Asian Research Journal of Agriculture
2(2): 1-10, 2016, Article no.ARJA.29868

SCIENCEDOMAIN *international*
www.sciencedomain.org

Food Security Status of Artisanal Fishers and Concerns of Bycatch in Nigeria

Clementina Oluwafunke Ajayi[1*]

[1]Department of Agricultural and Resource Economics, Federal University of Technology, P.M.B. 704, Akure, Nigeria.

Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/ARJA/2016/29868
Editor(s):
(1) Moreira Martine Ramon Felipe, Universidade de Santiago de Compostela, Spain.
Reviewers:
(1) Supaporn Poungchompu, Thailand.
(2) Aleksey F. Rogachev, Volgograd State Agricultural University, Russia.
(3) Ali Musa Bozdogan, Cukurova University, Turkey.
(4) Petro Maziku, College of Business Education, Tanzania.
Complete Peer review History: http://www.sciencedomain.org/review-history/16731

Original Research Article

Received 1st October 2016
Accepted 25th October 2016
Published 29th October 2016

ABSTRACT

There have been concerns about the part of the catch that is not the primary target of the fishing effort of artisanal fishers along their household food security status. This aimed the study to examine bycatch occurrence and usage, estimate the food security status of fishing households and highlight constraints faced by fishing households in Nigeria. Data collected from one hundred and fifty six (156) artisanal fish farmers of Lagos, Ondo and Kogi States of Nigeria between June 2015 and July 2016 were used for the analysis. The study used descriptive statistics as well as United States Household Food Security Survey Module to fulfil its objectives. The results revealed that majority (95%) of artisanal fishers indicated that introduction of a bycatch reduction device will raise the unit cost of effort and this cost increase induces a reduction in the profit maximizing level of effort and also reduces profit. 50.64% of fishing households were food secured while inadequate capital, lack of extension services, poor fishing gears, water pollution, poor value addition, poor storage facilities, unavailability of fish, lack of formal education, poor access to information, destruction of fish habitats and breeze among others were the constraints faced by artisanal fishers and the major reason they encourage bycatch. The study suggests that government should consistently give support to the extension agents and research institutes so as to give quality

**Corresponding author: E-mail: coajayi@futa.edu.ng;*

education to these farmers on importance of bycatch reduction; embrace effective bycatch reduction devices at minimum cost; implement proper policies that would eliminate these constraints by giving attention to the technical, social and regulatory approaches of bycatch and access to financial capital should be improved.

Keywords: Artisanal; bycatch; bycatch reduction; fishing household; food security; Nigeria.

1. INTRODUCTION

Aquaculture is the world's fastest growing food production sub-sector. It is growing at an annual rate of 8.9% since 1970 and contributes significantly to the world economy [1]. According to [2], fisheries contribute about one percent of the Nigerian Gross Domestic Product (GDP) and 3.24% of the Agriculture GDP. Fish is an important source of animal protein for many households. According to [3], fish contributes more than 60% of the world supply of protein especially in developing countries. As a maritime nation with a population of over 160 million people and a coastline measuring 853 kilometers, fish production as an enterprise has the capacity to contribute significantly to the agricultural sector [4]. Nigeria fishing industry comprises of three major sub sectors namely the artisanal, industrial and aquaculture of which awareness on the potential of aquaculture to contribute to domestic fish production has continued to increase in the country [5].

As a developing fishing nation, Nigeria has a strong fish culture supported by natural fisheries throughout the year with a total production of 960,000 metric tons, hence, playing a key role in food security [6]. This is not only for subsistence and small-scale fisher folks that rely on fisheries for food, income generation and services but also for consumers who regard it as a source of affordable high quality animal protein. Certainly for many poor households engaged in full-time, seasonal or occasional small-scale fishing activities, such contributions are crucial to individual/household food security. Despite Nigeria rich, moderate tidal dynamics in her coast and the existence of high fisheries potentials, notably within the outpouring zones of the continental shelf or the enrichment of the land based sources through the rivers, Nigeria fisheries have for a long time consisted of localized activities aimed at providing protein for her teeming population. This can be explained by bycatch and discard problem, obsolete and poor fisheries management, low level technology of fishing gears, less developed preservation techniques, lack of exploratory data for stock management fishing in the non trawling zone, and overexploitation among others.

Bycatch in the context of this paper is the part of the catch that is not the primary target of the fishing effort. It consists of both fish which is retained and marketed (incidental catch) and that which is discarded or released [7]. Bycatch is the incidental capture of non-targeted fish, including juveniles, and other species such as dolphins, marine turtles and seabirds. Each year, bycatch kills over 300,000 small whales, dolphins and porpoises, 100 million sharks, over 250,000 loggerhead and leatherback turtles, thousands of seabirds and billions of unwanted fish and invertebrates [8]. [9] observed that this part of the catch is usually unregulated, the capture of bycatch contributes to the problems of overfishing, may pose a threat to species diversity and ecosystem health. It is also noted that bycatch harms endangered and threatened species, often consists of juvenile food-fish species and is therefore a threat to food security and sustainable fisheries production. There is therefore an awareness that bycatch is a global problem that must be addressed. The concerns of bycatch is not going away and scrutiny of fishing activity is increasing.

Moreover, the lack of sustainable fishing practices is impacting food security and livelihoods in many parts of the world. Recent data from Food and Agricultural Organization indicates that approximately one third of world fisheries production occurs in low-income, food-deficient countries - where seafood is a major source of protein. Unfortunately, many of the fishing methods used in such countries lack the improvements that have been implemented in developed countries, which make fishing gears more selective. For example, the use of trawl nets in developing countries has, to a large extent, not incorporated the use of bycatch reduction technologies that reduces the wastage associated with the capture and discard (or, in many cases, retention) of undersize fish. This leads to the suboptimal use of the resource, with significant consequences for the population's food security [10]. Nigeria as a developing

country with unique bycatch challenges also lacks the resources needed to adhere to such a technology. Yet, there is a serious need for sustainable fishing practices to be implemented where food security is a major, long-term problem.

Fisher folks use canoes to exploit both marine and brackish water species common along the estuaries and lagoons. The limit of 5 nautical miles made exclusive to canoe users by virtue of the Sea Fisheries Decree, constitute the most lucrative fishing ground, being the shallowest portion of the continental shelf. The use of canoe by fisher folks enables them to penetrate all the breeding and nursery grounds and capture immature juveniles and breeding populations. The fishing gears used by canoe fisher folks are dangerous and include both active and passive gears such as cast nets, beach seine nets, purse seine nets, boat seines, gill-nets, traps, hooks etc.

Currently, at the commercial level, Nigerian shrimp trawl fisheries have extensive implementation of bycatch reduction technologies, which are mostly driven by European Union requirements for shrimp imports [10]. According to [11] only about 5% of the total landings are attributed to industrial marine fisheries using trawlers At the commercial level, the finfish bycatch has a well-established market where it is retained and on-sold at sea from trawlers to smaller-scale canoe operators who then on-sell this bycatch onto onshore buyers who dry and smoke the fish for sale at local and regional markets. This provides significant seafood protein to a large number of people who would otherwise simply lack it. Introducing Bycatch Reduction Devices (BRDs) causes a problem because it effectively reduces the bycatch available for on-selling.

The current challenges in the fisheries subsector in Nigeria include examining and resolving the economic implication of bycatch reduction, acknowledging the need for general awareness and an enlightenment campaign to educate the general population and key stakeholders about the need for sustainable fisheries management, conservation of resource and how changes to fishing practices can assist in such areas and also ensuring food security. To achieve this, there is need for this study and others to assess the economic implication of bycatch reduction as a food security measure in Nigeria. This is achieved by describing the socio economic characteristics of fishing household, perceiving the awareness of bycatch and its reduction devices among artisanal fisher folks, examining the effect of BRDs in the equilibrium population of the bycatch species at every level of effort directed at the target species of fish; on cost per unit effort; food security status of fishing households and constraints faced by fishing households.

2. METHODOLOGY

Nigeria has approximately 850 kilometers of coastline on the Gulf of Guinea to the south, which, extends from Ogun State to Cross Rivers State. Nigeria has Territorial (Marine) waters of thirty (30) nautical miles, which, came into operation in 1967. The Exclusive Economic Zone (EEZ) Decree (Act) of 1978 vests Nigeria with further extension of the marine waters (Ocean). The EEZ is described as an area extending from the external limits of the territorial waters of Nigeria up) to a distance of two hundred (200) nautical miles from the baselines from which the breadth of the territorial waters of Nigeria is measured. The surface area of the continental shelf is 46,300 km^2 while the EEZ covers an area of 210,900 km^2 within which Nigeria exercises sovereign rights for the purpose of exploring, exploiting, conserving and managing the natural resources. Of the 36 states in the country, 9 (Lagos, Ogun, Ondo, Edo, Bayelsa, Rivers, Akwa Ibom and Cross Rivers) are located in the coastal zone [12]. In addition Nigeria has territorial (fresh) waters in Lake Chad. Lake Chad is jointly owned by Nigeria, Republic of Chad, the Cameroons and Republic of Niger and is jointly administered by the Lake Chad Basin Commission. Moreover the country is blessed with big rivers, streams and huge manmade lakes [13]. Nigeria's coastal zone is endowed with numerous living and non-living resources. The most important living resources are fin and shellfish including shrimps predominantly members of the family penaeidae (Dublin-Green). Shrimps are highly relished and priced delicacy on the world food menu and Nigeria contributes significantly to wild caught shrimps from the tropics.

Primary data were used for this study and information was sourced with the aid of structured questionnaire. The questionnaire was designed in line with the objectives of this study. Snowballing was used to select one hundred and eighty (180) artisanal fish farmers across three coastal areas of Lagos and Ondo States and

riverine area of Kogi State. Out of 180 copies of questionnaire administered, 156 copies were complete and used for the analysis. The communities where the questionnaire was administered were Ibeju-Lekki, Epe and Badagry in Lagos State, Igbokoda, Ilaje and Okiti pupa in Ondo State and in Yagba and Okehi in Kogi State of Nigeria.

Data collected were analyzed using descriptive statistics, United States Household Food Security Survey Module and static fishery economic model. Descriptive statistics such as measures of central tendency and dispersion and frequency distribution were used to analyze respondents' socio economic characteristics and perceived awareness of bycatch and its reduction devices. The food security status of the respondents in the study area was analyzed based on the United States Household Food Security Survey Module, an 18-item scale- three stages designed to capture experiences associated with inadequate quality and quantity of the household food supply within the past 12 months [14,15]. Responses of "yes," "often," "sometimes," "almost every month," and "some months but not every month" are coded as affirmative. The sum of affirmative responses to a specified set of items is referred to as the household's raw score on the scale comprising those items [16]. Artisanal fishers responded in the affirmative or negative to each of the experiences itemized in the scale. For the purpose of this study, households with one or more children with raw score zero has high food security; 1-2 has marginal food security; 3-7 has low food security and 8-18 has very low food security while for households with no child present: zero has high food security; 1-2 has marginal food security; 3-5 has low food security and 6-10 has very low food security. Households with high or marginal food security are classified as food secure and those with low or very low food security are classified as food insecure.

Alaouze [17] highlighted the importance of BRDs as one that improves the survivability of bycatch species in two ways:

(1) Bycatch reduction devices increase the cost of effort directed at catching the target species and can therefore be expected to reduce fishing effort. Reducing fishing effort will increase the equilibrium populations of the bycatch species and the target species.

(2) Effective by-catch reduction devices can be expected to reduce the by-catch per unit effort directed at the target species. The reduced by-catch per unit effort directed at target species will also increase the equilibrium population of the bycatch species.

By increasing the equilibrium population of the bycatch species, the survivability of the bycatch species is improved. The reduction of bycatch species caught lessens the environmental damage caused by fishing, especially when bycatch species have low populations or high aesthetic value [17,18] and also increase food security.

The population equilibrium curves of the Bycatch species before and after the introduction of bycatch reduction device is as shown in Fig. 1. It is shown in the figure that the equilibrium population of the bycatch species at every level of effort directed has been increased. Where X is the biomass of the bycatch specie, Xm is the maximum attainable biomass of the bycatch specie, E_{π} is the profit maximizing level before the introduction of BRDs, E'_{π} is the profit maximizing level after the introduction of BRDs, T is time, E is effort directed at the target species per unit time and $\propto$ is the introduction of a BRD at 0.25. It is evident in Fig. 1 that increase in the equilibrium population of the bycatch species by AB before the introduction of the BRD is as a result of decrease in effort from E_{π} to E'_{π} and by CD after the introduction of BRD such that CD < AB. This suggests that the less significant the rise in equilibrium population attributed to the reduction in effort due to the introduction of the BRD, the more effective the BRD (the smaller effective the $\propto$). The introduction of a bycatch reduction device raises the unit cost of effort from C to C+B and this increase in costs brings a reduction in the profit maximising level of effort from E_{π} to E'_{π} and also reduces profit. When an effective bycatch reduction device is introduced, the contribution of the fall in effort in the equilibrium population of the bycatch species is reduced owing to the fact that the population equilibrium curve is flatter once the bycatch reduction device is introduced [16]. It is however important that bycatch reduction devices should be introduced at minimum cost. That is, without any incidental regulations which mainly increase costs and hence reduce effort and profitability without making any important contribution to the equilibrium population of the bycatch species.

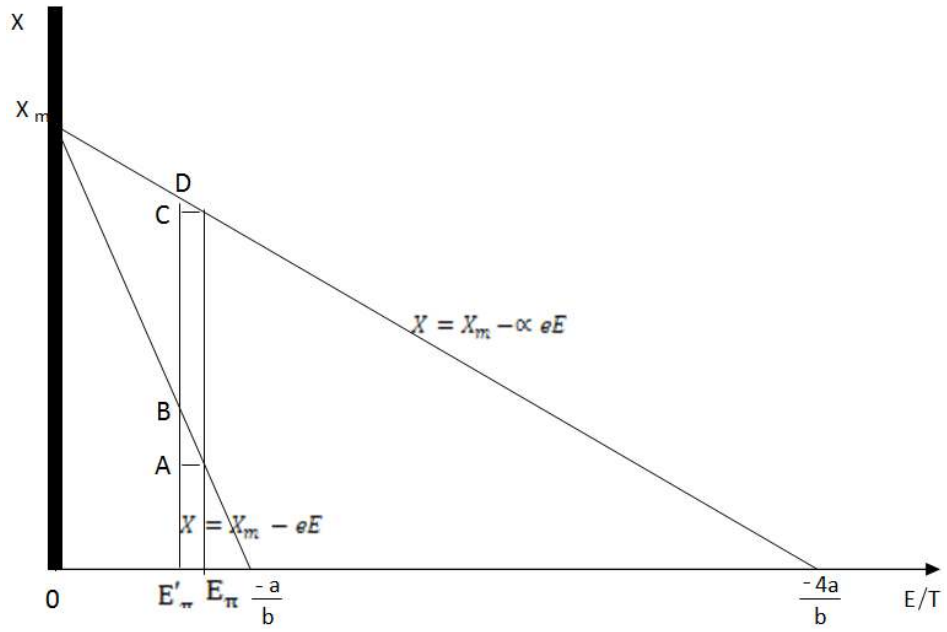

Fig. 1. The Population Equilibrium Curves of the Bycatch species ($\propto$ = 0.25)
Source: (16)

3. RESULTS AND DISCUSSION

3.1 Socio-economics Characteristics of Artisanal Fishers in the Study Area

Table 1 shows the socio-economic characteristics of the respondents. This included the age distribution, sex, marital status of fishermen, household size, educational status, years of experience, fishing goal and membership in the fishermen union. The socio-economic characteristics assessment helps to know how the fishermen were affected in artisanal fisheries. The mean age of the fish farmers was 42 years old. With the average life expectancy in Nigeria being 54.5 years [19], it shows that these farmers are still in their active years and in possession of the physical strength needed to handle most of the fishing operations themselves. They also still have many productive years ahead, which will augur well for the fishing industry in Nigeria. As shown in Table 1, majority (82.69%) of the artisanal fishers were males while 17.31% were female. This indicates that artisanal fishery is a male dominated occupation in the study area. This supports [20] who reported that in Africa, fish farming is an activity often taken up by male farmers. It was also revealed that 5.13%, 85.90%, 5.13% and 3.85% of respondents were never married, married, divorced and widowed respectively in the study area. The very high percentage of respondents that are married compared with those divorced is a reflection of strong moral value attached to the marriage institution in Nigeria, this is in agreement with the findings of [21,22] Being married also provided an added advantage of family labor because the dominant trend was a household size of 5-8 in the study area. Table 1 also revealed that 20.51% of respondents have no formal education while the mean years of education was 8.4 years. This portrays a low level of literacy among fish farmers and may be one of the constraints in accessing information and knowledge about bycatch and its reduction devices. The mean of 14.2 years farming experience of artisanal fisher folks showed that fisher folks are skilled and experienced, which holds opportunities for increased productivity. Access to finance is important to all small-scale farmers including artisanal fisher folk. Access to finance would improve their productivity especially assistance in upgrading their fishing equipment and expanding their business. Access to credit for artisanal fish farmers (93.58%) was mostly from informal sources (personal savings, fish farmers cooperatives, friends and relatives). Formal financing institutions were not a significant source of funding in the study area. This might be because the fisher folks in particular the marketers were unable to cope with the high level of interest rates charged by most commercial banks as well as a lack of collateral

required to obtain loans from banks as reported by [23].

3.2 Awareness Characteristics of Bycatch among Fisher Folks

Table 2 showed the awareness characteristics of bycatch among artisanal fishers in the study area. 68.59% of respondents were aware of bycatch, 32.69% claimed that they always have occurrence of bycatch while 67.31% sometimes encounter bycatch. The common bycatch species in order of their frequencies includes snake fish, crabs, shrimp/prawn, fin fish, sea turtle, crayfish, oyster, electric fish, periwinkle, black snail, water snail, white fish, turtle, crocodile, cockle, whelk, squid and octopus among others. The most common fishing gear was cast net (44.23%), followed by gill net (32.69%) and drag net (12.9%). These gears are primitive fishing gears and the usage does not encourage reduction of bycatch. 78.85% of respondents sold the bycatch from fishing as additional source of income while 21.15% prepared them as food for their households. It is important to note that these were the only options that were selected by respondents, other options such as 'return them to the waters after catch,' 'discard them but not to the waters,' 'sort and prepare them as foods for animals' and 'sort and give them away to community people' were not selected. Respondents were asked why and they provided the following reasons: Low fishing yields, lack of storage and preservation, sorting and preparation, low market, and low demand.

3.3 Effect of Bycatch Reduction Devices in the Equilibrium Population of the Bycatch Species

The major limitation faced with this study is the ignorance to the awareness of bycatch reduction devices by the artisanal farmers in the study area. This frustrated usage of the model but rather descriptive inference. The coastal artisanal fisher folks know little information about the effect of bycatch and its reduction devices. In the study of bycatch characteristics as shown above, the fisher folks were using fishing gears that are incompatible with bycatch reduction devices or make bycatch reduction difficult. However, when asked about the knowledge and use of bycatch

Table 1. Socio economics of artisanal fishers in the study area

Variable	Mean	Dominant indicator
Age	42	52.56% falls below 50 years (Active)
Sex		82.69% Male
Marital status		85.90% Married
Years of formal education	8.4	56.41% -secondary education, 10.26% -no formal education
Household size	6.8	48.72% of size 5-8
Farming experience	14.2	34.67% between 11 and 20 years
Access to credit	-	93.58% credit source from personal savings, relatives, friends and cooperatives
Source of information	-	39.74% Fish farmers association, 21.79% fellow fish farmers, 16.03% Research Institution.

Table 2. Awareness characteristics of bycatch among artisanal fishers in the study area

Variable	Dominant indicator
Awareness of bycatch	10.26% very much aware, 58.33% aware, 31.41% not aware
Occurrence of bycatch	32.69% always, 67.31% sometimes.
Common bycatch species	Snake fish, Crabs, Shrimp/prawn, fin fish, sea turtle, Crayfish, Oyster, electric fish, Periwinkle, black snail, Water snail, white fish, Turtle, crocodile, Cockle, Whelk, Squid, Octopus,
Fishing gears used	44.23% cast net, 32.69% gill net, 12.9% Dragnet, 12.18% hook and line, traps and basket.
What they do with bycatch	78.85% sell as additional income, 21.15% cook for household
Value realised from bycatch (₦/month)	₦18, 583.33 peak season, ₦11, 076.19 moderate, ₦4963.10 low
Reasons for getting bycatch	Small quantity of harvest, storage and preservation, sorting and preparation, low market, low demand

reduction devices, most of the respondents linked reduction devices to commercial trawlers stating that some of these species exploited in inshore waters by them are also caught in offshore waters when they are bigger by the commercial trawlers. Majority (95%) also revealed that the introduction of a bycatch reduction device to artisanal fishers will raise the unit cost of effort and this cost increase will induce a reduction in the profit maximizing level of effort and also reduces profit. While this problem of cost increment with the use of bycatch reduction devices should not be ignored, there is an urgent need to sensitize the fishermen on the implication of non-usage of bycatch reduction device. This is in consonance with [9] that the fishermen are strongly urged to use appropriate bycatch reduction measures to help maintain the productivity of the fishery and the long-term prosperity of the fishing industry. He stated further that by responding appropriately, fishermen could help to protect the marine environment and assist global food security both now and in the future.

3.4 Food Security Status of Fishing Households

The food security status of fishing households is presented in Fig. 2. The level of fishing households food security was measured by asking the fisherfolks questions using United States Household Food Security Survey Module statements (USHFSSM). Results of analysis showed that more than half of the fishing households (50.64%) in the study area were food secure. Food security status of fishing households though marginal was slightly above average and this may be due food insecurity being measured by the USHFSSM as shortages of food, unsuitability of food and the preoccupation with continuing access to food [24]. This implied that the food secure fishing households could meet their food requirement, has access to suitable food and are preoccupied with continuing access to food. The result is in contrast with [25] which studied the determinants of food security in among rural farming households in Kwara States and found that 65.85% of farming households were food insecure.

3.5 Constraints Faced by Fishing Households

The constraints faced by fishing households as shown in Fig. 3 include poor access to information (8.1%), inadequate capital (24.05%), poor fishing gears (19.87%), poor storage facilities (16.21%), poor value addition (15.58%) and others. Others include theft, lack of extension services, water pollution, unavailability of fish, breeze, destruction of fish habitats, and lack of formal education, infrastructure, and poor mobility to distant creeks among others.

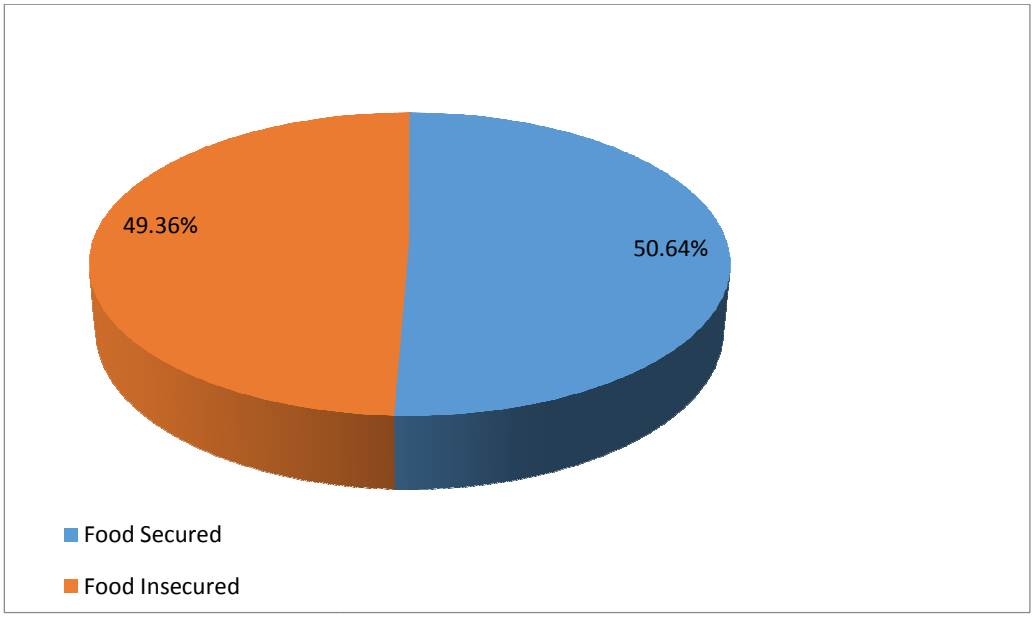

Fig. 2. Food Security status of fishing households in the study area

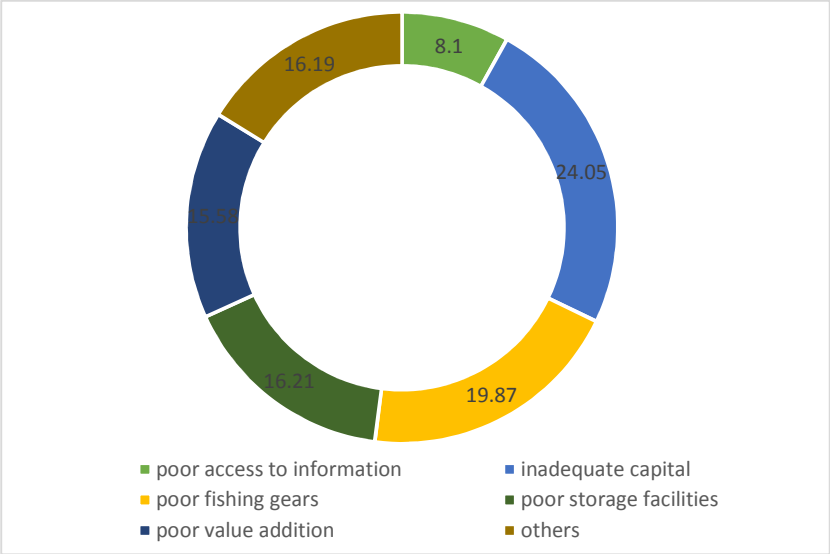

Fig. 3. Constraints faced by fishing households in the study area

4. CONCLUSION

The study found that the food security status of fishing household was slightly above average, introduction of bycatch reduction devices would raise the unit cost of effort, and the cost increase will induce a reduction in the profit maximizing level of effort and also reduce profit. The economic implication of the findings is that in the long run, the fishing households in the study area may become food insecure with introduction of bycatch reduction devices as this will reduce their profit and also, there are a large number of consumers who rely on the bycatch as their only affordable significant source of protein and otherwise would simply lack it thereby increasing food insecurity in the nation. However, conserving millions of fish and other organisms, decreasing the bycatch of large numbers of juvenile fish from shrimp trawls, the impact of fishing methods on whole ecosystems, impact of fishing on all species - not just those that are caught, retained or discarded, but also the ecological implications of disrupting habitats and the many uncaught species affected should also be of paramount importance in the short and long term Therefore, there is a crucial need for interventions that will reduce bycatch and discarding, improve selectivity and therefore lead to better managed fisheries while not neglecting sustainable food security of the fishing households and consumers and alternative means of livelihoods for those that are mainly bycatch fisherfolks.

5. POLICY IMPLICATIONS AND RECOMMENDATIONS

It can be deduced from findings that fisher folks are by no means prepared for usage of bycatch reduction devices to increase the equilibrium population of bycatch species. Hence the government, policy makers, research institutions, fisheries managers and extension agents have an important role to play in creating awareness and educating the fisher folks about the effect of bycatch reduction devices in the equilibrium population of bycatch species, sustainability of food security and environmental impact of bycatch.

Based on the findings from this study, it is recommended that:

(1) There is need for awareness and orientation about the bycatch reduction of the fish species and its overall importance in sustainable food security and environmental protection. Particular groups to target in such work are the captains, crews, artisanal fisher folks and consumers so that they can be sufficiently informed to part of the process.

(2) It has become necessary for the government to put in place a comprehensive formulation and implementation of proper policies that would eliminate constraints faced by artisanal fisher folks in the fishing process

by giving attention to the technical, social and regulatory approaches of bycatch with all attendant enforcements to prevent further exploitation.

(3) Government should embrace effective bycatch reduction devices at minimum cost and employ well trained extension agents to educate these farmers on importance of correct usage of bycatch reduction devices. Provision or subsidization of these devices and equipments as well as improvement on this equipment will go a long way in motivating the fish farmers and others who are not yet in the fisheries industry.

(4) Small scale fishing credit policy should be put in place to help the households; this can be made on the percentage of total agricultural loans to be given to the fisheries sub-section.

(5) Generally, improvement of infrastructure such as electricity has become critical to the survival of the agricultural industry of which the fisheries industry is not exempt.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. World Fish Center. World Fish Medium - Term Plan, 2010-2012: Reducing Poverty and Hunger by Improving Fisheries and Aquaculture. 2009;99.
2. Adebo GM, Toluwase SOW. Comparative analysis of fresh and smoked catfish marketing in Ekiti and Ondo States of Nigeria. Journal of Biology, Agriculture and Healthcare. 2014;4(19):6-12.
3. Food and Agriculture Organization. The State of World Fisheries and Aquaculture. 2006;162.
4. Osagie C. Aquaculture as path to thriving agriculture. Nigeria Rural Sociological Association; 2012.
   (Accessed online 5th October, 2012)
   Available:http://www.thisdaylive.com/articles/aquaculture-as-path-to-thriving-agriculture/124614
5. Adewuyi SA, Phillip BB, Ayinde IA, Akerele D. Analysis of profitability of fish farming in Ogun State, Nigeria. J Hum Ecol. 2010; 31(3):179-184.
6. Federal Office of Statistics. A Statistical Analysis of Food Supply And Demand in Nigeria from 1985-1995; 2008.
7. Clucas IA. Study of the options for utilization of bycatch and discards from marine capture fisheries. FAO Fisheries Circular. No. 928. Rome, FAO. 1997;59.
8. World Wildlife Fund. Factsheet on Bycatch; 2009.
   (Accessed 14th September, 2015)
   Available:http://wwf.panda.org/wwf_news/?166941/Bycatch-Factsheet
9. Eayrs S. A guide to bycatch reduction in Tropical Shrimp-Trawl Fisheries. (Revised Edition) Food and Agricultural Ogranization (FAO) of the United Nations, Rome, Italy; 2007.
10. Kenelly SJ. Solving by-catch problems: Successes in developed countries and challenges for protein-poor countries. J. Mar. Biol. Ass. India. 2014;56(1):19-27.
11. Nwosu FM, Ita EO, Enin UI. Fisheries management in Nigeria: A case study of the marine fisheries policy. International Research Journal of Agricultural Science and Soil Science. 2011;1(3):070-076.
12. Zabbey N. The Challenges of Sustainable Shrimp Fisheries in Nigeria. Centre for Environment, Human Rights and Development (CEHRD).
    (Accessed 13th September, 2016)
    Available:http://www.cehrd.org/files/SUSTAINABLE_SHRIMP_FISHERIES_IN_NIGERIA.doc
13. Adebolu VO. Fisheries Laws and Regulations of Nigeria and Room for Further Developments. Fisheries Society of Nigeria. 1983;2.
14. Ajayi CO, Adenegan KO, Amos TT, Ajayi JO. Effects of Food Insecurity on School Children's Academic Performance, Weight Gain, And Social Skills in Oyo State, Nigeria. OWSD - FUTA, Proceedings. 2015;552-557.
15. Bickel GW, Nord M, Price C, Hamilton W, Cook J. Guide to Measuring Household Food Security in the United States: USDA, Food and Nutrition Services Alexandria, VA. Revised. 2000;6.
16. United States Department of Agriculture. U.S. Household Food Security Survey Module: Three-Stage Design, With Screeners Economic Research Service, USDA. September; 2012.
17. Alaouze CM. The economics of by-catch reduction devices in regulated fisheries. Australian Agricultural and Resource

Economics Society; 2002. Canberra Proceedings.
18. King M. Fisheries Biology, Assessment and Management, Oxford: Fishing News Books; 1995.
19. World Health Ranking. World Health Organization; 2014.
(Accessed 13th September, 2016)
Available:http://www.worldlifeexpectancy.com/nigeria-life-expectancy
20. Agwu AE, Afieroho EA. Influence of personal and institution factors on adoption of improved pond management practices among fish farmers in Isoko Local Government Area, Delta State. Nigeria Journal of Animal Production. 2007;34(1): 121-131.
21. Adeleke ML, Afolabi JA. Appraisal of Fresh Fish Marketing in Ondo State, Nigeria. IIFET; 2012. Tanzanian Proceedings.
22. Oparinde LO. Structural Performance of Artisanal Fish Marketing in Ondo State, Nigeria. IIFET; 2012. Tanzanian Proceedings.
23. Mafimisebi TE, Oguntade AE, Mafimisebi OE. Re-engineering agriculture for enhanced performance through financing. Journal of Economics, Finance and Administrative Sciences. 2010;15(29):35-49.
24. Hamelin AM, Beaudry M, Baict JP. Characterization of food insecurity in Quebec: Food and feelings. Soc Sci Med. 2002;54(1):119-132.
(Accessed 13th September, 2016)
Available:http://www.ers.usda.gov/datafiles/Food_Security_in_the_United_States/Food_Security_Survey_Modules/hh2012.pdf
25. Omotesho OA, Adewumi MO, Muhammad-Lawal A, Ayinde OE. Determinants of Food Security among the Rural Farming Households in Kwara States, Nigeria. African Journal of General Agriculture. 2006;2(1):7-15.

Peer-review history:
The peer review history for this paper can be accessed here:
http://sciencedomain.org/review-history/16731