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# Perceptive Views of Fishermen on Sustainability of Fishing in the Fosu lagoon in Cape Coast, Ghana

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**Abstract**

Pollution of water bodies such as lagoons has rendered such natural resources unsustainable in terms of fishing activities. The Fosu lagoon in the Central Region of Ghana is suffering the same fate. The black chin tilapia catch which was the main source of fishing activity has reduced now-a-years while fishermen loose the economic incentive of their fishing activities. This study examines the perception of fishermen who fish in the lagoon. It looks at how the fishermen perceive the pollution of thelagoon ingeneral and how it is affecting fishing activities vis-à-vis sustainability of fishing in the lagoon. Sixty fishermen were sampled for the study. The purposive and snowball sampling methods were used in sampling the population. The Descriptive statistic technique was employed to analyze the data. Majority of the fishermen were of the view that the lagoon is not polluted though contaminated.They contended that fish catch was not sustainable when assessed in terms of lagoon habitat, overfishing, tilapia-stock depletion andpollution. It is recommended that measures should be taken to reduce if not eliminate pollution of the lagoon. The paper concludes that both sustainable fishing and pollution of the lagoon could be managed using modern scientific methods.
**Keywords:** fish-stock depletion, habitat destruction, over-exploitation,pollution, sustainable fishing.

## 1. Introduction

Ecosystems the world over are facing environmental problems due to human activities (Essumang, Dodoo&Kendie 2006). The importance of ecosystems cannot be overemphasized. They serve as homes to numerous plants and animals including fish species. They are also useful for religious, occupational, recreation and sporting, medicinal, saltmining, research, agriculture and fishing activities (Cunningham&Saigo, 1997; Mohammed 1993).

In spite these numerous benefits most lagoons the world over, including those in Ghana continue to be polluted to their extinction, the Fosu lagoon not excluded. The state of the Fosulagoon need not be desired. The reduction in its economic activities such as fishing is quite apparent. The depth of the lagoon has reduced as a result of siltation from debris, garbage and refuse from the municipality, both within and beyond. For those who have stayed in Cape Coast for the past fifteen to twenty years, the surface area of the lagoon has reduced beyond an average recognition (Mohammed, 1993).

It is in this light that pollution in the lagoon should be of concern. The generation, collectionand disposal of waste in the metropolis have not been in a sustainable manner (Essumang, 2000). Unsustainable settlement planning has also contributed to the continuing demise of the lagoon. The Nkanfoa waste disposal site, the Esuekyir and Adisadel dumping site all contribute to the pollution of the lagoon. Garbage and night soil also directly or indirectly find their way into the lagoon (Essumang et al, 2006). If precautionary measures are not taken, fishing in the lagoon might not be sustained in the not too distant future as a result of pollution, habitat destruction, depletion of fish stock and over-fishing among others. It is therefore pertinent to find fishermen's perceptions with regards to sustainability of fishing in the lagoon as the closest group of people to the lagoon.Knowing their perceptions will motivate the adoption of appropriate management measures to help sustain fishing in the lagoon.

### *1.1 Aim*

The aim of this study was to investigate the perception of fishermen who fish in the Fosu lagoon in Cape Coast, Ghana, in relation to the sustainability of fishing activities in the lagoon.

### *1.2 Objective of study*

- To find out the perception of fishermen on the current state of the Fosu lagoon.
- To find out the views of fishermen on the causes of lagoon pollution
- To investigate the perception of fishermen on fishing sustainability in theFosu lagoon.

### *1.3 Study Area*

The study concentrated on Fosu lagoon fishermen in relation to the current state of the lagoon in terms of pollution of the lagoon in general and how it is affecting lagoon habitat, overfishing, tilapia stock depletionvis-àvisfishing activities and sustainability of fishing in the lagoon.The fishermen were located in Cape Coast in the Central Region of Ghana.

Cape Coast is situated in the Cape Coast Metropolis. The main economic activities in the metropolis are services and industry, agricultural activities such as food crop cultivation, acacia wood-lot, teak wood lot, oil palm and coconut. Activities involving services include hairdressing, sewing, barbering and public services.

The major industrial activities include the AmeenSangari factory which produces soap brands and brake bands, and wood and lumber. Others are quarrying,*pito* brewing and automobile garaging and work-shopping. Small scale enterprises such as soap-making and food oil extractionare also found in the metropolis. Fishing activities are mainly in the sea, rivers, streams and ponds as well as the Fosulagoon. The major fish catch in the lagoon is the black chin tilapia.

## 2. Pollution

A popular definition of pollution dwells on the introduction by natural and artificial paths into the environment of a substance or energetic entity that can cause hazards to human health, and harm to living organisms as well as ecological systems (Tripathy& Panda, 2003). Pollution has negative effects on structures and amenities. It may interfere with good uses of the environment from theeffects of changes in energy patterns, radiation levels, chemical orphysical constitution or the abundance of organisms. Pollution therefore generates from both natural and human activities (Doe, 2007).

Pollutants are substances that cause pollution. A pollutant may comprise of any geochemical, chemical, biotic entity or its outcome, or physical element that in such magnitude as may have obnoxious, destructive, injurious or negative effects on matter. A pollutant may therefore be defined as any gaseous, liquid, or solid matter that is present in sufficient quantity such that it has the potential effect of becoming harmful to the environment (Tripathy&Panda, 2003).

According to Murthy (2008) two fundamental types of pollutants exist; primary and secondary. A primary pollutant could bring to bear detrimental effects in its raw state in which they come into contact with the environment. Secondary pollutants however are derived from primary pollutants by degradation as a result of chemical activities and developments, and in most cases, from smaller amount of noxious antecedents present in the environment. Environmental pollution can therefore be caused by the presence of chemicals which may generally be contemplated and perceived as not harmful. However, when they appear in relatively excessive amounts, could be harmful if found at specific times and locations. The factors that therefore affect pollution are the rate of emission, volume of emission and degree of noxiousness of the pollutant. The favorability and conduciveness of these factors could encourage the natural environmental process to degrade, integrate or embrace the pollutants that may be produced(Doe, 2007).

Cunningham &Saigo (1995) posit that environmental pollution is generally traced to a pollutant, pollutant source, and storage medium, transport medium which may be air, water or land and the recipient medium. They are of the view that the interrelation between pollutants produce cooperating and interacting reactions and this consequently generates secondary and tertiaryeffects. These effects could result in disastrous consequences, particularly when the pollutants are translocated through water and aquatic sink. Though some of these pollutants may not have extensive effects on the residual medium, the consequences could be fatal. According to Murthy (2008) chemical wastes and pollutants as well as household activities among others could pollute lakes, rivers and lagoons (. For these reasons, the threat to lagoon environments, for example,invites great attention to their pollution. The way people perceive pollution and its concomitant adversities to lagoon environments should therefore be of concern (UN Acts, 1973).

### *2.1 Sources of aquatic pollution*

The three basic types of pollution include soil, air and water (aquatic) pollution (Sinha, Shukla and Shukla, 2005). Aquatic pollution may be defined as the release of physical, chemical, biological, energetic entity or waveform into water environment at such magnitude that its harmful effect can affect the healthy or comfortable existence of living organisms or the quality of non-living matter now or the future. Substances of physical, chemical or biological features of adequate amount to water to alter its useful legitimate purpose may constitute aquatic pollution. The commonplace features of polluted water are turbidity, unpleasantness, bad smell, unsuitability for drinking, washing, bathing among others. It lacks some or all the potability characteristics (Sinha et al, 2005). It is for these reasons, among others, that pollution could have effects on both plants and animals including fishes since aquatic pollution affect potability characteristics. Aquatic pollution therefore has a direct relationship with the sustainability of fishing in aquatic environments such as lagoons.

According to Sinha et al (2005) discharge of organic sources from higher grounds pollutes water bodies such as lagoons. They (2005)continue that toxic wastes from urban areas continue to pollute lakes and lagoons. In some cases mortality rates of living organisms in lagoons may increase by 25% per annum. Sewage treatment plants may also discharge toxic organic and inorganic wastes into lagoon environments. In the view of Ahualey (2007) toxic and hazardouseffluent and solid wastes from factories and industries such as automobile-related workshops and garages may also find their way into lagoon environment.

Tailings and metal scraps, Waste sludge from automobile –related industries and workshops may also contribute to water pollution (Ahualey, 2007). Water bodies may be silted as a result of automobile–related workshop activities among others. Whether dumping of substantial quantitiesof sediments are direct or indirect, streams, rivulets and surface run-offs may subsequently transport these organic and inorganic materials into lagoons. Effluents ofthis nature may contain enough quantities of nitrates and phosphates which can go a long way to destabilize the entirewater body (Essumang et al, 2006; Hagan 1996). Leachates may find their way from dumping sites into an aquatic environment (Akwansah-Gilbert, 2007). Such pollutants may also contribute to unsustainable fishing in water bodies.

### *2.2 Sustainable fishing*

Globally fish catch has been declining and the impact can be felt by various communities close to coastal areas and water bodies (FAO, 2010). For example 32% of the world's fisheries areoverexploited, depleted or recovering while 53% are fully exploited. It is also on record that about 30% of all capture fisheries production that constitute most top tenmarine fish catch are either exploited or overexploited. In addition to this danger, many relevant commercial fish species are threatened to extinction (Worm, Barbier,Beaumont, Duffy,Folke,Harlpernet. al., 2006). This situation can be arrested through sustainable fishing.

In order for humans to survive fishing activities need to be encouraged. However, human development activities deplete and degrade fish environments (Redcliff, 2005). Hillborn (2005) distinguishes three ways by which sustainable fishing could be defined. First, sustainable fishing is viewed as a near steady state activitywhere nature is undisturbed such that yield changes little in the long term. In this situation there is enough relative time for natural replenishment so that future harvest, both quality and quantity is not compromised.

Second, sustainable fishing is considered as fishing activity where the intrinsic integrity of the ecosystem is maintained. In this direction sustainable fishing looks at a situation where multiple fish species could be rotated though there is depletion of individual stocks. In this context, sustainable fishing can be achieved in spite of the fact that someparticular fishspecies could be extinct or depleted. Biological, social and economic systems are therefore maintained.

Thirdly, sustainable fishing can be seen as fishing activity which does ensure the preservation of intergenerational equity. In the opinion of Hillborn (2005) sustainable fishing does not destroy the genetic structure, damage habitat or deplete stock levels such that there is the difficulty of rebuilding within a single generation. This is the most widely accepted definition.

Ensuring sustainable fishing requires measures suchas conservation by allowing both fishing occupation and aquatic ecosystems and their biodiversity to coexist (Knapp, Roheim& Anderson, 2007). However, conservation faces many challenges. Among these challenges are over fishing, habitat modification and pollution.

Hilborn (2005) defines overfishing as harvesting so many fish that the yield is less than it would be if fishing were reduced. Overfishing can precede severe stock depletion and lead to the collapse of fishing activities (Ludwig, Hilborn& Walter, 1993).

Habitat modification may result from fishing techniques used in fishing. For example, bottom trawls, dredgesand nets are continually dragged over the surfaces of aquatic shelves and slopes, underwater ridges and mounts, flatteringaquatic diversity in benthic habitats (Watling, 2005). Pollution including siltation may also negatively affect lagoon beds thus modifying fish stock habitats.

A recent survey shows that human development has impacted negatively on 41 percent of all parts of fishing grounds. The study further indicated that these fouling effects are caused by human polluted runoff, overfishing and other abuses (Benjamin, Walbridge, Selkoe, Kappel, Micheli, Agrosa, et al, 2008).The study concluded that because pollution is built into the economic systems which humans depend on and are generated from various sources, it has been difficult to fix pollution problems. Pollution among other environmental stressors may therefore affect over 75% of global fishing sources (Nellemann, Hain& Alder, 2008; New York Times, 2008).

According to Fred (2006) aquatic pollution is one of the recent causes of unprecedented reductions in fish communities in addition to overfishing. Though targeting one particular species, as occurs in the Fosu lagoon,could result in overfishing and subsequent depletion of that specie, fishing is not the only factor that may affect changes to aquatic life in this environment but rather pollution as well.

## 3. Research methodology

The respondents to the study were fishermen who fish in the Fosu lagoon. They were found to be located in various suburbs in the metropolis. These were Siwdo, Ayidan, Ekon, Bakaano and Adisadel.While 43.3 percent resided in Siwdo, 30% resided in Bakaano. Thus 73.3 percent stayedless than a kilometer from the lagoon. Other parameters considered include age, highest educational attainment, gender, monthly income and years of fishing. Sixty-twofishermen participated in the study. The response rate was 96.8%.The purposive and snowball sampling methods were employed as sampling techniques. Questionnaire was used to solicit information from the respondents. Both open and closed-ended questions were posed. The Rickett scale was used for the close-ended questions. The views of respondents were assessed in terms of their perception on lagoon contamination and pollution, overfishing of fish stock in general and depletion of tilapia stock in particular as well as fish habitat destruction. In few instances unstructured interviews were employed to supplement the main instrument in order to clarify issues for better understanding and explanation. The SPSS software program wasused to analyze data using the descriptive statistics technique. Strongly agree and agree perceptions were considered as high; uncertain as medium; and disagree and strongly disagree considered as low.

## 4. Results and Discussion

Age distribution among respondents indicated that 50% were between 40 and 49 years while 30% were in the 30 and 39 year group. Thirteen percent belonged to the 50-59 year group. Thus the most productive population constituted 80 % of the respondent population. All respondents were males. Over 93percent were between the ages of 30 and 59. The mean and modal ages were 43 and 49 years respectively. Thus majority of respondents were matured enough to assess the state of the lagoon in terms of pollution, overfishing, fish stock depletion and habitat destruction.

Seventy percent respondents had basic education as the highest educational background. Monthly income ranged between GH¢ 60 and GH¢ 450.00. Over 70 percent received less than GH¢ 100.00 per month, 23 percent received between GH¢ 103 and GH¢ 450 as monthly income. The modal and mean monthly incomes were GH¢ 60.50 and GH¢ 84.42 respectively.

Distribution of period of stay in the study area gave a considerable variation. Ranging between 22and 70 years, 80 percent had stayed in the area between 30 and 59 years. Mean and modal years of stay were 40.7 and 42 respectively. Fifty percent of respondents had practiced fishing in the lagoon between 20 and 29 years. Majority (about 83 percent) had fished in the lagoon in the range of 20 and39. Years of fishing ranged between 15 and 66 years. Mean and modal years of fishing were 31.7 and 27.5 years respectively. Thus respondents had fished in the lagoon for so long periods that they could be better assess the condition of the lagoon in terms of pollution, stock depletion and overfishing as well as habitat destruction.

Considering the perception of fishermen on fish depletion over 68 percent of respondents were of the view that fish are getting depleted in the lagoon. While 8.3 percent were uncertain, 23.3 thought otherwise. Those who were in support of lagoon depletion gave reduction in quantity of fish catch now-a -days as reasons. They were of the view that reduction in rainfall pattern (50 percent), reduction in lagoon area (11.7%) and increase in fishermen (6.75%) were the causes of fish depletion (refer figure. 2).

Over 86 percent of respondents were of the opinion that fish size had reduced over the years. Only 8.3 percent disagreed. Respondents gave reasons that they had been observing reduction in fish size over the years. Reasons given include not giving enough time for fish to grow (41.7%), increase in fishermen population, (10%) and reduction in rainfall pattern (35%) (Refer figure 1).

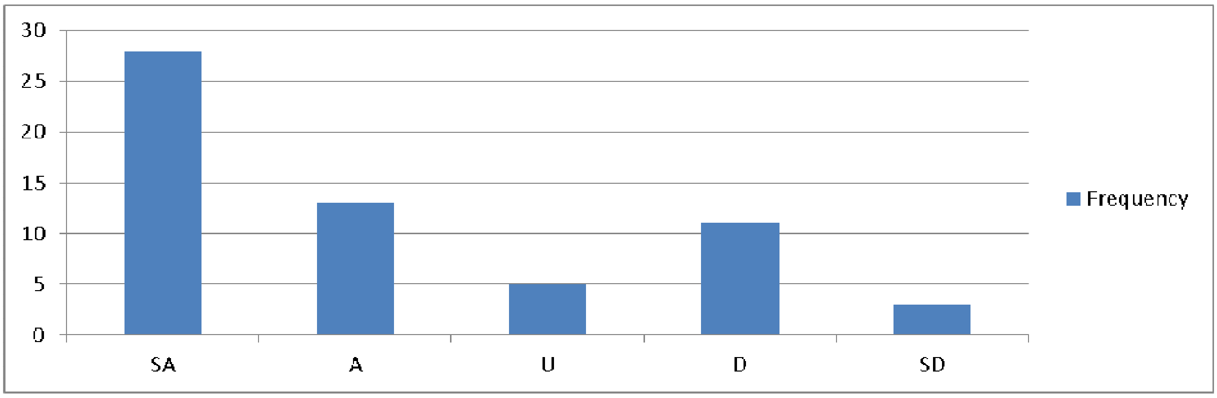


Figure 1: Perception on fish depletion (Source: Field data, 2012)

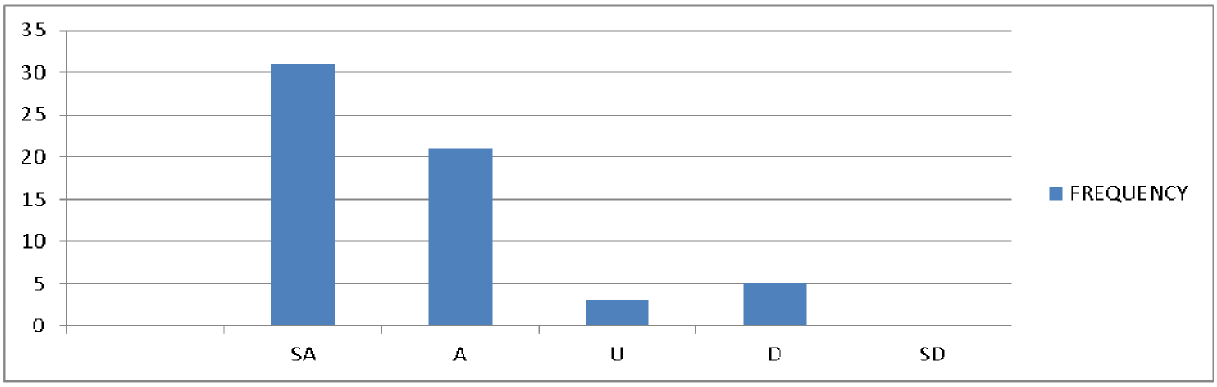


Figure 2: Perception on tilapia fish size reduction (Source: Field data, 2012)

Figures 2 and 3 show the frequency distribution of responses of respondents in terms of depletion of tilapia stock and tilapia size reduction respectively. Tilapia constitutes over 90 percent of fish catch in the lagoon according to the fishermen. Depletion of tilapia will therefore have serious economic consequences on the fishermen. Majority of respondents were of the opinion that tilapia stock is getting depleted and that its size has greatly reduced over the last thirty years or so. Averagely, Seventy five percent of respondents perceived that tilapia size and stock has greatly reduced over the years. However an average of 11.7 percent of the respondents disagreed. Reasons given were that there was not enough time for the fish to grow (25 %), change in rainfall pattern (41.7%) and (3.3%) undecided. In comparison with perception on general fish reduction, fewer agreed that tilapia stock is getting depleted.

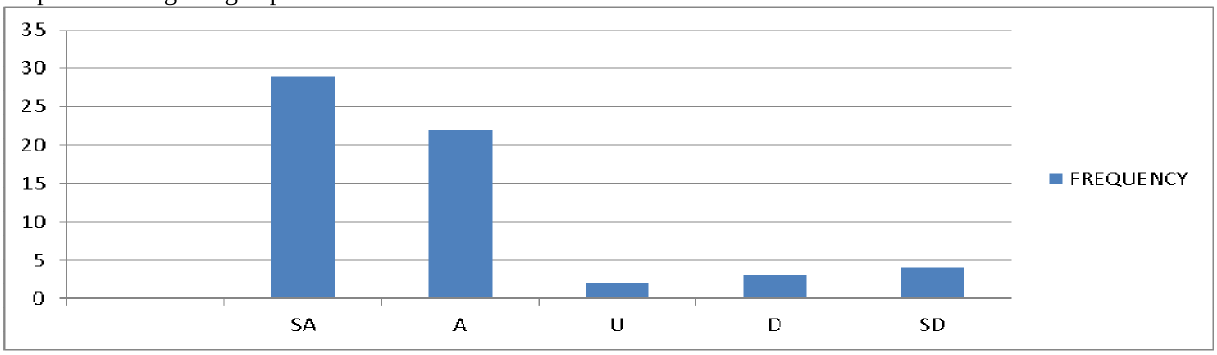


Figure 3: Perception on depletion of tilapia stock (Source: Field data, 2012)

Figure 4 also shows the distribution of fishermen's perception on over fishing. The assumption is that depletion is solely caused by fishermen's fishing activity and not pollution. Ninety four percent of respondents agreed that overfishing was caused by their activities alone. They agreed that reduction in fish catch and reduction in fish size particularly few months before the Fetu festival were indication of over fishing (refer figure 10). According to the respondents, fish catch and fish size increase after the one month fishing banin the lagoon is lifted.

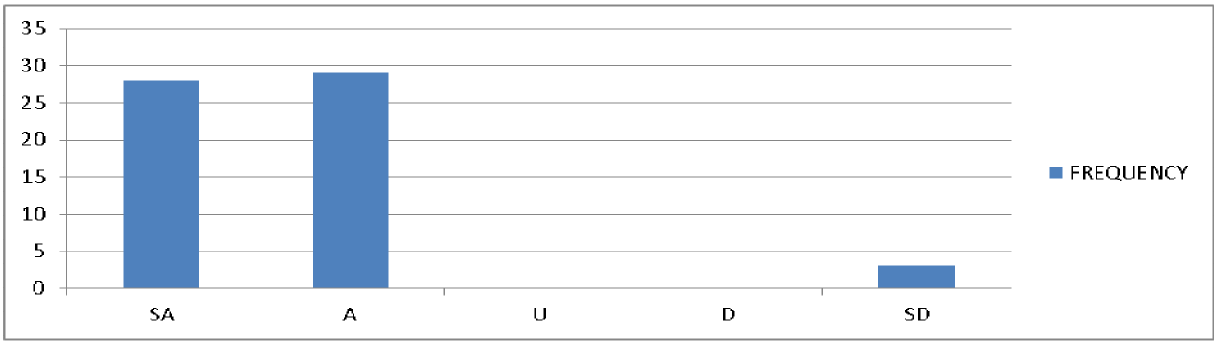


Figure 4: Perception on overfishing (Source: Field data, 2012)

Majority of the respondents had low perception when asked of their perception on lagoon pollution (86.7%). Only 5 percent agreed, while 8.3 percent were uncertain. They agreed that polythene, plastic materials, metal scraps could be found in the lagoon. They also gave reasons as runoffs and drains leading into the lagoon (refer figure 5). This is in agreement with the findings of Kendie (1997).

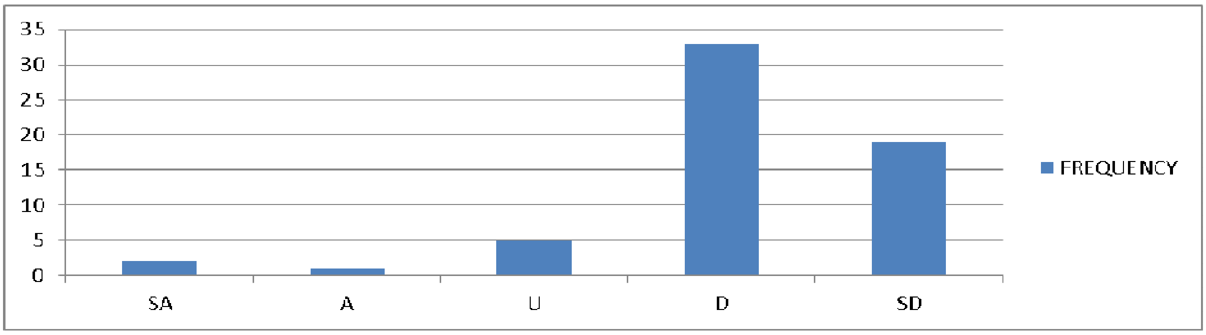


Figure 5: Perception on lagoon pollution (Source: Field data, 2012)

Considering the perception on lagoon contamination, 61.7 percent respondents thought that the lagoon was contaminated while 20 percent thought otherwise. 18.3 percent were uncertain. According to the respondents, polythene sacks, metal scraps and oils found in the lagoon, as a result of closeness to the Siwdo garages and workshops, as well as lagoon acting as sink to gutters and drainage systems from the municipality,were the reasons to their perception. This is in agreement with research findings by Kendie (1997). For those who had low perception (20 percent), materials found in the lagoon could not pollute any of the lagoon elements. Low educational background and ignorance could be the reasons for this perception (refer figure 6 and figure 9).

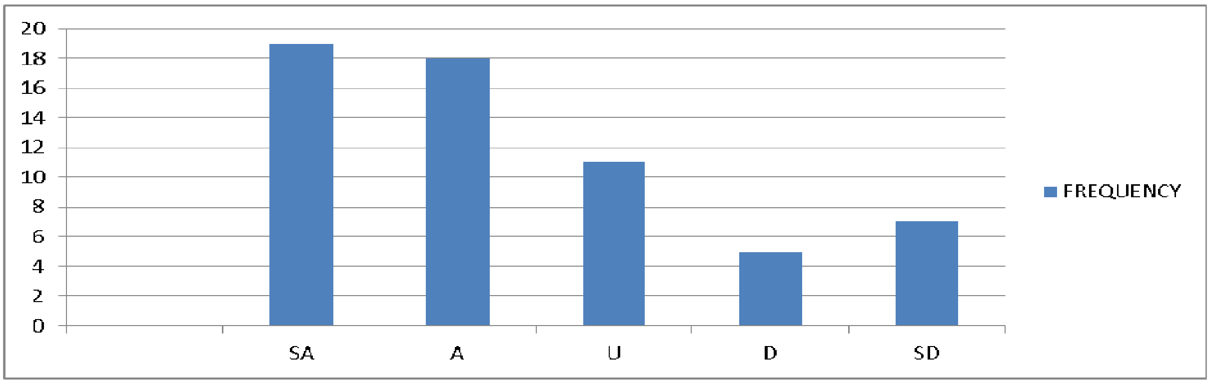


Figure 6: Perception on lagoon contamination (Source: Field data, 2012)

Majority of the respondents were of the opinion that pollution, if any, had no effect on fish stock depletion and fish size reduction. Only 13.3 percent had high perception in this regard with 35 percent being uncertain. Low level of educational background appears to be the main factor to this distribution. Fifty percent of respondents had low perception in this regard (refer figure 7).

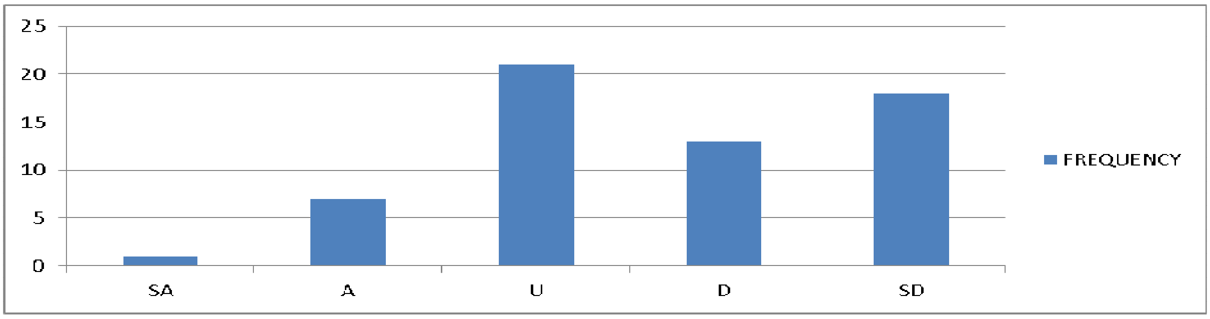


Figure 7: Perception on depletion and fish size reduction from pollution (Source: Field data, 2012)

Forty percent of the respondents did not perceive that pollution could bring about destruction of fish habitat, which is the lagoon. Fifty two percent were uncertain though they contended that it could be possible. However they were not certain of the consequences of pollution on fish habitat. They had no idea that there could be a relationship. This might also be due to illiteracy, low educational background and ignorance (refer figure 8).

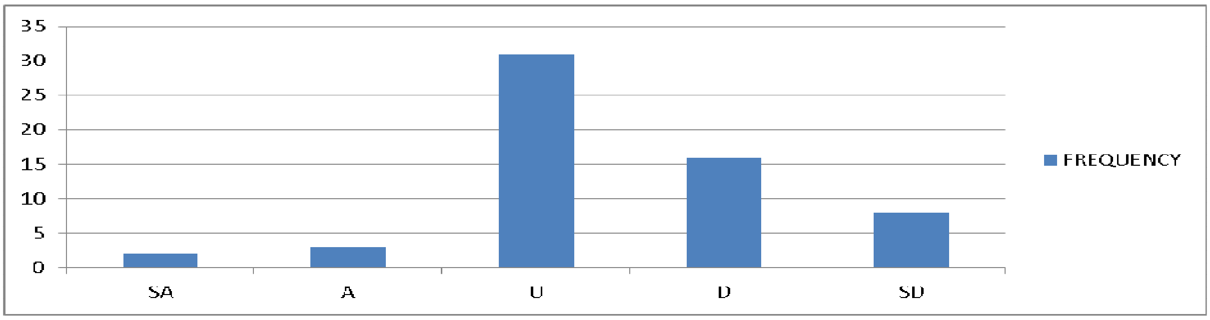


Figure 8: Perception on habitat destruction from pollution (Source: Field data, 2012)

## 5. Conclusion and recommendations

Table 1 is a summary of the results. Figure 9 shows the relationship between perceptions on fish stock depletion, fish size reduction, depletion of tilapia stock and overfishing in the lagoon. The respondents largely agreed that there was fish stock depletion in the lagoon. Perception on general fish stock depletion appeared to increase as perceptions on tilapia stock depletion, tilapia size reduction and overfishing in the lagoon also increased.

Table 1: Summary of responseson perceptions (Field data, 2012)

| Scoring statement | SA(%) | A(%) | U(%) | D(%) | SD(%) | TOTAL FREQ.(%) |
|---|---|---|---|---|---|---|
| General fish depletion | 28(46.7) | 13(21.7) | 5(8.3) | 11(18.3) | 3(5) | 60(100) |
| Tilapia fish size reduction | 31(51.7) | 21(35) | 3(5) | 5(8.3) | 0(0) | 60(100) |
| Depletion of tilapia stock | 29(48.3) | 22(36.7) | 2(3.3) | 3(5) | 4(6.7) | 60(100) |
| Overfishing | 28(46.3) | 29(48.3) | 0(0) | 0(0) | 3(5) | 60(100) |
| Lagoon pollution | 2(3.7) | 1(1.7) | 5(8.3) | 33(55) | 19(31.7) | 60(100) |
| lagoon contamination | 19(31.7) | 18(30) | 11(18.3) | 5(8.3) | 7(11.7) | 60(100) |
| Fish depletion and size reduction vrs pollution | 1(1.7) | 7(11.7) | 21(35 | 13(21.7) | 18(30) | 60(100) |
| Habitat destruction vrs pollution | 2(3.3) | 3(5) | 31(51.7) | 16(26.7) | 8(13.3) | 60(100) |

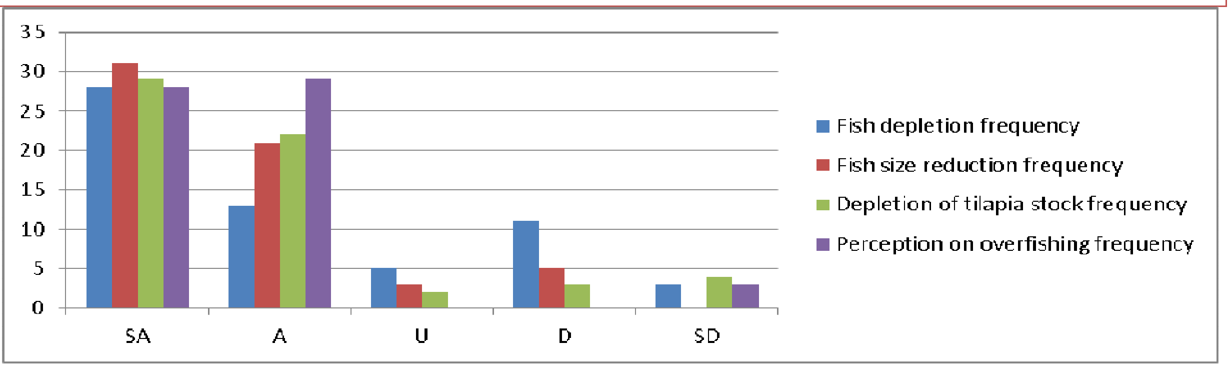


Figure 9: Perceptions on fish depletion, fish size reduction, tilapia stock depletion and over fishing (Source: Field data, 2012)

Figure 10 indicates the relationship between responses of lagoon pollution and lagoon contamination; as perception on lagoon contamination increased, perception on lagoon pollution appeared to decrease.Thus thoughrespondents were of the view that the lagoon was contaminated, they disagreed that it was polluted.

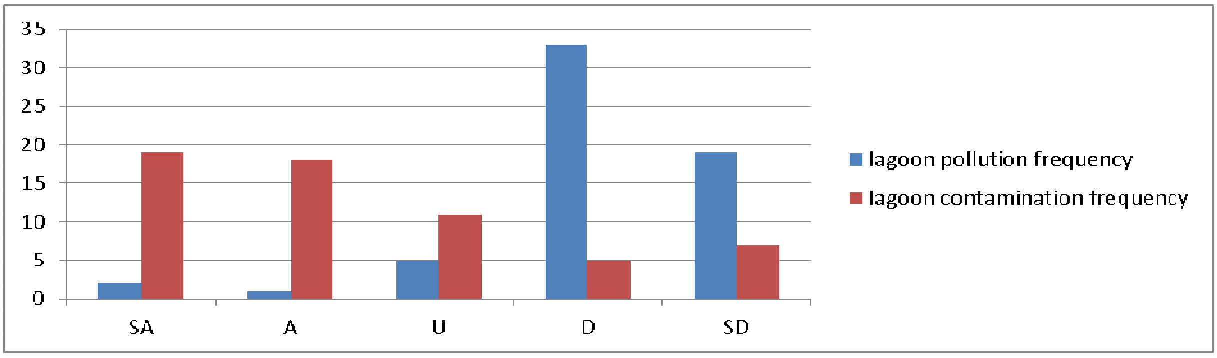


Figure 10: Perceptions on lagoon pollution and lagoon contamination (Source: Field data, 2012)

Figure 11shows a graphic picture of the views of respondents in terms of fish-size reduction and habitat destruction. Respondents were of the opinion that though tilapia size and stock had reduced, this was not caused by habitat destruction.Fishermen perceivedthat fish stock in general and tilapia in particular in the Fosu Lagoon is being depleted.Fishermen also perceived that size of fish caught had reduced over the last 10 to 30 years.They were of the view that there wasrelative overfishing by fishermen in the lagoon.The Fishermen contended that though lagoon elements might be contaminated they were not polluted.This opinion might be due to ignorance and illiteracy. Fishermen thought that the lagoon is not yet polluted to cause fish stock depletion, fish size reduction and fish habitat destruction. They were however of the view that fishing activities in the lagoon was not sustainable.They were also of the view that, change in rainfall pattern, resulting from climate change,reduction in lagoon area and overfishing were thecontributing factors of unsustainable fishing in the lagoon.

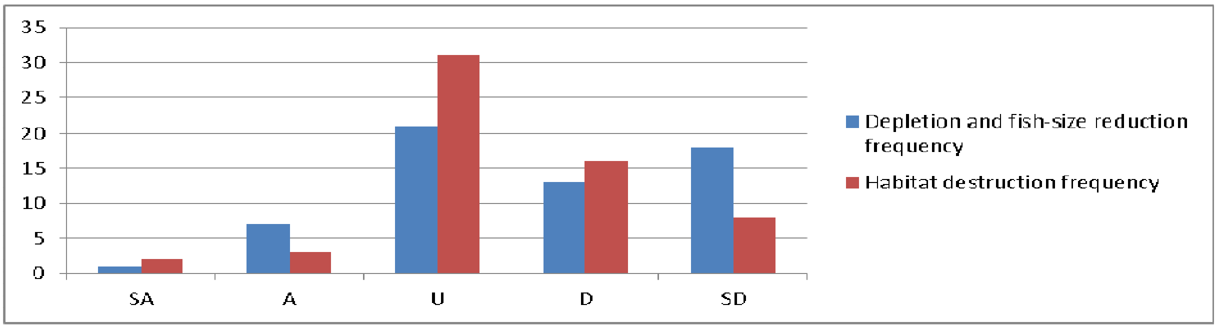


Figure 11: Perceptions on tilapia size reduction and fish depletion, and habitat destruction (Source: Field data, 2012)

There is the need to educate fishermen on the effects of pollution on fish size reduction, fish depletion, and habitat destruction.A primary reservoir should be built to contain run offs from drains and gutters leading to the lagoon. This should be treated before finally discharged into the lagoon. As the major singular source of pollution, the relocation on the Siwdo workshops and garages (Kendie, 1997) should be fast tracked while avoiding pollution translation whereby the source of pollution might be transferred from one location to another to produce the same environmental problems in the long term. The bare land shouldthen be afforested to protect the lagoon. Discharges and effluents from other sources such as St. Augustine's college, Metropolitan Hospital at Ola and Metro Mass transport workshop should also be treated before discharging into the lagoon.

Waste disposal sites at Esuekyir, Nkanfoa and Adisadel must be relocated. The new sites must be designed with new technologies (Mensah, 1997)to prevent pollution translation.Dredging the lagoon could go a long way to ensure sustainable fishing (Kendie, 1997). Over ninety percent of the respondents were not in support of such a project. They were of the view that stopping fishing for a minimum of 18 months will result in abject penury and depravation. Family health and life, and children's education could be seriously affected. There is therefore the need for intensive persuasion and education in this regard before commencing such a project.

In the view of Armah,Yawson, Pappoe&Afrifa(2009), involving all stakeholders in decision-making regarding management and conservation of the lagoon will help restore and replenish fish stock in the lagoon. He contended that tapping the expertise of these stakeholders shall motivate them to contribute their quota in lagoon fish utilization.

Introducing fish farming after the dredging process would go a long way to support fishing activities. Mangrove restoration in the Fosu lagoon wetland region could help sustain fish stock in the lagoon(Darkwa&Sardon, 2010). Introduction of policies and lawswith the help of metropolitan authority, the traditional council and the Environmental Protection Agency among other related stakeholders could reduce pollution and also encourage sustainable fishing in the lagoon. The metropolitan assembly should ensure that laws are made to enforce these measures. Applying the technologies indicated abovewith the right rules and regulations (Romer, 1990) by the Oguaa (Cape Coast) traditional council couldalso sustain fishing activities in the lagoon. For example, the one month annual ban of fishing that precedes the *fetu* festival could be extended to two months. On the other hand, introducing a one month semi-annual ban of fishing could help sustain fishing in the Fosulagoon.

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