): 305-353.
21. Lee, W.S., 2008. Propensity Score Matching and Variations on the Balancing Test Unpublished. paper, version. Melbourne Institute of Applied Economic and Social Research.
22. Rosenbaum, P.R. and D.B. Rubin, 1985. Constructing a Control Group Using Multivariate Matched Sampling Methods That Incorporate the Propensity Score. American Statistician, 39(1): 33-8.
23. Sianesi, B., 2004. An Evaluation of the Swedish System of Active Labour Market Programmes in the 1990s. Review of Economics and Statistics, 86: 133-55.
24. Heckman, J.J., H. Ichimura and P.E. Todd, 1997. Matching as an Econometric Evaluation Estimator. Evidence from Evaluating Job Training Program, Review of Economic Studies, 64: 605-654.
25. Coca-Perraillon, M. and M.A. Burlington, 2006. Matching with Propensity Scores to Reduce Bias in Observational Studies.
26. Keele, L., 2010. An overview of rbounds. An R package for Rosenbaum bounds sensitivity analysis with matched data. http://www.personal.psu.edu/ljk20/rbounds%20vignette.pdf