



بسم الله الرحمن الرحيم



Sudan University of Science and Technology
College Of Graduate Studies

**Impact of Fish Introduction in Al Rahad Turda - North Kordofan - on
Local Communities Development**

أثر إدخال الأسماك في ترده الرهد - شمال كردفان - علي تنمية المجتمعات المحلية

A Dissertation Submitted in Partial Fulfillment of the Requirement for
the Degree of Master of Fish Science and Technology

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Dedication

To the soul of My Late Father, , , ,

To My Mother, , , ,

To My family, , , ,

To My Friends and all colleagues, , , ,

ACKNOWLEDGMENT

First, I thank ALLA who gave me the aptitude and patience to conduct and finish this study.

I am sincerely grateful to Prof. Tamador- Elkhansaa Elnour Angara
For her supervision, continuous support, help and kindness.

My deep thanks are due to the staff of Ministry of Aquiculture and Animal resources-Al Rahad locality. Thanks for all local communities of Al Rahad and communities around Al Rahad.

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Abstract

The present study was conducted at Al Rahad Turda North Kordofan State. The main target of this study was to investigate the impact of fish introduction in Al Rahad turda on the development of the local community mainly the impact on the fisher men and fishing activity, the impact on market mediators and fish marketing and to study the impact on fish consumption .For data collection three questionnaires were designed for fishermen, market mediators and final consumers. Descriptive as well as analytical statistics was employed to analyzes the data. The study revealed that fish introduction had significant impact ($P < 0.05$) on fishermen and fishing activity .The number of the fishermen increased after introduction of fish Practicing fishing in the turda is back dated to more than 20 years but recently large number of people (60%) started their fishing activities in than seven years. New site of fishing namely Samaha was created which encompasses more that 50% of the fishermen. Fish introduction acted to generate more job opportunity especially for those of low education and youth mostly of the age group (21-30) year. The daily income of the fishermen increased significantly. Based on chi square test there is significant ($p < 0.05$) change in all aspect of the fishing activity studied before and after fish introduction with the exception of the type and ownership of fishing crafts ($p > 0.05$). With the exception of the age of market mediator , income, season of fishing and the problem encountered in fish marketing ($P < 0.05$) , there was no significant difference in the variables studied before and after introduction($P > 0.05$) .Regarding fish consumption all of the variable studied showed significant differences ($p < 0.05$) before and after fish introduction. After introduction demand to fish became inelastic.

They consumers conceive that eating fish is good for health, reduces the incidence of diseases and reduces iodine and protein deficiency. The Surrounding Communities were positively impacted by fish introduction new activities and business emerges .The study concluded that a fish introduction acted to develop the local communities including fishermen and consumers .

ملخص البحث

أجريت هذه الدراسة في مدينة الرهد ' ولاية شمال كردفان . هدفت هذه الدراسة لمعرفة وتقييم أثر إدخال الأسماك بتردة الرهد في تنمية المجتمعات المحلية، وأثرها علي الصيادين، نشاطات الصيد ، تجار الاسماك، تسويق الاسماك وعلی مجتمع المستهلكين.أستخدم الاستبيان لجمع المعلومات من الصيادين وتجار الاسماك والمستهلكين. استخدم الاحصاء الوصفي لتحليل بيانات الاستبيان (التكرار، النسبة المئوية والمربع اللاتيني) باستخدام برنامج التحليل الإحصائي (spss). توصلت هذه الدراسة ان إدخال الأسماك ذو أثر معنوي ($P < 0.05$) علي صيادي الاسماك ونشاطات الصيد . إزداد عدد الصيادين بعد إدخال الأسماك ، حيث ممارسه الصيد بالترده منذ أكثر من 20 عام ماضي ,لوحظ مؤخرًا نسبة (60%) من الصيادين بدأ مهنة الصيد قبل 7 سنوات.

مشروع سماحة أكثر المشاريع تجمع للصيادين (50%) من الصيادين. أدى إدخال الأسماك إتاحة فرص للعمل لغير المتعلمين والشباب الذين تتراوح اعمارهم بين (12-30) سنه . إزداد الدخل اليومي للصيد بشكل ملحوظ . إعتاداً علي المربع اللاتيني وجد فرق معنوي ($p < 0.05$) قبل وبعد إدخال الاسماك في جميع أنشطة الصيد وعدم وجود فرق معنوي في نوع وملكية وسيلة الصيد ($p > 0.05$). ماعدا اعمار تجار الأسماك ,الدخل , موسم الصيد والمشاكل التي تواجههم في مهنة تسويق الاسماك ($P < 0.05$) لا توجد فروق معنوية في مختلف متغيرات المدرسة قبل وبعد الإدخال ($P > 0.05$). فيما يتعلق بمستهلكي الأسماك كل المتغيرات المدرسة ذات فرق معنوي قبل وبعد الإنزال ($p < 0.05$). بعد ادخال الأسماك أصبح الطلب علي الأسماك غير مرن . يرى او يعتقد المستهلكين ان تناول الأسماك جيد للصحة ، يقلل من الإصابة بالأمراض ، يقلل من نقص اليود والبروتين الحيواني .تأثر محيط المجتمعات ايجابياادخال الاسماك حيث الأنشطة الجديدة والتجارة الواضحة .لخصت هذه الدراسة إن ادخال الأسماك ادي الي تنميه المجتمعات شملت مجتمع صيادي الاسماك والمستهلكين .

CHAPTER ONE

1. INTRODUCTION

1.1. Background

According to FAO (2000) capture fisheries and aquaculture have acquired significant importance in food security and income generation worldwide. The small water bodies constitute potential assets for fisheries development. There is a strong justification for improvement in fisheries and fisheries management in the small water bodies as they provide job opportunities in coastal, inland and rural areas, which are often viewed as economically and socially undeveloped. Therefore, fishing activities are usually considered as job providing opportunities available to local natives.

All over the world there is growing concern for rural community development; this requires national management of capture fisheries and aquaculture in terms of large scale production. However the small scale fisheries need much attention for development and sustainability for improving and sustaining the social welfare of the people. Salih (2007) mentioned that there are two main sectors of natural fisheries of Sudan; the inland fisheries (fresh water fisheries) and the marine fisheries of the Red Sea. In addition to that Sudan has a huge number of small water bodies including reservoirs, lakes, small ponds, canals, irrigation canals, swamps, and natural depressions or excavations in which rain water collects, These assets would form a solid basis for production of fish to substantiate protein diet of the local inhabitants. El Rahad Turda is one of the most important water bodies in North Kordofan. Its water surface is of 14 km long and 3 km wide with an average depth of 4 meters and a storage capacity of 64 million m³, it fed by creek Umm Tagrgar, Algeueser, Umm bagara and Abu Habil in the fall season. Beside water the turda supplies Al Rahad locality with satisfactory fish resources Ministry of Agriculture and Animal Resources (MAAR), (2017). Prior to fish introduction in 2010, it has been observed that presence of Nile Tilapia *Oreochromis niloticus* (Bolte) fish in small sizes together with *Hetrotis SP* (Um kuro) fish and the lack of

other species *Lates niloticus* (Alegeel), *Clarias gariepinus* (Algarmoot) and *Bagrus baged* (Albayad).

The turda had been subjected to overfishing as a result of the use of inappropriate fishing and mosquito nets. Fishermen are not organized in associations and fishing was considered a secondary profession whereas fish is sold at low prices only inside the city.

In 2010 Western Sudan Resource Management Program (IFAD) introduced 33,000 fish, of *Oreochromis niloticus*, *Lates niloticus*, *Clarias gariepinus* and *Bagrus baged* in Al Rahad Turda. The fishermen were assembled in a registered cooperative association of 61 fishermen and the election of an executive office of 15 members to run the association. A total of 15 fishermen were trained in the center of Al shagara to train the rest of the fishermen on fishing methods and legal nets making and fish marketing.

A local order was issued to regulate the practice of fishing, and the work of an enlightening workshop for fishermen to organize and explain fishing regulations with the supervision and periodic follow-up of specialized technical departments. The overall production of Al-Rahad Turda in 2013 reached about 306.5 tons. Worth mentioning that the total fish stocks are estimated at about 1000 tons / per year, i.e. the utilization of the available resource is about 30% (MAAR2017).

1.2. Statement of the Problem

The aim of Western Sudan Resource Management Program (IFAD) in introducing different spp of fish to Al Rahad turda was to make use of the available natural resources to develop the local communities. To what extend this aim was achieved? The answer to this question remains unidentified although it is necessary to evaluate the experience of fish introduction and to assess the impact of this experience on the local community. This is the concern of the current research.

1.3. Importance of the Research

The results of this research will provide information about the of fish introduction in El Rahad Turda, and the impact on the local communities, the lessons learnt from the experience will act as base on which other project can benefit from.

1.4. Research Objectives

The main objective

To study the impact of fish introduction in Al Rahad turda on the development of the local community.

Specific objectives

1. To investigate the impact of the introduction on the fisher men and fishing activity.
2. To know the effects of the introduction on market mediators and fish marketing.
3. To study the effects of the introduction on fish consumption.
4. To know the problems encountered before and after fish introduction.

1.5. Research Hypotheses

1. There are significant changes in the characteristics of the fishermen as well as development in fishing activity after introduction of fish.
2. Fish marketing process experienced improvement.

3. After introduction demand to fish increased and consumer taste changed toward fish consumption.

4. There are more problems encountered in fishing and fish marketing after introduction of fish.

1.6. Research Layout

Chapter one: introductory chapter containing background, statement of the problem, research objective, research Hypotheses time and place of the research and research layout.

Chapter two: Displays the theoretical aspect of the subject in question.

Chapter three: Describes the study area and the methodology of the research.

Chapter four: Displays the results obtained and their discussion.

Chapter five: Provides the conclusion drawn and the commendation set by the research.

CHAPTER TWO

2. LITERATURE REVIEW

2.1. The Importance of Fish

Fish plays a vital role in feeding the world's population and contributing significantly to the dietary protein intake of hundreds of millions of the populace on a global scale. Almost 16 percent of total average intake of animal protein was attributed to fish in 1998 (FAO, 2003). FAO fisheries report (2003) indicates that fish is very important in nutrition, as it provides vital nutrients and source of animal protein especially to the poor who are unable to purchase other more expensive sources such as beef, pork or chicken. The report estimated that capture fisheries feed about 17 million people at an average annual per capital consumption of 10 kg. Antonio and Akinwumi (1991) verified that fish allows for protein improved nutrition in that it has a high biological value in terms of higher protein retention in the body, higher protein assimilation as compared to other animal protein sources, low cholesterol content and one of the safest sources of animal protein. In developing countries, fish is a highly acceptable food that supplies as much as 40 percent of all animal protein availability of the countries where fish is the main source of animal protein. The poor spend proportionally more on fish than on meat or other sources of animal protein. Fish, as a source of "rich food for poor people", can play an important role in improving Africa's food security and nutritional status; more than 200 million Africans eat fish regularly. Fresh, but more often smoked, dried, or even as powder, fish is a critical source of dietary protein and micronutrients for many isolated communities in rural areas. Fish may also be the sole accessible and/or affordable source of animal protein for poor households in urban or peri-urban areas. Nutritionally, fish is therefore one

extremely important direct source of protein and micronutrients for millions of people in Africa. But fish also contribute indirectly to national food self-sufficiency through trade and exports. In equivalent terms, 50% of the low-income food deficit countries' import bill for food was paid in the year 2000 by receipts (Antonio and Akinwumi, 1991). Abigail et al.,(2016) pointed out 10 reasons that made the inland capture fisheries and aquaculture are important. These fisheries provide food for billions and livelihoods for millions of people worldwide. To individuals they provide (food security, economic security, empowerment), to society (cultural services, recreational services, human health and well-being, knowledge transfer and capacity building), and to the environment (ecosystem function and biodiversity, as aquatic “canaries”, the “green food” movement).

2.2. Small Water Body Fisheries and Development

Todaro and Smith (2011) define development as the process of that improve the quality of human lives and raise the people's levels of living, to assure self-esteem, and freedom. For them in economic terms, development means achieving sustainable rates of growth of per capita income to enable the nation to expand its output faster than the population. Economic development can be defined as “passage from lower to higher stage which implies change”. Charles P. Kindleberger and Bruce Herrick (1983) point out: “Economic development is generally defined to include improvements in material welfare especially for persons with the lowest incomes, the eradication of mass poverty with its correlates of illiteracy, disease and early death, changes in the composition of inputs and output that generally include shifts in the underlying structure of production away from agricultural towards industrial activities, the organization of the economy in such a way that productive employment is general among working age population rather than the situation of a privileged minority, and the correspondingly greater participation of broad based groups in making decision about the direction,

economic and otherwise, in which they should move their welfare”. ”. Charles P. Kindleberger,(1983) also added “an increase in the absolute size of annual production regardless of the size of the population, Fish production and marketing make significant contributions to economic growth, livelihood support and poverty alleviation in the country. So, farmer friendly fish culture is an economic activity of the rural people for augmenting their income, generating employment and ensuring food and nutritional security (Randhir, 1984). It also adds to the foreign exchange earnings of the country(Kumar , Anjani, 2004).Food and Agriculture Organization of the United Nations (FAO) define inland waters as lakes, rivers, streams, canals, reservoirs, and other land-locked waters (FAO 2014). Inland waters comprise approximately 0.01% of the total volume of water on earth (Stiassny, 1996). The small water bodies gain special importance in the developing world because of their unmistakable role in promoting fisheries development through mass participation of the local population (FAO, 2005). There are uncounted millions of multipurpose small water bodies around the globe which could contribute more importantly to food production if they were managed appropriately and in a way that is compatible with their other uses (ver heust, 1998). Fisheries in small water bodies complement those in large inland water or the sea; they provide an opportunity to increase food production in local areas. According to Bernacsek (1984) in Southern Africa, the potential fish yield from small water bodies and reservoirs is estimated to be between one to three million tons per year but are usually used for other purpose therefore they requires a multidisciplinary problem-solving approach in their management. Marshal and Maes (1995) mention that fishery resources in small water bodies, especially reservoirs built for water supply purposes seem generally to be a major priority, with a much great possibilities of enhancing fisheries in small water bodies than the largest one. A comparative study of small water bodies and reservoirs in seven

countries in three continents shows extreme variations in the contribution of small and medium sized water bodies to national fish production (Sugunan, 1997). Marshall and Maes (1995) studied the fisheries in small water bodies in Southern Africa and reported that the supply of fish is erratic in those areas which lack large water bodies and are otherwise distant from sources of fish. Some countries made a program to enhance fisheries in small water bodies i.e. “Zimbabwe”, by restocking dams that dried up during the severe drought of 1991-1992. Fishery, like many other farming practices, relies heavily on natural resources, such as water, land, seed and feed. Therefore, environmental interactions play a vital role in determining the aquaculture production (Jhingran, 1991). The need to address environmental interactions and various issues for the benefit of sustainable fishery development has been reiterated in several global inter-governmental conferences. Most of the world fishing areas have apparently reached their maximum potential for fisheries production, with the majority of stocks being fully exploited. Accordingly there is a bad need for substantial increase in total catch in the future. Contrary, aqua-cultural production has followed the opposite path. Starting from an insignificant total production, inland and marine aquaculture production has been growing at a remarkable rate, offsetting part of the reduction in ocean catch of fish (WHO, 2007).

2.3. Fishery Resources in Sudan

Although the fishery sector contribution to national income in Sudan is small (i.e. 0.4% of gross domestic product-GDP), fishing is the source of employment and livelihood for large communities (FAO, 2008). It is estimated that the sector provides employment to more than 12,000 full time fishers (Ali , 2000) supplying more than 60 thousand tons of fresh fish every year, 90% of which from inland waters (FAO, 2008). Inland waters of Sudan are inhabited with over 100 fish species in various localities in the country and the main inland fisheries are lakes

and reservoirs. Per capita fish consumption is currently estimated at 1.6 kg which is considered low compared to other parts of the world (FAO, 2008). However with current population growth rates of 2.6 per annum and very high urbanization patterns especially the influx to the capital city region it is predicted that demand for fish will rapidly over take current supplies placing pressure on fisheries ecosystems and hiking fish prices in the country. Prudent fisheries management is therefore of particular importance to fishing communities and the potential of fish consumption as an alternative high value animal protein in Sudan. There is evidence that fishery resources in Sudan in general is under serious pressure from over-fishing especially in Jebel Aolia Reservoir (JAR), which is the most adjacent and main supplier of fresh and processed fish to the capital city Khartoum and nearby sub-urban areas where there is high concentration of demand for fish. Local inhabitants who are highly dependent on fishing use destructive gears putting extreme pressure on the stock in the area (Fisheries Department, 2004; Ali, 2000; FAO, 2008; FAO, 1999). Important consequences of over-fishing include change in fish biodiversity as some species become rare or disappear. A decrease in sizes of commercial species as fish production has been observed in this area (FAD, 2004; FAO, 1999). A number of studies conducted in this area show that the size of *Alests spp. and Hydrocyns. spp.* has decreased from over 15 and 30 cm to 10 cm, respectively. *Protopterus senegalus* appeared from time to time and *citharinus scitharus* has never been seen for six years (Asma, 1985; FAO, 1999). Other problems associated with fish supplies from the JAR include the highly scattered fish introductions, lack of efficient transport and proper storage facilities and difficulty with enforcing regulation (Ali, 2000). This is aggravated by difficulties with modernization and mechanization of a largely subsistence fishery dependant on traditional technology (i.e. fishing gears and preservation and curing methods) (Ali 2000). In Sudan **AOAD (1981)** made an estimate of the yield of the small

water bodies in "Savanna belt" in both "Kordofan" and "Darfur" states as 258 tons/year, of which EL Rahad Truda accounts for over 46 % .

Table 2-1: Shows water bodies in Sudan

Lakes or dams	Production tons/year	Area (km ²) or Capacity million meter ³ (m ³)
El-RahadTurda	120	8 km ²
Wud el-Bagg dam	11	3.7m m ³
EL-Aunn dam	12	4 m.m ³
Lake Kaliuk	80	8 km ²
Murry Boura	12	4 m.m ³
Lake Sharro	-	-
Lake Cundi	20	2 km ²
Lake Anzeeli	-	-
Golo dam	3	1 m.m ³

Source:(Salih.M.A.A .2007)

There is evidence that fishery resources in Sudan in general is under serious pressure from over-fishing especially in the JAR, which is the most adjacent and main supplier of fresh and processed fish to the capital city Khartoum and nearby sub-urban areas where there is high concentration of demand for fish. Local inhabitants who are highly dependent on fishing use destructive gears putting extreme pressure on the stock in the area (Fisheries Department , 2004; Ali , 2000; FAO, 2008; FAO , 1999). Important consequences of over-fishing include change in fish biodiversity as some species become rare or disappear. A decrease in sizes of commercial species and fish production has been observed in this area (FAD, 2004; FAO ,1999). Other problems associated with fish supplies from the JAR

include the highly scattered fish introductions, lack of efficient transport and proper storage facilities and difficulty with enforcing regulation (Ali , 2000). This is aggravated by difficulties with modernization and mechanization of a largely subsistence fishery dependant on traditional technology (i.e. fishing gears and preservation and curing methods) (Ali , 2000).

Fishing in the JAR and in Sudan in general is regulated by issuing access licenses, ban of destructive gears and small mesh sizes. Licensed fishers also receive subsidies to help them overcome poverty conditions - a common practice in developing countries (Sterner 2003). However, it is believed that poor enforcement of fishery regulations in JAR is a major constraint to sustainable management of local fish resources (Aulia Regulation Unit 2004, FAO , 2008; FAO, 1999).

CHAPTER THREE

3. MATERIALS AND METHODS

3.1. The Study area

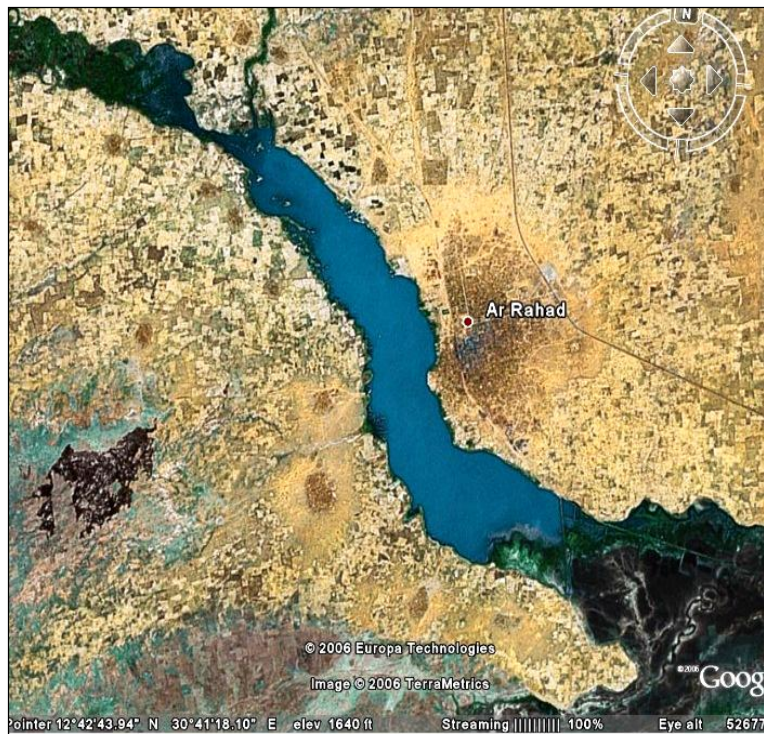
Al Rahad Locality is considered to be one of North Kordofan localities. Its geographical location adds to its strategic importance because, its a cross road conjunction linking numerous parts of Sudan, its capital (Al Rahad) represents a commercial center and it rich with a variety of natural resources iendowments. All the a foresaid facts make of it a place of strategic importance. Al-Rahad locality is located between longitudes of 18:30 and 21:31 degrees east and latitudes 45: 12 and 42:13 degrees north. From the north its adjacent to the locality of Um dm Haj Ahmed and the localities of south k kordofan south wise, its east border Um Rawaba locality and its westward Shekan locality. It has an area of about 6,320 km² and multiple climates and diverse agricultural environments. In the north there is a semi-desert climate and poor savannah in the center and rich Savannah in the south. The prevailing wind is the southwest wind blowing from April to October, also blows the northeastern wind.

The locality has a population of approximately (167838) thousands. Their major activity is agriculture, and the most important cash crops are (sesame, peanuts, chard, gum Arabic, cotton, maize, millet, and gardening). Most of the population relies on breeding livestock .**The Commercial activities** include oil-mills-soap factories, agencies and companies which are centers for buying, collecting, preparing and exporting cash crops outside the state. There are also many fuel stations.



Google: Sudan Political map.

Map (3-1) Al Rahad Locality



Map (3-2) Satellite image of EL Rahad Turda, North Kordofan (Sudan) 12° 42' N 30° 41' E. showing the sampling stations “1”, “2” and “3.

3.2. Sources of data collection: The data were collected from the secondary source plus the primary source.

3.2.1. The secondary data: Different sources were used to collect the secondary data, from the represent in scientific references, previous studies, publication, reports and the internet sites.

3.2.2. The primary data: These were collected by executing a field survey during the period from to march .2017. The survey included three populations the fisher men community, consumers community and mediators community in the Al Rahad locality

3.2.2.1. The type and size of the sample

A. A sample consisting of 100 the fisher men was selected using stratified random sample, where the fishermen were divided according to their site of work to eight places as shown in table (3-1).

Table 3-1: The number fishermen and fishing site in Al Rahad Turda

Site	Number	%
Market	18	18%
Samaha	10	10%
Alregela	39	39%
Wad alhende	6	6%
Alganobe	8	8%
Almarwaha	7	7%
Albarageet	4	4%
Alarabat	8	8%
Total	100	100%

B. The market mediators: The entire 14 market mediator were surveyed.

There were visited at their work locations as shown in table (3-2).

Table 3-2 The type and size of the sample of the market mediators

Site	Number	%
The main market	10	71.6
Samaha	1	7.1
Alganobe	1	7.1
Wad alhende	2	14.2
Total	14	100%

C. A Total of 35 persons were selected purposely to represents the different sectors of the consumer community .They were visited in house , market, turda and office.

3.2.3. The tools of the data collection

Three questionnaires were used to collect the data the three study populations. Direct interviews with the resource persons were also used to collect the required data. Also the Camera was used to document the researcher observations.

3.2.4. Time and place of the Research

The time limits: from Feb to April -2017.

The locative limits: Al Rahad Locality, south Kordofan State, Sudan.

3.3. The statistical analysis

Descriptive as well as analytical statistics were employed to analyzes the collected data where frequency, percentage cross tabulation and (chi-square) used. SPSS version 21is the program me which was use in the analysis.

CHAPTER FOUR

4. RESULTS AND DISCUSSION

This chapter is devoted to the presentation of the results obtained and their discussion

4.1. The Characteristics of the Fishermen

Table (4-1) presents the characteristics of the investigated fishermen .All of them (100%) are males mostly of the age group (21-30) year, about 78% are married. Primary educational level is the dominant one (58%). Fishing is the main job of 92% the investigated fishermen population and the family sizes are mostly (42%) of 7-9 persons.

Table (4-1) The characteristics of the fishermen

Character	Number	%
Gender	Male	100
	Female	00
	Total	100
Age	10-20	10
	21-30	34
	31-40	25
	41-50	26
	51-60	5
	Total	100
Educational level	Illiterate	17
	Khalwa	13
	Primary	58
	Secondary	11
	University	1
	Total	100
Main Job	Fishing	92
	Farmer	4
	Seller	4
	Total	100

Family size	1-3	7	7%
	4-6	40	40%
	7-9	42	42%
	10-12	8	8%
	13-15	3	3%
	Total	100	100%
Social status	Married	78	78%
	Un married	22	22%
	Total	100	100%
Belong to fish man society	Yes	54	54%
	No	46	46%
	Total	100	100%
Receiving training course	Yes	65	65%
	No	35	35%
	Total	100	100%
The training course about	fishing equipments	12	12%
	Methods of fishing	15	15%
	Fishing environment	8	8%
	All of the above	26	26%
	Total	61	61%

4.2. Description of the Fishing Activity

According to table (4-2) below there are eight fishing sites in Alrahad turda, with Samaha been the most popular one (50% of the fishermen are found in this site). Practicing fishing in the turda is back dated to more than 20 years but recently large number of people (60%) started their fishing activities in than seven years. Many types of fishing vehicles are used, namely wooden (Figure4.1) and iron (Figure4.2) boats and the dominant type is the traditional boat (Taroor) (Figure4.3). About 98% of the fishermen own their fishing vehicles and (62%) use seine nets (Figure 4.6).Fishing is practice all over the year with summer being the most active season where (62%) of the fishermen are actively operating.

Table (4-2) Description of the fishing activity

Character	Number	%	
The site of fish	Samaha	59	59%
	Wad alhende	10	10%
	Alganobe	9	9%
	Almarwaha	6	6%
	Albarageet	8	8%
	Alarabat	2	2%
	Almazlagan	4	4%
	Almashtal	2	2%
	Total	100	100%
Duration of fishing activity	1-3	35	35%
	4-6	25	25%
	7-9	12	12%
	10-12	9	9%
	13-15	12	12%
	16-18	3	3%
	19-21	2	2%
	22-24	2	2%
	Total	100	100%
	Type of fishing craft	Boat of wood	4
Boat of iron		2	2%
Traditional boat(Taroor)		94	94%
Total		100	100%
Ownership of the fishing craft			
	Self ownership	98	98%
	Rented	1	1%
	Partnership	1	1%
	Total	100	100%
Type of filaments			
	Thread like	25	25%

	Plastic	8	8%
	Seine net	62	62%
	Plasticity and Seine net	5	5%
	Total	100	100%
Season of fishing			
	Summer	62	62%
	Autumn	15	15%
	Winter	10	10%
	Winter and summer	4	4%
Number of day fishing/week			
	1	1	1%
	2	1	1%
	3	2	2%
	4	5	5%
	5	19	19%
	6	30	30%
	7	42	42%
	Total	100	100%
The daily income (SDG)			
	10-50	29	29%
	51-100	55	55%
	101-150	12	12%
	151-200	2	2%
	201-250	1	1%
	251-300	1	1%
	Total	100	100%
The problem encountered in fishing job	Fishing craft	30	30%
	Environment	1	1%
	Fish preservation	11	11%
	Transportation	17	17%
	All	32	32%
	Total	100	100%



Figure (4.1) Wooden Boat



Figure (4.2) Iron Boat



Figure (4.3) Traditional Boat (Taroor) made of Taroor

Nearly (98%) all of the fishermen own their fishing crafts. They used different types of nets, these include Thread like Figure (4.4), Plastic net Figure (4.5) and Seine net Figure (4.6) with the Seine net being the most popular one (more 62%). Fishing is practiced all over the year however; summer is season where fishing is more likely to be practice. Whereas, the job is mostly continue all over the week. The average daily income ranges between 10 to 300 SDG with the most common range is 51-100 SDG per day.



Figure (4.4) Thread like net



Figure (4 .5) Plastic net



Figure (4.6) Seine net

4. 3. The Economics of Fishing in Al Rahad Turda

According to table (4-3) most (45%) of fishermen spent 1200 Sudanese pound for establishing their fishing activity in term of capital investment cost about. It worth mentioning that they finance their business from their own resources and operate individually however, some of the fisher men (9%) operate in partnership. They sell their catch mainly to the market mediators and rarely to the final consumers.

Table (4- 3) the economics of fishing

item		Number	%
The capital investment cost	1200	45	45%
	1500	30	30%
	2000	19	19%
	4500	2	2%
	6000	2	2%
	6500	2	2%
	Total	100	100%
Source of capital			
	Self finance	91	91%
	Partner	9	9%
	Total	100	100%
Fish buyer			
	Market mediator	64	64%
	Final consumer	2	2%
	Both	34	34%
	Total	100	100%

4.4. The Impact of Fish Introduction on Fishermen

Table (4-4) provides a comparison between the characteristic of the fishermen before and after the introduction. Based on chi square test (appendix 4) apart from the gender (where fishermen are male before and after introduction no single

women practiced fishing in the study area) there is a significant difference ($P < 0.05$) in all the characters studies before and after introduction. Before introduction, for some people fishing was not the main job but after introduction all of the investigated individuals practice fishing as a main job. This indicates that the income generated from fishing is better than other job practiced before. Age wise before introduction fishing is a job of people older than 30 years after introduction the job become attractive to younger people even children were observed to practice fishing than means young, less educated people were able to

Table (4- 4) The characteristics of the fishermen before and after fish introduction

DESCRIPTION	Before introduction		After introduction		Total		P value
	No	%	No	%	No	%	
Main job							0.000
Seller	4	4	0	0	8	8	
Farmer	4	4	0	0	8	8	
Fisher man	26	26	66	66	92	92	
Total	34	34	66	66	100	100	
Gender							A
Male	34	34	66	66	100	100	
Female	0	0	0	0	0	0	
Total	34	34	66	66	100	100	
Age							0.000
10-20	0	0	10	10	10	10	
21-30	0	0	34	34	34	34	
31-40	3	3	22	22	25	25	
41-50	26	26	0	0	26	26	
51-60	5	5	0	0	5	5	
Total	34	34	66	66	100	100	
social status							0.000

Married	12	12	66	66	78	78	
Un married	22	22	0	0	22	22	
Total	34	34	66	66	100	100	
Size of family							0.000
1-3	0	0	7	7	7	7	
4-6	0	0	40	40	40	40	
7-9	24	24	19	19	43	43	
10-12	7	7	0	0	7	7	
13-15	3	3	0	0	3	3	
Total	34	34	66	66	100	100	
Educational level							
Illiterate	0	0	17	17	17	17	
Khalwa	0	0	13	13	13	13	
Primary	22	22	36	36	58	58	
Secondary	11	11	0	0	11	11	
University	1	1	0	0	1	1	
Total	34	34	66	66	100	100	

find job opportunity and get married this reflected the appearance of small family size after introduction. These findings come in agreement with FAO (2000) justification for improvement in fisheries and fisheries management in the small water bodies as they provide job opportunities.

4.5. The Impact of Fish Introduction on Fishing Activity around Al Rahad Turda

Table (4-5) presents the differences in the fishing activity before and after fish introduction. Based on chi square test there is significant ($p < 0.05$) change in all aspect studied with the exception of the type and ownership of fishing crafts ($p > 0.05$). After introduction a new fishing site was created namely Samaha where

more than half (59%) the studied population are operating a few percentage of the new fishermen are operating in Alganobe whereas those who used to practice fishing before introduction continued their operation in the traditional sites (almashtal, albarageet, wad alhende ,almazlagan ,almarwha, alarabat). The number of fishermen expands from 34 before introduction to 100 with 66 fishermen join the job after introduction.

Table (4-5) Description of the fishing activity before and after introduction

DESCRIPTION	before introduction		after introduction		Total		P
	No	%	No	%	No	%	
Site of fishing							
Samaha	0	0	59	59	59	59	0.000
Alganobe	2	2	7	7	9	9	
Almashtal	2	2	0	0	2	2	
Albarageet	8	8	0	0	8	8	
wad alhende	10	10	0	0	10	10	
Almazlagan	4	4	0	0	4	4	
Almarwha	6	6	0	0	6	6	
Alarabat	2	2	0	0	2	2	
Total	34	34	66	66	100	100	
Duration of the job							
1-7 year	0	0	66	66	66	66	0.000
8-20	29	29	0	0	29	29	
More than 20 year	5	5	0	0	5	5	
Total	34	34	66	66	100	100	
Fishing craft							
Boat of wood	0	0	4	4	4	4	0.193
Boat of ion	0	0	2	2	2	2	
Traditional boat(taroor)	34	34	60	60	100	100	
Total	34	34	66	66	100	100	
Ownership of the fishing craft							
Self owner ship	32	32	66	66	98	98	0.138
Rented	1	1	0	0	1	1	
Partner ship	1	1	0	0	1	1	
Total	34	34	66	66	100	100	
Type of filament used							
Thread like	0	0	25	25	25	25	0.000
Plasticity	0	0	8	8	8	8	
Seine net	29	29	33	33	58	58	
Plasticity and Seine net	5	5	0	0	5	5	

Total	34	34	66	66	100	100	
Season of fishing							0.000
Summer	0	0	62	62	62	62	
Autumns	11	11	4	4	15	15	
Winter	10	10	0	0	10	10	
Summer& autumn	4	4	0	0	4	4	
Summer & autumns	9	9	0	0	9	9	
Total	34	34	66	66	100	100	
Number of fishing days /week							0.000
1	0	0	1	1	1	1	
2	0	0	1	1	1	1	
3	0	0	2	2	2	2	
4	0	0	5	5	5	5	
5	0	0	19	19	19	19	
6	0	0	30	30	30	30	
7	34	34	8	8	42	42	
Total	34	34	57	57	100	100	
Capital investment							0.000
1200	0	0	45	45	45	45	
1500	21	21	21	21	42	42	
2000	9	9	0	0	9	9	
4500	2	2	0	0	2	2	
6000	2	2	0	0	2	2	
Total	34	34	66	66	100	100	
Source of capital							0.000
Self finance	9	9	66	66	75	75	
Partner	25	25	0	0	25	25	
Total	34	34	66	66	100	100	
Fish buyer							0.000
Market mediator	0	0	64	64	64	64	
Final consumer	34	34	2	2	36	36	
Total	34	34	66	66	100	100	
Short term preservation							0.000
Sac	21	21	66	66	87	87	
cooling box	7	7	0	0	7	7	
Net	6	6	0	0	6	6	
Total	34	34	66	66	100	100	
Long term preservation							0.000
Freezing	0	0	10	10	10	10	
Cooling	0	0	55	55	55	55	
Drying	23	23	1	1	24	24	
save in net	11	11	0	0	11	11	
Total	34	34	66	66	100	100	
Receiving training course							0.000
Yes	0	0	65	65	65	65	

No	34	34	1	1	35	35	
Total	34	34	66	66	100	100	
Benefit from the training course							0.000
Yes	-	-	61	61	61	61	
No	-	-	5	5	5	5	
Total	-	-	66	66	66	66	
Type of the training course							0.000
Fishing equipment	-	-	12	12	12	12	
Fishing methods	-	-	15	15	15	15	0.000
Fishing environment	-	-	8	8	8	8	
All of the above	-	-	31	31	31	31	
Total	-	-	66	66	66	66	
Belong to fisher men society							
Yes	0	0	54	54	54	54	0.000
No	34	34	12	12	46	46	
Total	34	34	66	66	100	100	
Belong to cooperation society							
Yes	0	0	21	21	21	21	0.000
No	34	34	45	45	79	79	
Total	34	34	66	66	100	100	
The problem encountered in fishing job							
Fishing craft	0	0	30	30	30	30	
Environment	0	0	10	10	10	10	
Save fish	0	0	11	11	11	11	
Transportation	2	2	15	15	17	17	
All of the above	32	32	0	0	32	32	
Total	34	34	66	66	100	100	0.000

Before introduction the traditional boats made of Taroor were the only type of fishing boats used in after introduction new types of boats made of wood and iron were introduced beside the traditional ones. Seine nets which were former used beside the plastic filament nets were completely prohibited after introduction because they have small mish size and replaced by the thread like nets. It worth mentioning that other traditional nets namely Umm kobok, Alsaryma and the Iron mish nets (Figure 4.7, 4.8 and 4 .9) had already been prohibited before introduction. Summer and winter were the main seasons of fishing before introduction meanwhile after introduction fishing is practice all over the year and

at different per week. The catch was sold to the final consumer before introduction and to both final consumer and the market mediators after introduction due to the large quantities and higher demand. Fishermen used to preserve fish for short term in sac and cooling boxes and nets (Figure 4.10, 4.11) and for long term preservation they use drying, and net before and after introduction in addition to freezing and cooling after introduction. The success achieved in fishing after introduction is partially due the training courses attended by the fishermen in different areas of fishing equipment, methods of fishing and fishing environment. Also fishermen were enrolled in different cooperative bodies which enlighten the fishermen with the laws and regulation of fishing and facilitate the access to fishing gears and support them in their livelihood. All these together acted to jump with the daily production from about 20 to 30 pound to 50 to 300 pound per day after introduction

From development prospective, socio- economically, there is a great change in the fishermen community after fish introduction; jobs were open to number of people youth and lower education levels were able to generate higher incomes, married and headed families and enrolled in cooperation society.

Technically fish introduction acted to build the capacity of the fishermen through training courses and also raised their awareness to preserve their fish resources by using suitable nets. These finding come in agreement with Charles P. and Bruce (1958) who pointed out to the improvements in material welfare for persons with the lowest incomes and with". Charles (1983) in the increase in the absolute size of annual production.



Figure (4.7) Umm kobok



Figure (4.8) Alsaryma



Figure (4.9) Iron mish net



Figure (4.10, 4. 11) carrying fish in sacs



Figure (4.12) chilling fish



Figure (4.13) preservation in cooling box

4.6 The Characteristics of the Market Mediators

Table (4.6) presents the characteristics of the investigated market mediators. Most of them (85.7%) are males of (41-50) year old, about 92.9% of them are married and they are mostly (42.9%) head families of 7-9 persons in sizes. Khalwa education level is the dominant one (50%). Selling fish is the main job of 57.1% the investigated market mediators. They earn monthly income ranging from 500 to 3000 with an average .

Table (4-6) The Characteristics of fish market mediators

Character	Number	%
Gender		
Male	12	85.7%
Female	2	14.3%
Total	14	100%
Age		
20-30	2	14.3%

31-40	1	7.1%
41-50	5	35.7%
51-60	4	28.6%
61-70	2	14.3%
total	14	100%
Education level		
	2	
Illiterate	7	14.3%
Khalwa	4	50%
Primary	1	28.6%
University	14	7.1%
Total		100%
Main job		
Seller of fish	8	57.1%
Seller	4	28.6%
Farmer	2	14.3%
Total	14	100%
Family size		
1-3	1	7.1%
4-6	2	14.3%
7-9	6	42.9%
10-12	2	14.3%
13-15	2	14.3%
16-18	1	1.7%
Total	14	100
Social status		
Married	13	92.9%
Un married	1	7.1%
Total	14	100%
Monthly income		
500-1000	2	14.3%
1001-1500	3	21.4%
1501-2000	3	21.4%
2001-2500	2	14.3%
2501-3000	4	28.6%
Total	14	100%

4.7. Description of the Fish Marketing Activity.

According to table (4-7) out of the 14 market mediator investigated there are 10 whole sellers and 4 retailers in market. About 12 (85.7%) of them receive the fish from fishermen. Most of them (78.6%) sell fish to final costumer. Two types of fish are sold in the market: Lates niloticus and Oreochromis niloticus. Oreochromis niloticus is of the prime preference (71.4%). Many marketing function are performed in the market, these include chilling, cleaning, storage and transportation with transportation being the most dominant (35.7%) fish marketing function. About 12 (85%) of seller use cooling to preserve the fish. The save of fish is most problems in marketing (35.1%). There are 11 market mediators work after introduction (78.7%).

Table (4-7) The description of the fish marketing activity

Description	Number	%
Role of the market mediators	10	71.6%
Whole sellers	4	28.4%
Relaters	14	100%
Total		
The source of fish		
Fisherman	12	85.7%
Whole sellers	2	14.3%
Total	14	100%
To whom they fish buys		
Final costumer	11	78.6%
Seller	3	21.6%
Total	14	100%
Type of fish sold		
Lates niloticus	4	28.6%
Oreochromis niloticus	10	71.4%
Total	14	100%
Fish marketing functions		
Transportation	5	35.7%
Cooling	2	14.3%
Cleaning	3	21.4%
Storing	4	28.6%

Total	14	100%
Preservation of fish		
Cooling	12	85%
Freezing	2	14.3%
Total	14	100%
The problem in marketing		
Fish preservation	5	35.1%
Space for selling	4	29.8%
No thing	5	35.1%
Total	14	100%
Number of mediators		
Before introduction	3	21.3%
After introduction	11	78.7%
Total	14	100%

4.8. The Impact of Introduction on Fish Marketing

Table (4-8) presents the impact of introduction on fish marketing. With the exception of the age of market mediator, high income season and the problem encountered in fish marketing ($P < 0.05$), there was no significant difference in the variables studied before and after introduction ($P > 0.05$) based on chi square test. Age wise more elder people tend to join fish marketing after introduction this may attributed to the fact that elder people have enough capital to invest in fish marketing. Although the fish market operates all over the year, yet the income generated in summer is much higher than the other seasons. This result consolidate our finding that there is significant different in the seasons of fishing with summer been the best one where fish usually tend to move towards the relatively cold water surface and hence easy to catch. There was a significant difference in the problems encountered in fish marketing before and after introduction, before introduction fish preservation was the only problem facing the market mediator whereas after introduction to find place for fish sell is another problem. This indicates that the market infrastructure is not so develop to meet the rising supply and demand for fish after introduction. Although there was no significant difference in fish

marketing functions before and after introduction, extra function were introduced namely cooling and cleaning and storing which is a sign of development when there is more marketing functions demanded.

Table (4-8) impact of fish introduction on fish marketing

Description	Before introduction		After introduction		Total		P
	No	%	No	%	No	%	
							0.425
Gender							
Male	3	21.4	9	64.3	12	85.7	
Female	0	0	2	14.3	2	14.3	
Total	3	21.4	11	78.6	14	100	
Age							0.000
20-30	1	9.1	1	9.1	2	18.2	
31-40	0	0	1	9.1	1	9.1	
41-50	2	18.2	3	27.3	5	35.7	
51-60	0	0	4	36.4	4	36.4	
61-70	0	0	2	18.2	2	18.2	
Total	3	27.3	11	73.7	14	100	
Main job							0.239
seller of fish	3	21.4	5	35.7	8	57.1	
Seller	0	0	4	28.6	4	28.6	
Farmer	0	0	2	14.3	2	14.3	
Total	3	21.4	11	78.6	14	100	
social status							0.588
Married	3	21.4	10	71.4	13	92.9	
Unmarried	0	0	1	7.1	1	7.1	
Total	3	21.4	11	78.6	14	100	
Family size							0.683
1-3	0	0	1	7.1	1	7.1	
4-6	1	7.1	1	7.1	2	14.3	
7-9	2	14.3	4	28.7	6	42.9	
10-12	0	0	2	14.3	2	14.3	
13-15	0	0	2	14.3	2	14.3	
16-18	0	0	1	7.1	1	7.1	
Total	3	21.4	11	78.6	14	100	
educational level							
Illiterate	1	9.1	1	9.1	2	18.2	

Khalwa	2	14.3	5	35.7	7	50	0.467
Primary	0	0	4	28.6	4	28.6	
Secondary	0	0	1	9.1	1	9.1	
Total	3	23.4	11	78.6	14	100	
Rat of in com/month							0.132
500-1000	1	9.1	1	9.1	2	18.2	
1001-1500	2	14.3	1	9.1	3	23.4	
1501-2000	0	0	3	23.4	3	23.4	
2001-2500	0	0	2	14.3	2	14.3	
2501-3000	0	0	4	28.6	4	28.6	
Total	3	32.4	11	78.6	14	100	
mediator role							0.331
Whole seller	3	21.4	7	50	10	71.	
Retailer	0	0	4	28.6	4	28.6	
Total	3	21.4	11	78.6	14	100	
Source of fish							0.425
Fisherman	3	21.4	9	64.3	12	85.7	
Whole seller	0	0	2	14.3	2	14.3	
Total	3	21.4	11	78.6	14	100	
fish buyer							0.308
Final costumer	3	21.4	8	57.1	11	78.6	
Retailer	0	0	3	21.4	3	21.4	
Total	3	21.4	11	788.5	14	100	
The most dominant spp.							0.099
Latesniloticus	0	0	2	14.3	2	14.3	
Tilapias	3	21.4	9	64.3	12	85.7	
Total	3	21.4	11	78.6	14	100	
Fish marketing functions							0.076
Transportation	3	21.4	2	14.3	5	33.7	
Cooling	0	0	2	14.3	2	14.3	
Cleaning	0	0	3	21.3	3	21.4	
Storing	0	0	4	18.6	4	18.6	
Total	3	21.4	11	78.6	14	100	
high pocket/season							0.032
Summer	3	21.4	2	14.3	5	35.7	
Winter	0	0	3	21.4	3	21.4	
Autumn	0	0	6	42.9	6	42.9	
Total	3	21.4	11	78.6	14	100	
Site of fish supply							0.308
Introduction site	3	21.4	8	57.1	11	78.6	
Market	0	0	3	21.4	3	21.4	
Total	3	21.4	11	78.6	14	100	

Methods of fish preservation							0.425
Cooling	3	21.4	9	75	12	85.7	
Freezing	0	0	2	14.3	2	14.3	
Total	3	21.4	11	78.6	14	100	
the problem in marketing							0.032
Fish preservation	3	21.4	2	14.3	5	35.7	
Place to market	0	0	4	28.6	4	28.6	
Nothing	0	0	5	35.7	5	35.7	
Total	3	21.4	11	78.6	14	100	



Figure (4.14) Al-Rahad fish market

4.8.1 The Average Prices of Fish

Table 4-9 and presents the price of the different species at fisherman, wholesale and retail level the analysis of variance shows no significant different ($P < 0.05$) between the price of fish species at fisherman and consumers levels.

Table (4-9) The average prices of the fish

Fish Species	Fisherman	Wholesale	Retail
Latis niloticus	21.7± 2.3	25±0.0	35.7± 5.0
Bagrus baged	18.7±2.1	20±0.0	30.7± 5.0

Oreochromis niloticus	17.8± 2.4	20±0.0	27.7±4.2
Clarias gariepinus	15±0.0	16.0±2.0	27.7±4.2
Heteros sp	16.6± 2.3	15±0.0	27.0± 4.5
P value	< 0.05	A	< 0.05

4.9. The Characteristics of the consumers

Table (4-10) presents the characteristics of the investigated of consumers, mostly of the age group (41-50) year. About 25 are married. University educational level is the dominant one (51.4%). Officer is the main job of 42.9% the investigated consumers population and the family sizes mostly (51.4%) of 6-10 persons.

Table (4-10) The characteristics of consumers

Character	Number	%
Gender		
Male	17	48.6%
Female	18	51.6%
Total	35	100%
Age		
20-30	6	17.1%
31-40	8	22.9%
41-50	11	31.45%
51-60	4	11.4%
61-70	6	17.1%
Total	35	100%
Educational level		
Illiterate	2	5.7%
khalwa	2	5.7%
Primary	7	20.0%
Secondary	5	14.3%
University	18	51.4%
Post graduates	1	2.9%
Total	35	100%
The social status		
Married	25	71.4%
Un married	10	28.6%
Total	35	100%
Family size		
1-5	15	42.9%

6-10	18	51.4%
11-15	2	5.7%
Total	35	100%
The job		
Officer	15	42.9%
Seller	4	11.4%
Farmer	6	17.1%
Home marker	5	14.3%
Worker	5	14.3%
Total	35	100%
Income /month		
500-1000	15	43%
1001-1500	10	28.6%
1501-2000	10	28.6%
Total	35	100%

According to table (4-11) there are 21 of the consumers' preferable fish (60%). There are 12 consumers preferable *Oreochromis niloticus* (34.3%) .Most of consumer gets fish from market (68.6%). The common average of quantity of fish purchased each time about 2kg (34.3%).

Table (4-11) Fish consumption in Al Rahad community compared with other kind of meat

Description	Number	%
Preferable meat		
Fish	21	60%
Chicken	3	8.6%
Read meat or beef	11	31.4%
Total	35	100%
Preferable fish		
Lats niloticus	6	17.1%
Bagrus baged	3	14.3%
Oreochromis niloticus	12	34.3%
Clarias gariepinus	3	8.6%
Heteros sp	9	25%
Total	35	100%
Place of getting fishing		

Market	24	68.6%
Alturda	11	31.4%
Total	35	100%
Quantity of fish/ once		
1kg	16	45.7%
2kg	12	34.3%
3kg	2	5.7%
4kg	2	5.7%
5kg	1	2.9%
7kg	2	5.7%
Total	35	100%

4.10. The Impact of Introduction on fish Consumption

Table (4-12) presents the impact of fish introduction on fish consumption all of the variable studied showed significant differences ($p < 0.05$) before and after fish introduction. These variables included the characters of the 35 consumers investigated. Before introduction only male workers of 20-30 years, lower income and joiner education level used to consume fish and purchaize small quantity each time, but after introduction both male and female with different age group , jobs , income levels and mostly of higher education are used to consume fish and purchaize quantities up to 6 kg at each time. Before introduction the consumers used to get their needs from the market but after introduction the get their requirement from both market and Al turda most probably from the turda. Before introduction, if the price of fish increases all of them reduce the quantity demanded while after introduction most of them do not reduce the quantity indicating that the demand to fish became inelastic after introduction and all of them increase their demand if the price drops. This comes in agreement with the demand law.

Table (4-12) Impact of introduction on fish consumption

Description	Before introduction		After introduction		Total		P value
Gender							0.002
Male	6	17.1	11	31.5	17	48.6	
Female	0	0	18	51.4	18	51.4	

Total	6	17.1	28	82.8	35	100		
Age								
20-30	6	17.1	0	0	6	17.1	0.000	
31-40	0	0	8	22.9	8	22.9		
41-50	0	0	11	31.4	11	31.4		
51-60	0	0	4	11.4	4	11.4		
61-70	0	0	6	17.1	6	17.1		
Total	6	17.1	29	82.9	35	100		
Job								
Officers	0	0	9	25.8	9	25.8	0.000	
Seller	0	0	4	11.4	4	11.4		
Farmer	0	0	6	17.1	6	17.1		
Home wife	0	0	5	14.3	5	14.3		
Worker	6	17.1	5	14.3	11	32.4		
Total	6	17.1	29	82.9	35	100		
Social status								
Married	6	17.1	19	54.4	25	71.5	0.000	
Un married	0	0	10	28.5	10	28.5		
Total	6	17.1	29	82.9	35	100		
Family size								
1-5	6	17.1	9	25.8	15	42.9	0.000	
6-10	0	0	18	51.4	18	51.4		
11-15	0	0	2	5.7	2	5.7		
Total	6	17.1	29	82.9	35	100		
Educational level								
Illiterate	2	5.7	0	0	2	5.7		0.000
Khalwa	2	5.7	0	0	2	5.7		
Primary	2	5.7	5	14.3	7	20		
Secondary	0	0	5	14.3	5	14.3		
University	0	0	18	51.4	18	51.4		
Above university	0	0	1	2.9	1	2.9		
Total	6	17.5	29	82.9	35	100		
Income /month								
500-1000	6	17.1	0	0	6	17.1	0.000	
1001-1500	0	0	9	25.7	9	25.7		
1501-2000	0	0	10	28.6	10	28.6		
2001-2500	0	0	10	28.6	10	28.6		
Total	6	17.1	29	82.9	35	100		
Preferable meats								
Fish	6	17.1	15	42.9	21	60	0.000	
Chicken	0	0	3	8.6	3	8.6		
Red meat	0	0	11	31.4	11	31.4		
Total	6	17.6	29	82.9	35	100		
Preferable fish								
Lats niloticus	0	0	6	17.1	6	17.1		

Bagrus baged	6	17.1	5	14.3	11	31.4	0.000
Oreochromis niloticus	0	0	6	17.1	6	17.1	
Clarias gariepinus	9	25.7	3	8.6	12	33.3	
Heteros sp	0	0	9	25.7	9	25.7	
Total	15	42.8	20	58.2	35	100	
Frequency of consuming fish/week							
0	6	17.1%	0	0			
1	23	65.7%	5	14.3%			
2	6	17.1%	17	48.6%			
3	0	0	10	28.6%			
4	0	0	2	5.6%			
7	0	0	1	5.7%			
Total	32	100%	35	100%			
Quantity of fish/ each time							
1kg	6	17.1	10	28.6	16	45.7	0.000
2kg	0	0	12	34.3	12	34.3	
3kg	0	0	2	5.6	2	5.6	
4kg	0	0	2	5.6	2	5.6	
5kg	0	0	1	2.9	1	2.9	
6kg	0	0	2	5.6	2	5.6	
Total	6	17.1	19	82.9	35	100	
Place of getting fishing							
Market	6	17.1	11	31.4	17	48.5	0.000
Alturda	0	0	18	51.5	18	51.5	
Total	6	17.1	29	82.9	35	100	
If the price few increase the order							
Yes	6	17.1	29	82.9	35	100	0.000
No	0	0	0	0	0	0	
Total	6	17.1	29	82.9	35	100	
If the price increase order decrease							
Yes	6	17.1	3	8.6	9	25.7	0.000
No	0	0	26	74.3	26	74.3	
Total	6	17.1	35	82.9	35	100	
If the price decrease / order increase							
Yes	6	17.1	29	82.9	35	100	0.000
No	0	0	0	0	0	0	
Total	6	17.1	29	82.9	35	100	
The problems							

encountered in obtaining fish							0.000
Availability of fish time wise	6	17.1	4	11.5	10	28.6	
Price of fish	0	0	8	22.9	8	22.9	
Low supply	0	0	12	34.3	12	34.3	
No problem	0	0	5	14.3	5	14.3	
Total	6	17.1	29	82.9	35	100	
Impact of fish consumption							0.000
Reduce the incidence of diseases	6	17.1	12	34.3	18	51.4	
reduce iodine deficiency	0	0	3	8.6	3	8.6	
reduce protein deficiency	0	0	1	2.9	1	2.9	
Good for health	0	0	3	8.6	3	8.6	
Nothing	0	0	10	28.6	10	28.6	
Total	6	17.1	29	82.9	35	100	

The problems encountered by consumer before introduction limited to availability of fish time wise only, whereas the consumer complaint from high price and low supply after introduction. The reflect the change of consumer taste towards fish, this high demand can be explain based on their opinion on the impact of fish consumption, they conceive that eating fish Good for health, reduces the incidence of diseases and reduces iodine and protein deficiency. For that they prefer fish to red meat and chickens because fish is much cheaper than red meat. This finding comes in agreement with improvements in material welfare especially for persons with the lowest incomes as stated by Charles and Bruce,(1983) .

4.11. Impact of Fish Introduction on the Surrounding Communities

Fish introduction acted to flourish the fishing activity which in turn stimulates other activities in which other community member enrolled. At the turda many members enrolled in fish transport using fiberglass boats (Figure 4.15) others including children engaged in fish cleaning (Figure 4 .16), women operate small

business for tea and nut sale at the turda bank (Figure 4.17). Also in the market area may related activities were developed, cleaning (Figure 4.18) and cooking (Figure 4.19) fish are common activities observed in the market area. This reflects the impact of introduction in generating job opportunities and secures a source of income to many families.



**Figure (4.15) Fibreglass boat for fish
truda Transportation**



Figure (4.16) Cleaning fish at



Figure (4.17) Tea maker and nuts seller



Figure (4.18) Cleaning fish at Fish market

CHAPTER FIVE

5. CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The study concluded that the experience of fish introduction in Al Rahad turda have a great positive impact in developing the local communities. It showed that all the local communities succeeded in making a change after fish introduction.

In case of the fishermen community and fishing activity: the number of the fish species increased from two species to five after introducing which indicates increase the stock of the fish in Turda, also there is significant increase in the number of the fishermen, some of them practice fishing for the first time and the new fishermen are younger including children they are less educated. The income generated is higher than before. Technically fish introduction acted to build the capacity of the fishermen through training courses and also raised their awareness to preserve their fish resources by using suitable nets. They also tend to organized in cooperative societies. The use of harmful fishing nets was abandoned after fish introduction. The fishing activity is practiced all over the year instead of summer and winter. The catch was sold to both finals consumer and the market mediators after introduction. The daily production jump from about 20 to 30 pound to 50 to 300 pound per day after introduction

For market mediators presents the impact of introduction on fish marketing. Elder people dominate the market. The income generated in summer is much higher than the other seasons. After introduction of fish, market mediators were face by few places for fish selfish preservation. Extra marketing functions were introduced namely cooling and cleaning and storing.

Fish introduction impacted the consumers' community positively. Unlike before introduction both male and female with different age group, jobs, income levels and mostly of higher education are used to consume fish and purchase relatively high quantities of fish. They get their requirements from both market and Al turda most probably from the turda. The demand to fish became inelastic after introduction and their taste changed towards fish.

For the surrounding communities fish introduction allowed other activities to take place generating more job opportunities and secured a source of income to many families.

In conclusion the experience of fish introduction in Al Rahad Turda is a success and can be conveyed to other water bodies in Sudan.

RECOMMENDATIONS

1. A study on the impact of the mud removal from the banks of the Turda on increasing the water capacity of the Turda is needed.
2. A study about the introduction of new species of fish in increase the fish stock in the Turda.
3. More efforts are needed to control the fishing activity.
4. As long as there is extra fish resource in the turda while consumers are complaining from low supply, marketing system should be improved through:
 - a. Conducting study to improvement of marketing facilities.
 - b. Conducting study to opening of new markets.
5. Application of the experience to other water bodies.

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Appendix 1

• Questionnaire of the fishermen

1.The gender:

1. male

2. Female

2.Age:

.....year.

3.The main job:

1.fisherman

2.farmer

3.seller

4.The social status:

1.married

2. Unmarried

5.family size:

..... person.

6. Educational level:

1. illiterate

2. Khalwa

3.primary

4.secondry

5.university

7. The site of fish:

1. Samaha

2. Wad alhende

3. Alganobe

4. Almarwaha

5. Albarageet

6. Alarabat

7. Almazlagan

8. Almashtal.

8. Duration of fishing activity:

.....year.

9.Type of fishing craft:

1. Boat of wood boat(Taroor). 2. Boat of iron 3. Traditional

10. ownership of the fishing craft:

1. Self ownership 2. Rented 3. Partnership .

11. Type of filaments:

1. Filament net 2. Entanglement net 3. Seine net
4. Entanglement and Seine net.

12. Season of fishing:

1. summer 2.autumn 3.winter.

13. Number of day fishing/week:

.....day.

14. Source of capital:

1. Self finance 2. Partner.

15. The capital investment cost:

.....pound.

16.Fish buyer :

1.market mediator 2. Final consumer 3. Both

17.Away to save fish:

1.Sac 2.cooling box 3.net

18.The way to save fish when fish not buy:

1.freezing 2.cooling 3.drying 4.net

19.Receiving training course:

1.Yes 2.No

20. Benefit from training course:

Appendix 2

• Questionnaire of the market mediators

1.The gender:

1.Male

2.Female

2.The age:

.....year

3.The main job:

1.seller of fish

2. Seller

3.farmer

4.The social status:

1.married

2.un married

5.Family size:

..... person.

6.Educational level:

1. illiterate

2. Khalwa

3.primary

4.secondry

5.university

7.Rat of income/month:

.....pound.

8. Role of the market mediators:

1.hole seller

2.ratea seller

9.The price of species of fish from the fisher man:

1. Latis niloticus

2. Bagrus bagrus

3. Oreochromis niloticus

4. Clarias gariepinus

5. Heteros niloticus

10.Source of fish:

1.fisher man

2. Seller

11. Fish buyer :

- 1. final customer
- 2. seller

12. The price of species of fish to the final customer:

..... pound.

13. The seller species:

- 1. Lates niloticus
- 2. Bagrus bagrus
- 3. Oreochromis niloticus
- 4. Clarias gariepinus
- 5. Heterotis niloticus

14. Utilities to fish:

- 1. Transportation
- 2. cooling
- 3. cleaning
- 4. Storing

15. The Production season:

- 1. summer
- 2. winter
- 3. Autumn

16. Preservation of fish:

- 1. cooling
- 2. Freezing

17. The problem in marketing:

- 1. The size
- 2. The place of market
- 3. nothing

11. Number of taking fish/week before landing:

.....day.

12. Number of taking fish/week after landing 2010:

.day.

13.The quantity of fish/ once:

.....kg.

14.Getting fish from:

1.market

2.Altorda

15.If the price few increase order:

1.yes

2.No

16.If the price increase few order:

1.Yes

2.No

17.If increase income increase order:

1. Yes

2.No

18.The problems when you need to get fish:

1.markiting

2. Price of fish

3. Un multitude fish

4.nothing

19.Changes when you eat fish:

1.resisting the disease

2. Stop decrease of iodine

3.Stop decrease of protein

4.Good for health

Appendix 4

Type of the fish in Al Rahad Turda



scientific name: *Oreochromis niloticus*

English name :Tilapia

Common name : Albolti



scientific name : *Clarias gariepinus*

English name : Cat fish

Common name : Al garmot



scientific name : Heterotis SP
English name: African bony tongue
Common name : Umm kuro



scientific name : Lates niloticus
English name : Nile perch
Common name : Alegeel



scientific name :Bagrus baged
English name : Bagrus beiyad

Common name : Beiyad

Appendix 5

Al Rahad Turda



General view of El Rahad Turda with Fisher men Fishing



General view of El Rahad Turda