REPUBLIC OF KENYA

MINISTRY OF AGRICULTURE, LIVESTOCK AND FISHERIES

STATE DEPARTMENT FOR FISHERIES AND THE BLUE ECONOMY

FISHERIES ANNUAL STATISTICAL BULLETIN 2016

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1.0 INTRODUCTION

Fisheries production in Kenya can be classified into three groups namely fresh water capture fisheries, marine capture fisheries and aquaculture. The major sources of capture and aquaculture data (including prices) are Fisher folks dealing with marine and inland fishing such as Beach Management Units (BMUs); Aquaculture farmers, County Directors of Fisheries in the various counties, Kenya Marine and Fisheries Research Institute, Kenya National Bureau of Statistics (KNBS), Association of Fish Processors and Exporters of Kenya (AFIPEK), Government and County fish farms and hatcheries, Fish and fish products markets.

On fisheries data exchange, the State Department for Fisheries and the Blue Economy has active collaborative initiatives with various organizations. Due to the fact that some of the most important fisheries in the country are Tran-boundary, there are strong mechanisms of data sharing with the aim of fostering better management of the shared fisheries resources. The department thus exchanges data with regional bodies such as the Lake Victoria Fisheries Organization (LVFO), the Indian Ocean Tuna Commission (IOTC), the Food and Agricultural Organization (FAO) and the South West Indian Ocean Fisheries Commission (SWIOFC). Data exchange with these organizations is wide ranging encompassing all aspects of fisheries.

LVFO is also involved in setting benchmarks of data collections protocols by issuing standard operating procedures in data collection and analysis so that the data thus collected can be compared across the shared water body regardless of the country. Data exchange with Indian Ocean Tuna commission (IOTC) concerns tuna and tuna like species which are highly migratory. The stocks are shared by the countries bordering the Indian Ocean and for effective management, the member countries share fisheries data to enable species specific stock assessment in the Indian Ocean. The South West Indian Ocean Fisheries Commission mainly deals with demersal species, near-shore pelagics, crustaceans and molluscs which mainly are within a country's water boundaries or are shared with the immediate neighbours. The department also makes submissions to FAO statistical year books as well as for the annual economic survey reports by Kenya National Bureau of Statistics. This report details on the fisheries production data for the years 2016 and compares the results with those of the previous years. The imports and export data are also important for evaluation of the per capita consumption of fish in the country.

2.0 NATIONAL FISH PRODUCTION

Kenya is endowed with both marine and inland water resources. The inland water resources include lakes, dams and rivers of varying sizes. Some of the major lakes include: Lake Turkana (6,405 Km^2), Lake Victoria-Kenyan side (6% of the whole lake =4,128 km^2), Naivasha (210 Km^2), Baringo (129 Km^2), and Lake Jipe (39 Km^2). Major rivers include Tana (700 Km), Athi/Galana/Sabaki (530 Km), Ewaso-Ngiro-North (520 Km), Kerio (350 Km), Suam-Turkwel (350 km), Mara (280 km), Nzoia (240 km), Voi (200 km), Yala (170 km), Ewaso-Ngiro-south (140 km), Sondu (105 km), Malewa (105 km) and Kuja (80 km. Across the country are also dams stocked with fish and in areas like Uasin Gishu and Laikipia, the fish production is quite substantial.

Further to these inland water resources, Kenya also enjoys a vast coastline of 640 km on the Western Indian Ocean, besides a further 200 nautical miles Exclusive Economic Zone (EEZ) under Kenyan jurisdiction. The

total area of the territorial waters is 9,700 Km^2 while the Kenyan EEZ is 142,400 Km^2. Kenya also lays claim to extended EEZ reaching 350 km with an extra area of approximately 103,320 Km^2. The total area for exploitation by the country is a massive 255,420 Km2 which is about half of the Kenyan land cover area.

The Kenyan fishery is mainly artisanal with very few commercial/industrial vessels targeting mainly shallow water shrimps, deep water shrimps and lobsters. The country has for a period been having a Kenyan flagged longliner exploiting the EEZ. Other vessels are purse seines and long liners owned by Distant Water Fishing Nations (DWFN) which operate under Kenyan license in our Economic Exclusive Zone (EEZ) targeting Tuna and Tuna like species. The artisanal fishery accounts for most the inland and marine water catches reported in this bulletin and consequently it is currently the most important fishery in the country, even though our EEZ which is predominately for commercial fishing is under exploited with an estimated potential of between 150,000 to 300,000 metric tonnes (Commonwealth secretariat report 2003 by Dr. George Habib).

The fisheries sector plays a significant role in employment and income generation. During the year under review the sector supported a total of 65,2501 people directly as fishermen and 59,095 fish farmers with 55,750 stoked fish ponds. The sector supports about 1.2 million people directly and indirectly, working as fishers, traders, processors, suppliers and merchants of fishing accessories and employees and their dependents. Besides being a rich source of protein especially for riparian communities, the sector is also important for the preservation of culture, national heritage, and recreational purposes.

During the year (2016) under review, the total fish production was 147,916 metric tons worth 25,619 million Kenya shillings (Figure 1). The production was 10% decline compared to 164,310 tons worth 24,463 million Kenya shillings in landed in 2015. Most of the production as in the past was from inland capture fisheries amounting to 108,255 metric tons with an ex-vessel value of Kshs.16,753 million. The production from marine and aquaculture was 24,709 and 14,952 metric tons worth Kshs. 4,612 and 4,254 million shillings respectively (Fig 2).

Inland capture fisheries contributed 73.2% of Kenya's total fish production, with the principal fishery being that of Lake Victoria. The lake accounted for 98,166 metric tons or 90.7% of the country's total annual inland fish production in 2016. Lake Turkana, Kenya's largest freshwater body (6,405 km^2) produced 7,926 metric tons of fish during the year under review. Other freshwater-bodies of commercial importance included lakes Baringo (141 MT), Naivasha (1,064 MT), Jipe (127 MT).

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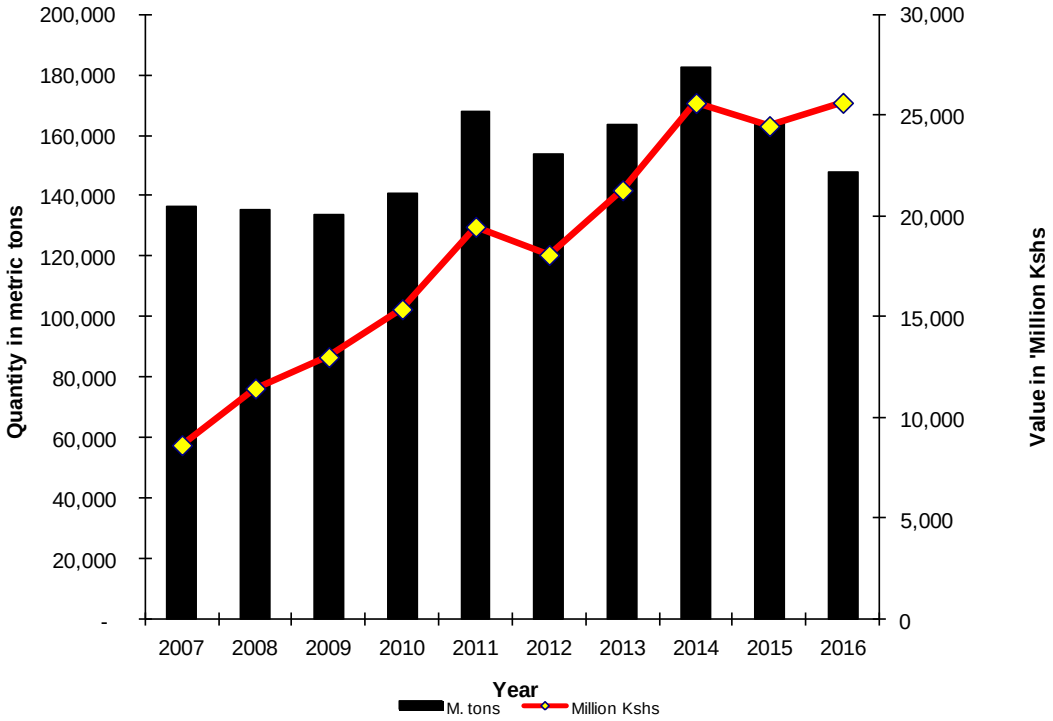

Figure 1: Fish production by quantity and value 2007-2016

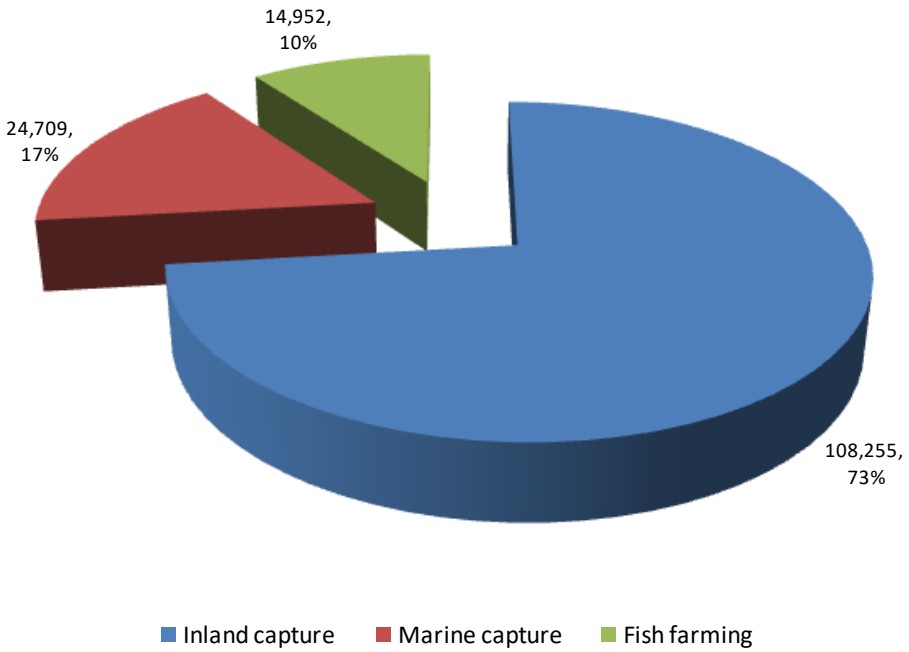

Figure 2: National fish production by Fishery Category 2016

The fish and fish products produced in the country are marketed domestically or exported to the international markets. The main fish and fishery products exported during the year under review included Nile perch products (fillets, maws, headless and gutted whole Nile perch), Octopus, Fish meal and marine shells. Fish and fishery products imported into the country included the following products among others: frozen mackerels, frozen tilapia, frozen tilapia fillets, frozen sardines, frozen pangasius fillets and tuna fish meals among others.

The fisheries production by different water bodies in 2016 is shown in table 1. The table also has number of fishers, fish farmers and production inputs such as crafts and ponds during the year. Table 2 compares the fish production for the past three years (2014 – 2016) while the production by species for the same period is shown in table 3.

Table 1 Fish landings by Weight, Value, Number of Fishers, Ponds and fishing Crafts 2016

Fresh water	**M. tons**	**000 Kshs.**	**Fishers**	**Farmers**	**Crafts**	**Ponds**
Lake Victoria	98,166	15,826,307	43,653		14,365	
Lake Turkana	7,926	576,493	7,000		1650	
Lake Baringo	141	49,173	120		47	
Lake Naivasha	1,064	141,006	150		50	
LakeJipe/Dams	127	24,871	66		46	
Lake Kanyaboli	262	43,805	188		99	
Lake Kenyatta	48	4,560	120		40	
Tana River dams	444	72,229	316		180	
Turkwel dam	42	9030				
Fish Farming	14,952	4,254,002		59,095		55,750
Tana River delta	20	1,970	220		83	
Riverine	14	3500				
Total Fresh water	**123,207**	**21,006,947**	**51,833**	**59,095**	**16,560**	**55,750**
Marine Artisanal	24,165	4,434,126	13,417		2,974	
Marine Industrial	544	177,947				
Total Marine	**24,709**	**4,612,073**				
Grand Total	**147,916**	**25,619,020**	**65,250**	**59,095**	**19,534**	**55,750**
	M. tons	**000 Kshs.**	**% Quantity**	**% Value**		
Inland Capture	108,255	16,752,945	73.2	65.4		
Marine Capture	24,709	4,612,073	16.7	18.0		
Aquaculture	14,952	4,254,002	10.1	16.6		
Total	**147,916**	**25,619,020**	**100**	**100**		

Table 2: Quantity and Value of fish landings 2014 – 2016

	2014		2015		2016	
FRESH WATER	**M. tons**	**000 Kshs**	**M. tons**	**000 Kshs**	**M. tons**	**000 Kshs**
L. Victoria	128,708	14,601,790	109,902	14,494,839	98,166	15,826,307
L. Turkana	4,166	433,790	10,605	735,717	7,926	576,493
L. Naivasha	633	68,070	1,072	132,617	1,064	141,006
L. Baringo	302	86,595	176	54,859	141	49,173
L. Jipe/Dams	115	19,249	122	21,031	127	24,871
Lake Kanyaboli	134	10,466	268	38,489	262	43,805
Lake Kenyatta	51	3,899	64	5,085	48	4,560
Tana River Dams	1,024	98,311	852	115,020	444	72,229
Fish Farming	24,096	5,601,722	18,656	5,014,149	14,952	4,254,002
Turkwel dam	56	11,547	28	5,936	42	9030
Tana delta	47	3,574	54	4,818	20	1,970
Riverine	8	1,894	24	4,212	14	3500
TOTAL	**159,340**	**20,940,907**	**141,823**	**20,626,772**	**123,207**	**21,006,947**
Marine Artisanal	23,287	4,641,349	22,407	3,795,575	24,165	4,690,541
Marine Industrial	83	25,205	248	69,599	544	177,947
Marine Total	**23,370**	**4,666,554**	**22,655**	**3,865,174**	**24,709**	**4,868,488**
GRAND TOTAL	**182,710**	**25,607,461**	**164,478**	**24,491,946**	**147,916**	**25,875,435**

Table 3: Fresh Water and Marine fish artisanal catches by Species, Weight and Value 2014- 2016

	2014		2015		2016	
	M. tons	**000 Kshs**	**M. tons**	**000 Kshs**	**M. tons**	**000 Kshs**
Alestes spp.	**318**	**26,871**	**620**	**96,600**	430	48,616
Bagrus spp.	101	8,398	90	4,965	61	6,625
Barbus spp.	101	10,777	14	2,936	53	7,589
Black bass	3	461	20	2,164	10	840
Clarias spp.	7,174	1,252,514	5,180	857,874	4,299	630,811
Rastrineobola argentia	69,561	4,129,707	61,662	5,457,786	46,810	4,257,158
Labeo spp.	622	61,135	684	69,569	559	58,351
Haplochromis spp.	929	73,211	2,624	149,035	2,212	154,180
Lates niloticus	43,399	8,473,050	31,348	6,823,874	30,105	9,052,043
Protopterus spp.	1,339	158,834	1,147	156,509	1	44
Synodontis spp.	136	11,672	1,407	96,630	1,134	151,464
Oreochromis niloticus	26,278	5,746,526	29,410	5,847,829	864	52,485
Tilapia others	2,612	300,187	19	2,202	24,418	5,137,507
Trout	241	142,943	937	467,700	16	1,924
Carps	2,083	202,237	1,667	257,897	748	419,111
Eels	-	-	-	-	983	198,623
Citharinus spp.	116	13,866	224	19,318	-	-
Hydrocynus	106	9,650	-	-	246	9,712
Distichodus niloticus	319	33,946	477	37,348	0	10
Caridina niloticus	-	-	2,201	43,258	391	18,249
Schilbe mystes	-	-	1,602	176,226	6,856	496,095
Unspecified	3,903	284,922	322	28,437	2,652	267,737
TOTAL	**159,340**	**20,940,907**	**141,655**	**20,598,156**	**123,207**	**21,006,947**
MARINE FISH						
Demersal	13,302	2,139,486	10,135	1,493,850	9,974	1,589,113
Pelagic	5,834	1,049,390	7,844	1,298,861	9,303	1,560,917
Sharks/Rays	1,312	181,583	1237	166,826	1,033	161,706
Mixed species	423	48,039	525	58,596	880	112,622
TOTAL	**20,870**	**3,418,498**	**19,741**	**3,018,133**	**21,190**	**3,424,358**
CRUSTACEA						
Lobster	408	885,657	263	343,600	390	651,024
Prawns	170	39,061	213	60,637	163	90,161
Crabs	135	43,389	145	70,274	220	146,480
TOTAL	**713**	**968,107**	**621**	**474,512**	**772**	**887,664**
MOLLUSCS						
Beche-de-mers	13	2,297	19	2,158	6	4,986
Cuttlefish	45	10,493	47	8,994	70	8,671
Octopus	1,610	233,756	1,832	258,926	2,063	349,414
Squids	35	8,198	147	32,853	64	15,447
TOTAL	**1,703**	**254,744**	**2,045**	**302,930**	**2,203**	**378,518**
TOTAL MARINE	**23,287**	**4,641,349**	**22,407**	**3,795,575**	**24,165**	**4,690,541**
GRAND TOTAL	**182,627**	**25,582,256**	**164,062**	**24,393,731**	**147,372**	**25,697,488**

3.0 INLAND CAPTURE FISHERIES

Most of the fish landings from inland capture fisheries in Kenya are from lakes Victoria, Turkana, Naivasha, Baringo, Jipe, Tana River dams, and Tana river delta. The rest are from the dams and rivers. In capture fisheries, gill netting was the most used fishing method during the year. The other methods included use of gears such as long line hooks, hand line, traditional traps, trolling, ring nets, cast nets and small (mosquito) seines for *Rastrineobola argentea* fishing. There are other methods which are used though are prohibited due to their destructive nature. They include; Beach seining, Monofilament gill netting, Trawl netting, Scuba diving, spear gunning and vertical integration of gears.

3.1 LAKE VICTORIA FISHERY

Lake Victoria's contribution to total national annual inland fish production is enormous 98,166, Metric tons of the total inland fisheries production of 108,065 Metric tons which is (90.8% in 2016) even in the face of rapidly declining fish stocks in the lake. Capture fisheries of Lake Victoria are a source of livelihood to many people employed directly as boat owners, fishermen (40,113), fish traders, fish processors, etc and indirectly as fishing gear manufacturers, boat builders, and ice producers among others. Lake Victoria is a multi-species fishery with many of known species, but only *Rastrienobola argentea* (Omena) 46,810 Metric tons, *Lates niloticus* (Nile perch) 30,070 Metric tons and *Oreochromis niloticus* (Nile tilapia) 5,267 Metric tons are of major economic significance which contributed combined catch of 82,148 Metric tons out of the total catches of 98,166 Metric tons from the lake (Kenyan side) which is makes 83.7% of the catches from the lake during the year under review (Figure 3). This has been the case for a number of years. However, for the last few years there have seen a rapid decline of fish stocks in Lake Victoria thereby creating a wide gap between supply and demand for fish in the country. The catches of the other species from the lake increased in representation from 10.6% in 2015 to 16.3% in 2016. In response to this undesirable situation, the government has taken concrete steps to promote aquaculture development in the country to bridge the existing supply demand gap. Cage farming in the Lake Victoria has also been supplementing the dwindling catches from the lake.

During the year 2016, fish production from Lake Victoria decreased from 109,902 metric tons to 98,166 metric tons with an ex-vessel value of Kshs billion 14.6 compared to Kshs 14.49 billion, an ex-vessel value of 2015. The landings of this year decreased by 10.7% compared to 2015 while the 2015 ex-vessel value increased by 0.7% from the ex-vessel value of 2015. In terms of species contribution to the total weight of fish landed from the lake, *Rastrineobola argentea* took the lead with 47.7 % this year compared to 56.1% in 2015, *Lates niloticus* 30.6% this year compared to 28.5% in the year 2015, *Oreochromis niloticus*, 5.4% in this year compared 4.9%, in 2015. *Caridina niloticus* landings were 7.0% compared to 2.0% in 2015. *Clarias spp* contribution was 2.2% this year, a similar percentage to that in 2015. *Protopterus aethiopicus* 1.0% in this year, which was a marginal increase compared to 0.9% recorded in 2015, *Haplochromis spp.* 2.2% this year compared to, 2.4% of the 2015 and the others species combined contributed 3% which is similar to the 2015 contribution figure 4. While the major species are on a decline, there was an increase in the *Haplochromis spp. Caridina niloticus* and *Mystis schilbe* among other species in the lake. As in the previous years, Homa Bay County contributed 55.6% of the total Lake Victoria catch this year compared to 60.6% in 2015, Siaya contributed 28.8% this year compared to 26.6% in 2015, Migori contributed 6.7% compared to 4.7% in 2015, Kisumu contributed 4.2% this year compared to 4.0% in 2015 while Busia contributed 4.8% this year compared to 4.1% in 2015.

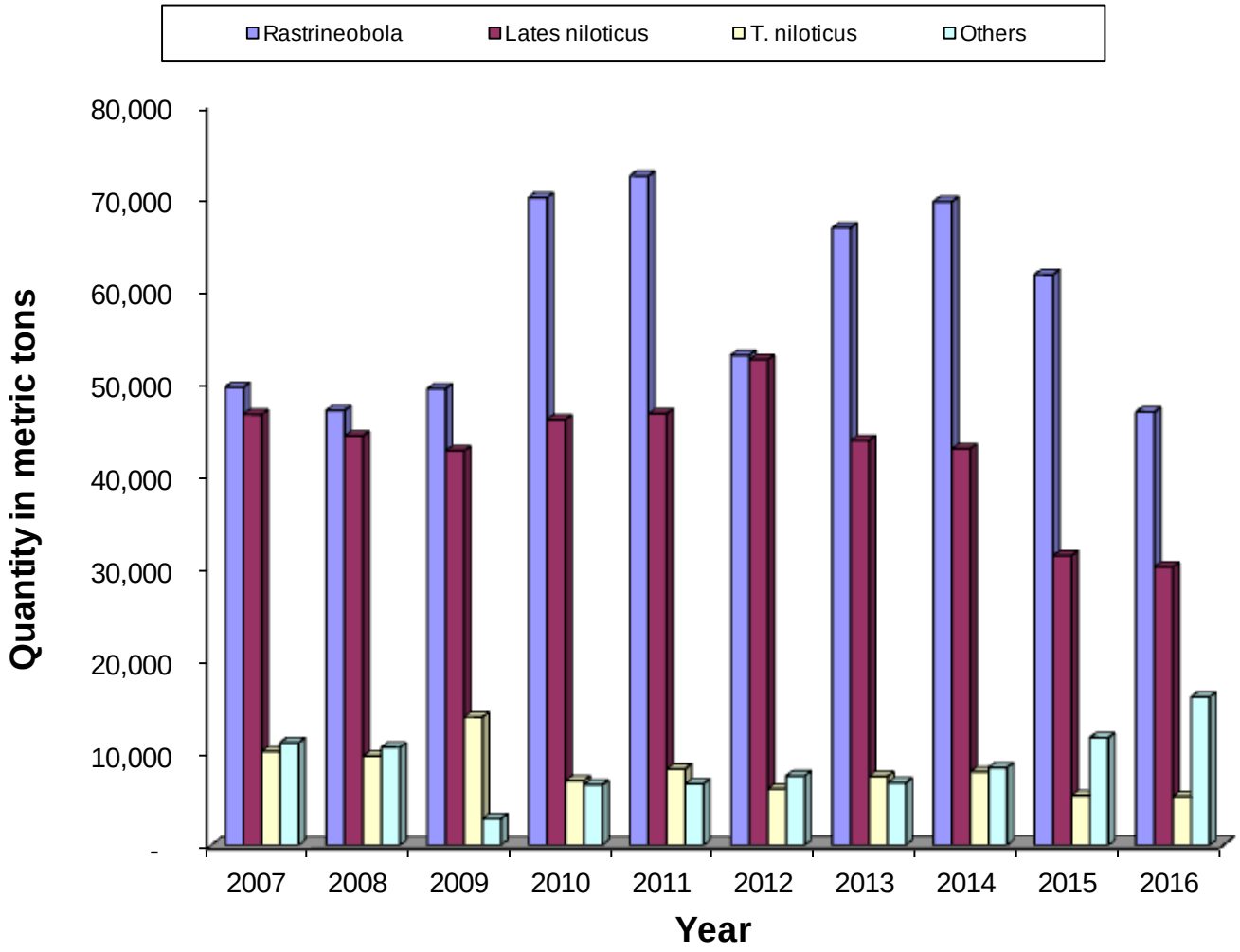

Figure 3: Lake Victoria species catch composition 2007-2016

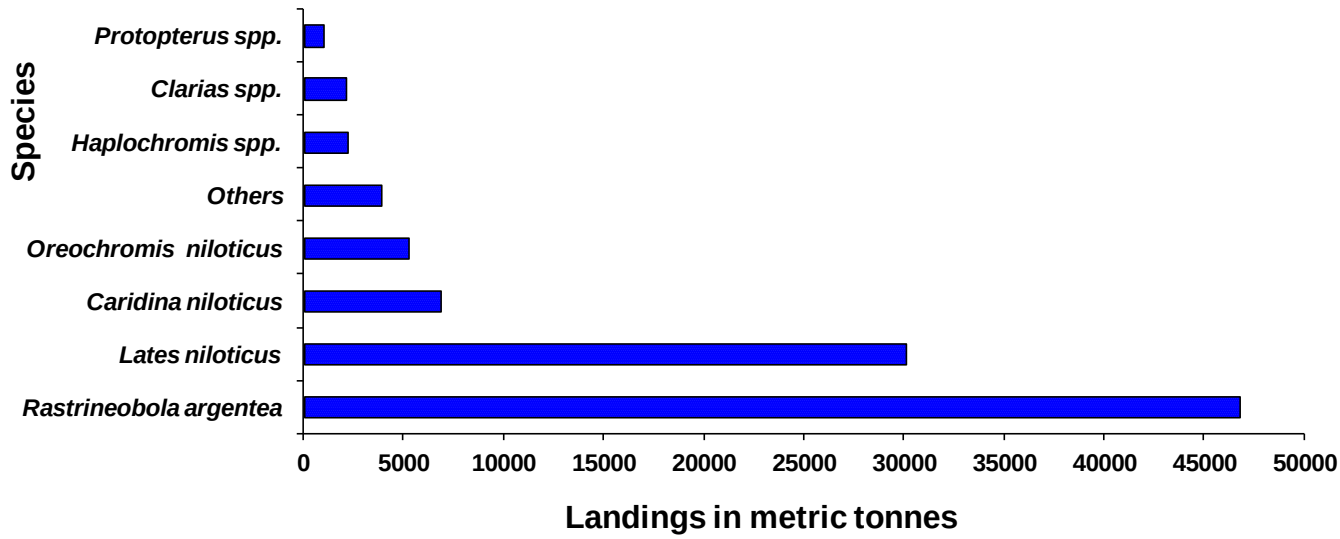

Figure 4: Lake Victoria species catch composition 2016

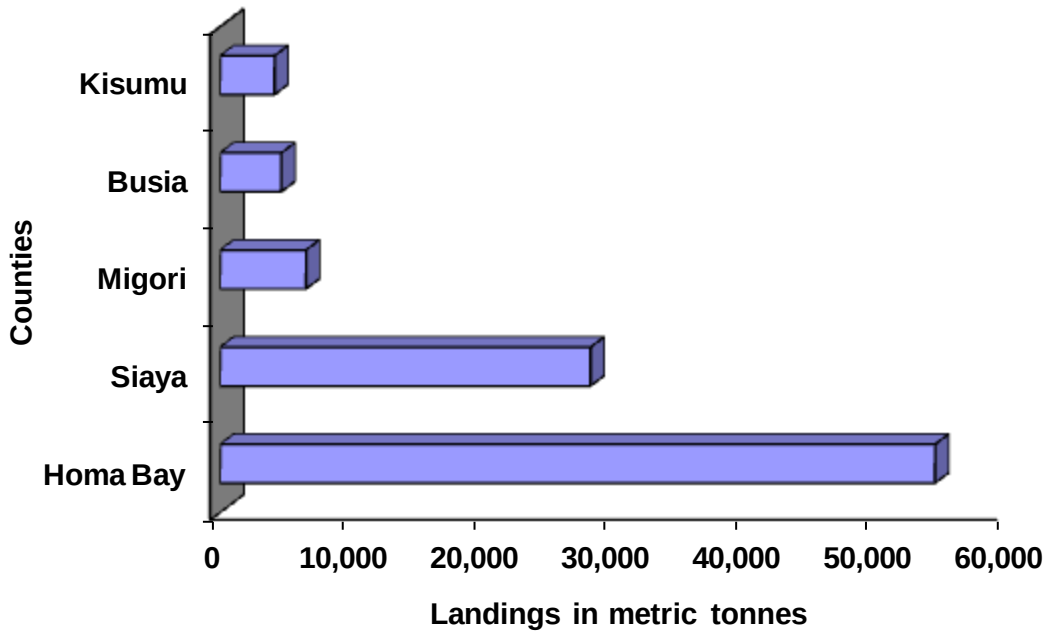

Figure 5: Lake Victoria fish landings by Counties 2016

Challenges facing Lake Victoria fishery:

i. The declining trend in catches of *Lates niloticus*, *Rastrineobola argentea* and *Oreochromis niloticus*, an indicator of reduced fish stocks particularly in Lake Victoria;
ii. Infestation of the lake by aquatic weeds i.e. Water Hyacinth and the Hippo grass;
iii. The major challenge afflicting the fisheries of Lake Victoria is still mainly attributed to over fishing and habitat degradation. These have had adverse impacts to the fishery by changing the species diversity and reduction in total harvestable biomass;
iv. Increase in illegal fishing gears and methods;
v. Lack of appropriate fish handling and preservation facilities that usually lead to post-harvest losses and poor quality of fish and fishery products;
vi. Weak and unfavorable fish marketing systems along the fish landing sites leading to poor prices and therefore resource deterioration;
vii. Inadequate resources (human and funds) to ensure efficient Monitoring, Control and Surveillance for sustainability.

The State Department of Fisheries is concerned about the sustainability of Lake Victoria fisheries. Scientists have advised that the fish stocks are continuously declining and unless this is effectively dealt with, the sustainability of the fishery remains under threat. This will eventually have a negative impact on other businesses and the fishers.

All stakeholders especially fish processors and gear distributors should collaborate with the State Department of Fisheries in order to manage Lake Victoria fisheries resources sustainably. Many illegal gears are still in use and this can only be controlled with the cooperation of all the stake holders.

Table 4: Lake Victoria fish landings by Species, Weight and Value 2014 – 2016

	2014			2015			2016		
Species	**Metric tons**	**Million Kshs**	**% Comp**	**Metric tons**	**Million Kshs**	**% Comp**	**Metric tons**	**Million Kshs**	**% Comp**
L. niloticus	42,838	8,405	33	31,287	6,815	28	30,070	9,047	31
R. argentae	69,561	4,130	54	61,662	5,458	57	46,810	4,257	48
O. niloticus	7,927	1,332	6	5,352	1,360	5	5,267	1,228	5
Clarias spp.	2,440	273	2	2,402	252	2	2,115	177	2
Proptopterus spp.	1,122	105	1	975	112	1	968	111	1
Haplochromis spp.	919	73	1	2,616	148	2	2,192	152	2
Others	3,901	285	3	5,608	350	5	10,744	854	11
TOTAL	**128,708**	**14,602**	**100**	**109,902**	**14,495**	**100**	**98,166**	**15,826**	**100**

Table 5: Lake Victoria Monthly fish landings by Species, Weight (M. Tonnes) 2016

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
L. niloticus	1,242	1,789	2,708	3,297	3,083	3,380	2,635	2,809	2,491	2,143	2,468	2,025	**30,070**
R. argentea	2,029	2,865	2,870	2,775	2,589	3,118	3,521	3,364	3,544	5,440	7,026	7,669	**46,810**
O. niloticus	537	775	937	502	531	557	528	504	504	493	494	494	**6,856**
Clarias spp.	214	366	737	830	616	439	372	319	354	295	362	362	**5,267**
Protopterus spp.	152	112	115	154	111	142	113	86	95	86	872	76	**2,115**
Haplochromis spp.	92	108	76	85	78	94	75	69	77	64	84	66	**968**
Caridina niloticus	106	133	524	413	361	97	294	68	50	54	53	40	**2,192**
Others	445	172	814	948	364	250	357	72	86	113	145	122	**3,888**
TOTAL	**4,817**	**6,320**	**8,782**	**9,004**	**7,733**	**8,077**	**7,895**	**7,292**	**7,201**	**8,688**	**11,504**	**10,854**	**98,166**

Table 6: Lake Victoria Annual fish landings by Species, Weight, Value and by Counties 2016

County	Busia		Homa bay		Kisumu		Migori		Siaya		Total	
Species	Metric tonnes	000 Kshs	Metric tonnes	000 Kshs	Metric tonnes	000 Kshs	Metric tonnes	000 Kshs	Metric tonnes	000 Kshs	Metric tonnes	000 Kshs
L. niloticus	747	138,743	16,912	3,933,361	269	61,405	2,013	579,134	10,129	4,334,667	**30,070**	**9,047,309**
R. argentea	3,210	167,327	28,215	2,887,889	1,433	161,510	3,333	485,971	10,620	554,463	**46,810**	**4,257,158**
O. niloticus	525	170,461	2,362	602,475	358	95,113	237	69,746	1,785	289,826	**5,267**	**1,227,621**
Clarias spp.	2	399	1,094	40,797	532	76,550	2	364	485	58,546	**2,115**	**176,656**
Protopterus spp.	8	1,337	301	31,184	324	45,768	7	1,691	327	31,094	**968**	**111,074**
Haplochromis	159	13,668	1,643	90,659	55	5,506	154	30,151	180	12,102	**2,192**	**152,087**
Caridina niloticus	-	-	1,000	123,353	500	25,000	799	111,889	4,556	235,852	**6,856**	**496,095**
Others	18	1,495	3,012	285,488	678	58,250	8	1,601	172	11,475	**3,888**	**358,308**
Total	**4,670**	**493,431**	**54,540**	**7,995,205**	**4,149**	**529,102**	**6,553**	**1,280,545**	**28,255**	**5,528,024**	**98,166**	**15,826,307**

3.2 MARINE CAPTURE FISHERY

3.2.1 MARINE ARTISANAL LANDINGS

The marine capture fishery is composed of coastal and near shore artisanal, semi-industrial and offshore industrial fisheries. Artisanal and semi-industrial fisheries are exploited by the coastal local communities while the industrial fisheries are exploited by foreign fishing companies. During the year under review, the artisanal fishing fleet comprised of 2,913 fishing crafts and 12,915 fishermen (*Marine Artisanal Fisheries Frame Survey 2014 report*) while the semi-industrial fleet had two licensed trawlers. The inshore waters which are fishing grounds for artisanal fishermen are over-exploited and degraded. Great potential exists in the exploitation of the Kenyan EEZ where estimates done in 1975-1980 indicate potential of 100,000 to 150,000 metric tonnes annually (FAO, 1980) and more recent estimates indicate potential of 300,000 metric tonnes (Habib, 2003). This fishery is currently exploited by Distant Water Fishing Nations (DWFN) upon payment of access fees to the State Department of Fisheries. The State Department has limited capacity for Monitoring, Control and Surveillance (MCS) to ensure compliance with the established fisheries management standards, besides it is possible that vessels could be accessing our EEZ resources without payment of access fees. However the challenge at hand is large and needs a comprehensive approach in order to establish and deploy a national fisheries enforcement unit. A well trained and a disciplined law enforcement unit is critical toward the management of every fishery particularly when its operation is based on best scientific information.

The artisanal fishing activities are affected by Kenya's coastal oceanographic conditions which are caused by changes in the monsoon wind system (UNEP, 1998) that results to seasonal reversal process with NE monsoons between November-March and SE monsoons between May-September. These oceanographic processes cause distinct seasonality in the artisanal fishery, with high catches during the NE monsoon than the SE monsoon. These two seasons are referred to as *Kazi kazi* and *Kusi* by the locals. During *Kazi kazi* the sea is calm and there is a lot of fishing activities and fish landings are normally high while during *Kusi* the winds render the sea rough thus unfavorable to fishing trips. During the rough sea season, the exploitation of the near reefs, lagoons and bays is highest leading to degradation of the resource.

Marine artisanal fishery capture over the reporting period increased compared to 2015 production. In 2016, a total of 24,165 Metric tons with an ex-vessel of Ksh. 4.691 billion was landed. The 2015, marine capture landings from artisanal sources was 22,407 Metric tons with an ex-vessel value of Ksh. 3.79 billion. The catch represented an increase of 7.8% production with a corresponding 23.6% increase in the ex-vessel value. Over the past 8 years (2006-2013), fish production from the marine artisanal fishery had remained fairly constant between 7,000 and 9,000 metric tons. However this trend changed in 2014 and 2015 when the State Department of Fisheries and Blue Economy introduced new methodology and approaches in the collection of catch data and estimation of fish landings. The collection was undertaken in 22 primary and secondary landing sites which were used for raising catches for the sites not covered using the frame survey data. The results show that there was underreporting in areas especially where the fisheries staff were not accessing previously.

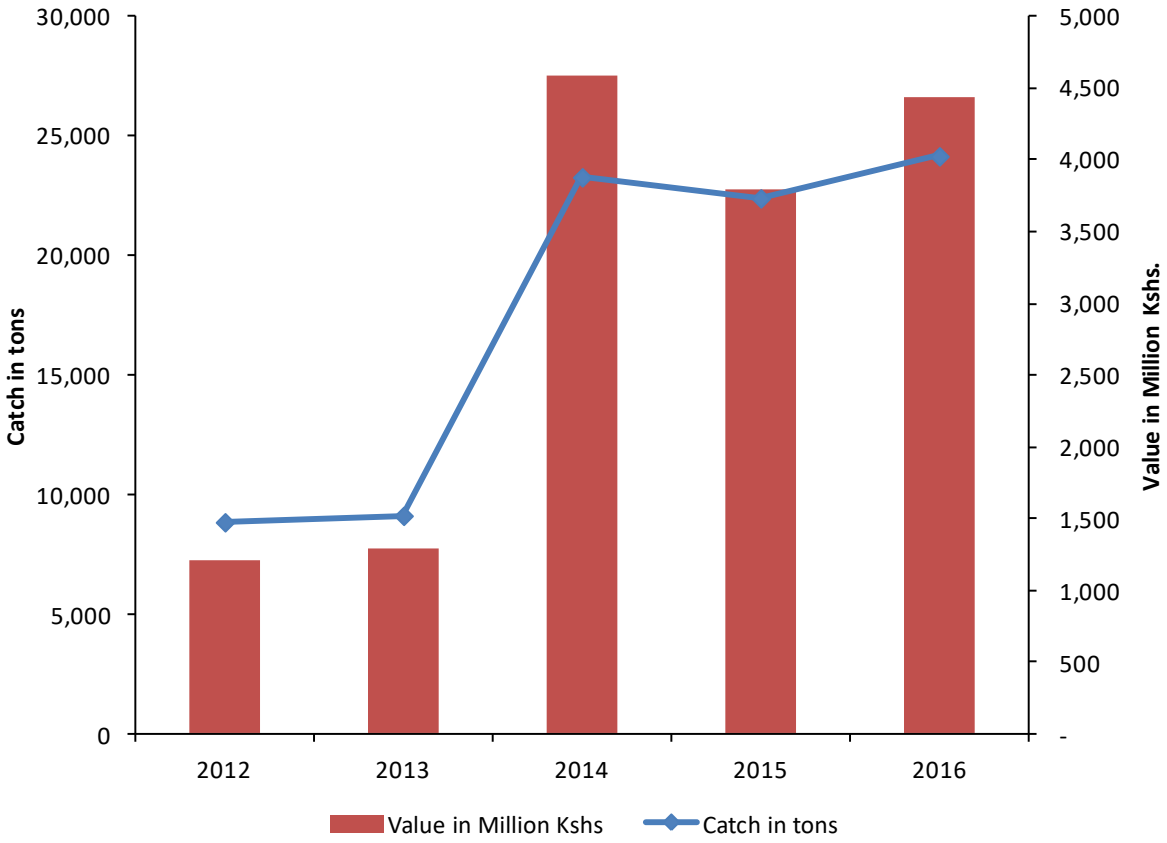

Figure 6: Trends of marine fish production by quantity and value 2012-2016

In 2016, demersals dominated artisanal marine fisheries catch accounting for 41% (9,974 Metric tons) of the total landings. Pelagics contributed 39% (9,303 Metric tons) while Molluscs accounted for 9% (2,203 Metric tons). Sharks, rays and mixed species contributed 8% (1,913 Metric tons) and crustaceans 3% (772 Metric tons).

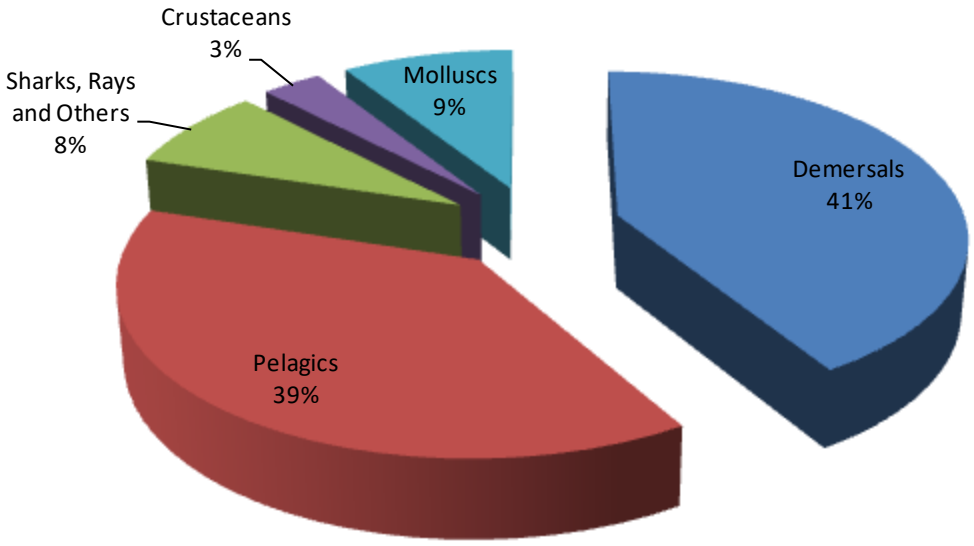

Figure 7: Percentage contribution of marine fish species groups 2016

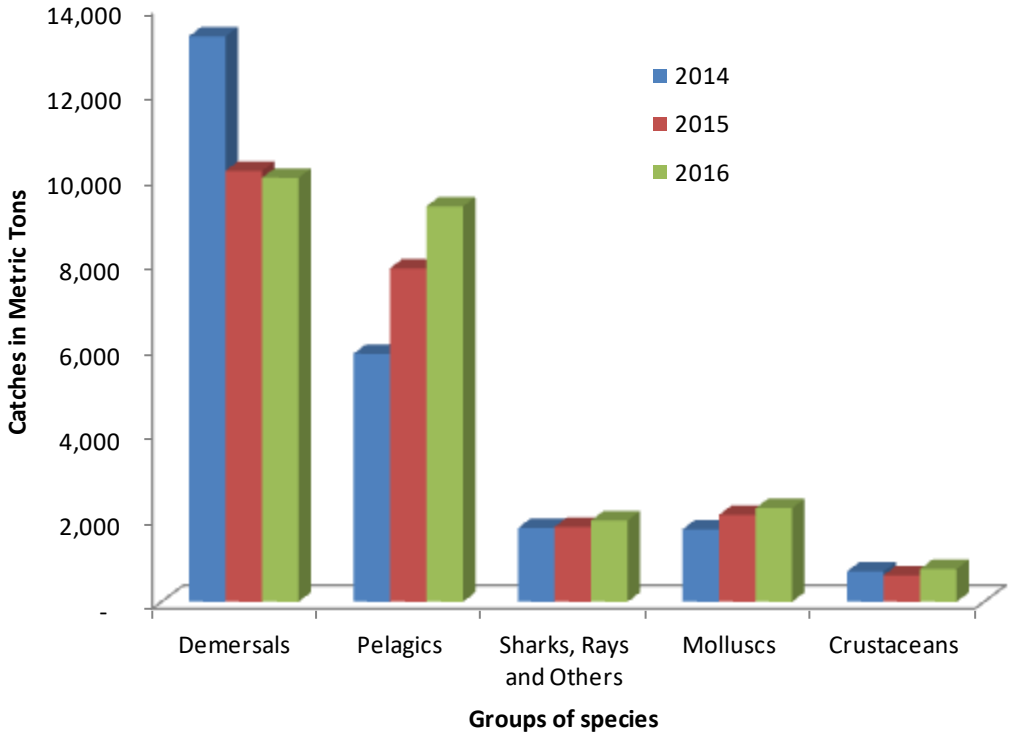

Figure 8: Trends of landings of marine fish species groups 2014-2016

In this reporting period, Kilifi county contributed the highest quantity of marine artisanal landing of 12,211 Mt (51% of the total landings) with an ex-vessel value of Ksh. 2.205 billion (47% of the total ex-vessel value). Kwale county contributed 5,011 Mt (21%) with ex- vessel value of Ksh. 874 Million (19%), followed by Lamu county with 4,666 Mt (19%) with ex-vessel value of Ksh. 1.023 billion (22%). Mombasa contributed 1,726 Mt (7%) with ex-vessel value of Ksh. 435 Million (9%) with Tana River county contributing the least, 552 Mt (2%) with ex-vessel value of Ksh. 153 Million (3%). See Figure 9 below.

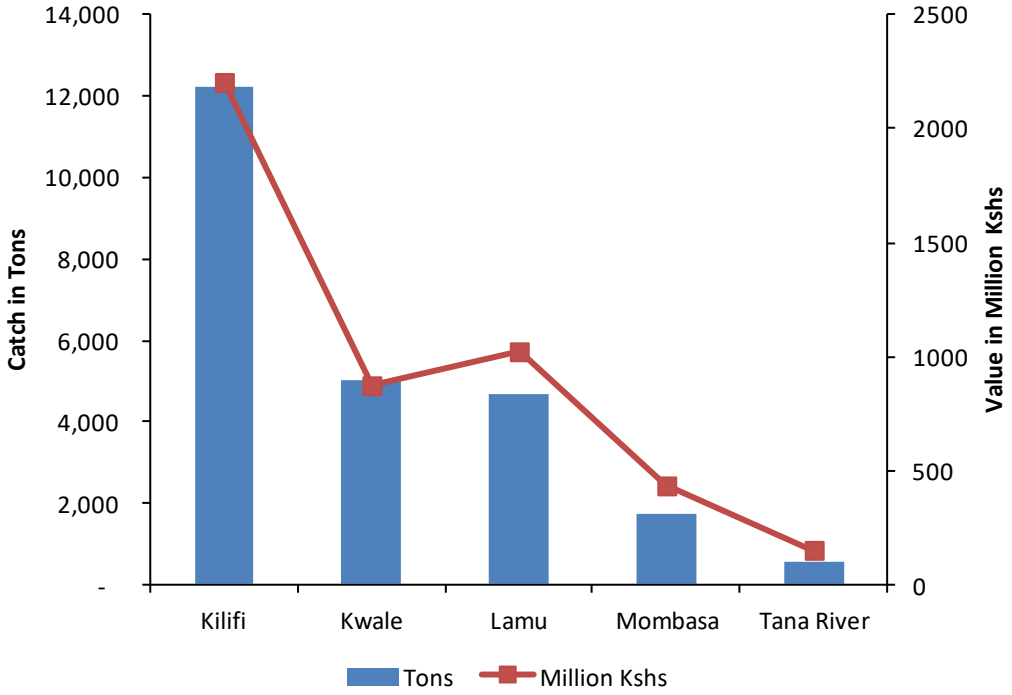

Figure 9: Marine fish production by Quantity, Value and Counties 2016

For the second time, the catches by gear types for marine fishery were reported from the new catch assessment survey report. There over 20 types of gears used along the coast as per the marine frame survey reports. In 2016, seven of the gears used by coast fishers landed 74% of the total catch. Gillnets contributed the most catch (7,395 Mt), followed by handlines (3,278 Mt), beach seine (2,196 Mt), monofilament (2,120 Mt), ringnet (1,270 Mt), spear gun (1,275 Mt) and longline (289 Mt) while all the other gears combined landed 6,343 Mt, (Figure 10). The landings by gear types were similar in pattern to those observed in 2015. The main difference was that while gillnet catches were leading in 2016 followed by handline, in 2015 the landings by handlines were more than catches from gillnets. The rest of the gears maintained their contributions as the main gear types.

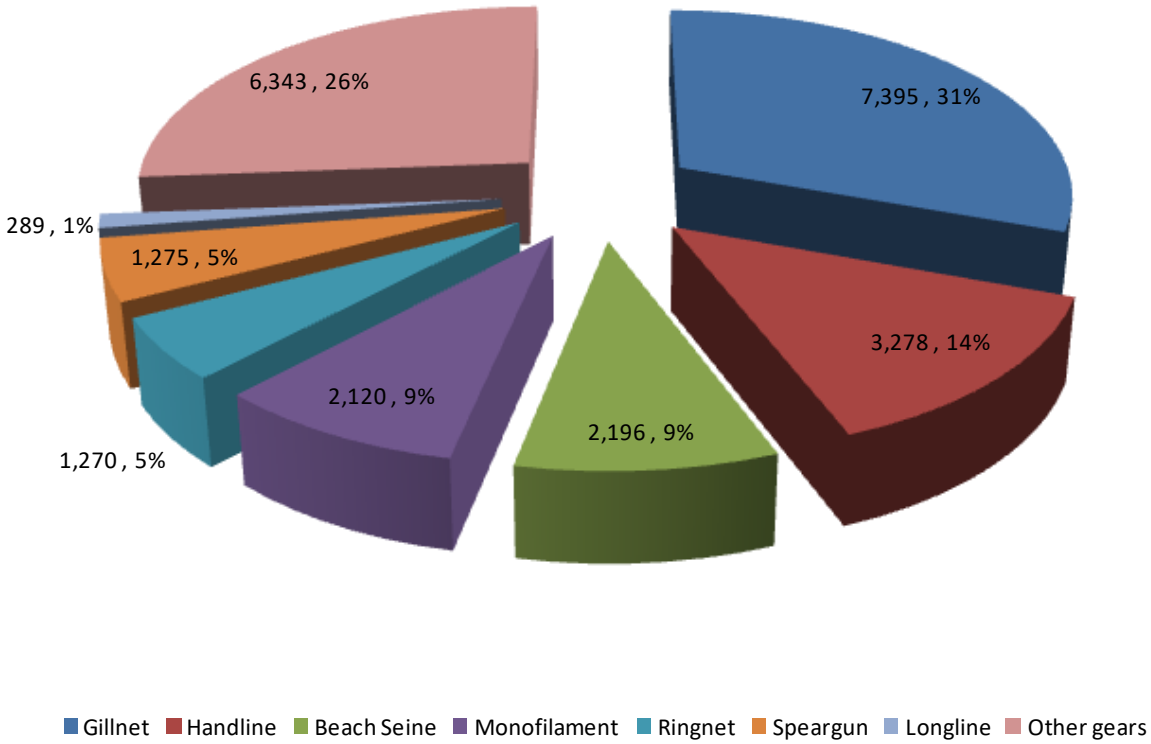

Figure 10: Marine artisanal landings by gear types in 2016

Table 7: Marine Fish Landings by Species, Weight and Value 2014 to 2016

SPECIES		2014		2015		2016	
Demersals	**Demersals**						
Siganidae	Rabbitfishes	2,507	410,586	1,488	240,562	2,294	424,526
Lutjanidae	Snappers	3,358	567,335	1,687	290,809	1,640	275,157
Lethrinidae	Scavengers	1,947	316,779	1,247	198,576	1,368	236,753
Scaridae	Parrotfishes	1,231	167,355	846	103,516	1,269	159,364
Serranidae	Groupers	573	90,523	694	106,912	483	77,868
Haemulidae	Grunts	597	86,944	399	54,189	414	59,404
Mugilidae	Mullets	320	47,015	454	60,267	376	58,110
Acanthuridae	Surgeonfishes	295	40,765	510	65,586	317	42,308
Nemipteridae	Threadfin breams	572	81,623	630	72,834	296	39,833
Mullidae	Goatfishes	174	30,210	182	30,325	269	51,774
Mixed demersal		1,729	300,352	1,998	270,271	1,250	164,016
Total demersals		**13,302**	**2,139,486**	**10,135**	**1,493,847**	**9,974**	**1,589,113**
Pelagics							
Belonidae	Needlefishes	1,682	374,967	2,313	447,961	2,759	427,214
Scombridae	Tunas/Mackerels	522	75,995	1,215	174,201	1,798	379,180
Carangidae	Jacks/Trevallies	767	129,278	795	141,985	1,186	230,220
Sphyraenidae	Barracudas	534	95,070	729	131,432	709	129,897
Hemiramphidae	Halfbeaks	725	89,350	632	71,619	883	109,711
Clupeidae	Sardines	457	86,738	649	113,493	618	69,622
Engraulidae	Anchovies	48	5,302	285	37,036	455	60,638
Istiophoridae	Sailfishes	431	85,403	402	70,207	235	49,576
Xiphiidae	Swordfishes	180	35,783	158	24,191	160	35,786
Chirocentridae	Wolf Herrings	198	26,388	274	29,709	266	31,499
Mixed pelagics		291	45,117	392	57,158	235	37,575
Total pelagics		**5,834**	**1,049,390**	**7,845**	**1,298,994**	**9,303**	**1,560,917**
Others							

Sharks &Rays	Sharks & Rays	1,312	181,563	1,236	166,696	1,033	161,706
mixed fish/Others	mixed fish/Others	423	48,039	525	58,596	880	112,622
Total		**1,735**	**229,622**	**1763**	**225,422**	**1,913**	**274,328**
Crustaceans							
Palinuridae	Lobsters	408	885,657	263	343,600	390	651,024
Portunidae	Crabs	135	43,389	145	70,274	163	90,161
Penaeidae	Prawns/Shrimps	170	39,061	213	60,637	220	146,480
Total crustaceans		**713**	**968,107**	**621**	**474,512**	**772**	**887,664**
Molluscs							
Octopodidae	Octopus	1,610	233,756	1832	258,926	2,063	349,414
Loliginidae	Squids	35	8,198	147	32,853	64	15,447
Sepiidae	Cuttlefishes	45	10,493	47	8,994	70	8,671
Holothuridae	Sea cucumber	13	2,297	19	2,158	6	4,986
Total molluscs		**1,703**	**254,744**	**2,045**	**302,930**	**2,203**	**378,518**
Total Marine		**23,287**	**4,641,349**	**22,407**	**3,795,575**	**24,165**	**4,690,541**

Table 7: Marine monthly fish landing in Weight by family group 2016

	Family	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Demersals														
Siganidae	Rabbitfishes	90,569	57,742	69,349	233,723	119,827	195,450	264,679	242,221	147,557	268,609	245,518	358,679	2,293,922
Lutjanidae	Snappers	111,459	187,309	224,843	49,277	248,028	66,814	49,515	85,784	141,177	60,266	100,114	315,514	1,640,099
Lethrinidae	Scavengers	90,773	82,945	126,548	149,562	78,384	105,060	85,426	110,455	82,073	111,923	160,737	183,675	1,367,560
Scaridae	Parrotfishes	65,121	61,289	78,361	229,162	71,229	124,603	86,099	81,968	62,291	78,273	139,125	191,320	1,268,841
Serranidae	Groupers	46,166	59,359	56,118	46,971	49,509	9,696	34,081	25,662	30,032	42,834	49,131	33,287	482,845
Haemulidae	Grunts	26,029	29,121	37,911	62,751	30,305	36,542	27,905	27,394	18,592	20,089	35,613	61,294	413,548
Mugilidae	Mullets	48,796	38,762	40,841	12,606	49,073	19,671	45,519	17,456	37,945	23,735	33,322	8,351	376,077
Acanthuridae	Surgeonfishes	17,342	15,283	8,554	10,549	13,085	6,384	8,084	25,867	11,400	12,919	61,332	125,715	316,515
Nemipteridae	Threadfin breams	56,928	18,883	35,963	41,458	53,504	3,376	8,153	4,985	21,256	16,367	13,588	21,303	295,764
Mullidae	Goatfishes	47,082	42,971	17,263	17,747	34,725	26,339	15,799	12,153	8,094	16,277	12,030	18,866	269,346
Mixed demersals		140,003	116,628	108,427	80,142	184,174	75,244	83,975	55,290	103,705	125,917	96,127	80,093	1,249,726
Total demersals		740,268	710,290	804,178	933,950	931,844	669,178	709,235	689,235	664,121	777,209	946,639	1,398,097	9,974,244
Pelagics														
Belonidae	Needlefishes	29,341	13,848	32,507	83,945	93,635	125,272	619,791	1,007,910	97,826	48,299	15,878	590,806	2,759,059
Scombridae	Tunas/Mackerels/ Wahoos	200,658	95,198	222,318	59,179	91,092	121,296	170,740	98,682	240,163	100,107	238,611	160,374	1,798,419
Carangidae	Jacks/Trevallies/Queenfishes	227,678	96,528	54,338	84,180	49,031	53,057	170,669	159,142	90,088	50,128	66,591	84,282	1,185,711
Sphyraenidae	Barracudas	49,015	51,166	45,842	25,938	30,869	10,034	28,250	107,666	242,099	54,388	12,245	51,107	708,619
Hemiramphidae	Halfbeaks	81,360	25,803	60,356	51,751	69,957	72,745	54,808	63,165	56,815	77,106	104,813	163,972	882,650
Clupeidae	Sardines	16,882	36,442	19,152	24,969	24,216	70,218	334,702	36,066	8,035	13,298	11,606	22,768	618,355
Engraulidae	Anchovies	21,756	15,243	51,105	649	18,227	27,279	232,664	79,609	4,151	3,157	-	1,029	454,869
Istiophoridae	Sailfishes	33,718	29,673	37,470	12,590	31,284	18,251	7,959	-	7,981	6,595	15,526	34,082	235,129
Chirocentridae	Wolf Herrings	13,053	6,223	3,781	633	42,374	8,065	4,720	52,998	42,217	46,761	8,922	36,248	265,995
Xiphiidae	Swordfishes	18,406	12,979	17,480	25,419	9,678	1,570	1,969	2,846	3,003	20,248	35,657	10,563	159,817
Other pelagicss		26,856	14,918	66,038	12,053	41,639	8,548	15,636	1,739	13,503	9,739	10,617	13,454	234,738
Total pelagics														

Sharks and Rays, mixed species														
Mixed species		31,458	25,917	23,261	42,702	23,096	13,766	161,337	16,984	37,338	13,019	24,338	466,774	879,991
Dasyatidae	Sharks	30,885	44,687	14,716	47,625	24,931	8,591	3,117	14,041	16,233	40,976	77,690	61,134	384,627
Carcharhinidae	Sting Rays	31,289	20,125	33,885	40,214	57,963	22,098	34,977	18,103	14,597	19,156	27,849	22,439	342,695
Myliobatidae	Manta Rays	12,463	18,464	18,028	305	21,768	1,287	735	557	9,744	205	147,428	5,287	236,271
Sphyrnidae	Hammerhead sharks	13,277	6,165	6,303	102	3,481	3,108	3,264	53	-	-	-	1,544	37,296
Mobulidae		-	-	-	236	-	9,440	7,428	982	9,674	211	2,752	315	31,037
Rhinobatidae	Guitarfishes/Skates	-	-	-	-	-	-	-	-	-	-	771	-	771
Total Sharks & rays		119,372	115,358	96,193	131,183	131,239	58,290	210,858	50,719	87,587	73,567	280,829	557,493	1,912,688
Crustaceans														
Palinuridae	Lobsters	17,821	13,724	14,585	26,072	31,750	16,051	26,573	32,083	25,256	61,323	69,585	55,079	389,901
Portunidae	Crabs	20,059	5,901	10,676	6,438	34,961	11,060	42,588	3,870	5,240	11,561	2,112	8,048	162,514
Penaeidae	Prawns/Shrimps	11,565	1,460	6,530	18,586	22,413	85,731	27,204	5,489	6,943	24,194	2,701	7,018	219,834
Total crustaceans		49,444	21,085	31,791	51,096	89,123	112,842	96,365	41,442	37,440	97,077	74,398	70,145	772,249
Molluscs														
Octopodidae	Octopus	146,895	176,821	120,645	154,542	114,046	120,233	124,317	244,648	215,688	231,184	219,132	194,496	2,062,648
Loliginidae	Squids	6,333	7,779	9,236	624	25,427	1,602	35	2,118	2,076	2,544	3,967	2,218	63,959
Sepiidae	Cuttlefishes	4,330	2,548	4,906	9,069	2,225	7,112	14,105	17,215	1,837	1,290	1,541	3,373	69,551
Holothuridae	Sea cucumber	1,259	1,223	-	533	416	-	881	1,479	528	-	-	77	6,396
Total Molluscs		158,817	188,370	134,787	164,769	142,115	128,947	139,338	265,459	220,129	235,018	224,641	200,164	2,202,554
Toral Marine		1,786,626	1,433,123	1,677,334	1,662,305	1,796,322	1,485,590	2,797,706	2,656,679	1,815,156	1,612,697	2,046,974	3,394,584	24,165,096

Table 8: Marine fish landing by Species, Weight and Value and by Counties 2016

Family	Common Name	Kilifi		Kwale		Lamu		Mombasa		Tana River		Total	
Zoological	English	Catch (Kg)	Value	Catch (Kg)	Value	Catch (Kg)	Value	Catch (Kg)	Value	Catch (Kg)	Value	Catch (Kg)	Value
Demersals													
Siganidae	Rabbitfishes	537,523	118,442,914	486,186	98,169,516	831,441	83,941,205	438,678	123,961,948	94	10,339	2,293,922	424,525,922
Lutjanidae	Snappers	985,252	186,446,620	215,147	34,485,148	319,642	31,604,225	50,351	14,284,701	69,707	8,336,505	1,640,099	275,157,200
Lethrinidae	Scavengers	286,285	58,467,580	329,924	60,447,326	490,546	47,357,473	249,842	69,165,151	10,963	1,315,590	1,367,560	236,753,119
Scaridae	Parrotfishes	220,796	34,652,452	281,110	43,987,897	669,750	58,133,397	94,537	22,378,391	2,648	211,825	1,268,841	159,363,961
Serranidae	Groupers	181,628	36,163,011	105,788	15,205,611	154,553	15,880,557	37,321	10,262,927	3,555	355,543	482,845	77,867,649
Haemulidae	Grunts	93,331	15,876,915	63,989	10,839,098	201,668	20,180,330	43,076	11,670,391	11,484	837,764	413,548	59,404,498
Mugilidae	Mullets	124,148	22,406,788	34,832	5,020,021	193,238	27,672,421	7,508	1,798,981	16,350	1,211,558	376,077	58,109,770
Acanthuridae	Surgeonfishes	213,146	25,311,469	54,472	7,267,687	109,360	9,971	44,341	9,429,701	4,447	289,024	316,515	42,307,851
Nemipteridae	Threadfin breams	83,057	12,610,114	160,918	22,347,831	18,538	1,543,160	-	-	33,251	3,332,223	295,764	39,833,328
Mullidae	Goatfishes	128,442	24,703,335	75,345	14,960,201	29,672	3,166,451	35,888	8,943,993	-	-	269,346	51,773,980
Mixed demersal		415,924	68,985,589	344,870	45,241,287	278,016	22,577,491	68,751	14,167,236	142,237	13,047,923	1,249,726	164,015,898
Total Demersals		3,269,533	604,066,789	2,152,581	357,971,622	3,296,423	312,066,680	1,070,294	286,063,419	294,737	28,948,293	9,974,244	1,589,113,175
Pelagics													
Belonidae	Needlefishes	2,630,336	408,399,013	84,303	13,055,683	36,835	3,543,955	7,585	2,214,950	-	-	2,759,059	427,213,601
Scombridae	Tunas/Mackerels	1,099,952	252,941,733	539,112	100,057,899	95,905	13,603,562	52,341	12,357,389	11,108	219,286	1,798,419	379,179,868
Carangidae	Jacks/Trevallies/Queenfishes	735,894	153,563,818	234,863	43,430,584	147,000	16,842,174	61,655	15,788,293	6,300	595,068	1,185,711	230,219,938
Sphyraenidae	Barracudas	440,715	89,738,456	207,771	31,446,756	36,594	3,581,493	16,160	4,699,816	7,380	430,487	708,619	129,897,008
Hemiramphidae	Halfbeaks	149,185	22,410,109	109,614	15,620,399	621,364	71,110,696	2,316	555,775	171	14,229	882,650	109,711,207
Clupeidae	Sardines	370,366	42,023,919	82,395	370,991	33	5,249	163,295	27,149,375	2,266	72,062	618,355	69,621,596
Engraulidae	Anchovies	341,623	50,102,216	112,750	10,492,192	-	-	148	14,786	348	29,220	454,869	60,638,413
Istiophoridae	Sailfishes	222,071	47,023,202	6,607	1,122,501	2,143	171,429	4,082	1,224,620	226	33,937	235,129	49,575,688
Xiphiidae	Swordfishes	52,901	7,406,090	11,011	1,651,705	-	-	95,905	26,727,722	-	-	159,817	35,785,517
Chirocentridae	Wolf Herrings	210,699	26,454,461	15,295	1,013,428	38,559	3,846,277	1,441	184,929	-	-	265,995	31,499,095

Mixed pelagics		137,127	23,954,889	83,950	11,585,529	7,035	787,907	5,172	187,928,640	1,381	103,587	234,665	224,360,551
Total pelagics		6,390,868	1,124,017,904	1,487,672	229,847,667	985,467	113,492,742	410,100	278,846,295	29,180	1,497,875	9,303,288	1,747,702,483
Mixed species													
*Mixed NEI		646,877	88,205,180	135,277	9,710,621	94,953	14,042,289	2,610	638,222	274	26,096	879,991	112,622,409
Carcharhinidae	Sharks	186,789	33,195,976	28,922	4,488,948	12,449	1,411,532	71,385	18,190,988	43,150	4,337,306	342,695	61,624,750
Dasyatidae	Sting Rays	264,734	40,370,898	104,819	14,932,621	2,040	163,616	9,491	1,233,355	3,544	221,998	384,627	56,922,489
Myliobatidae	Manta Rays	173,068	22,877,922	57,585	6,576,411	-	-	4,954	767,906	664	66,412	236,271	30,288,652
Sphyrnidae	Hammerhead sharks	36,428	7,476,473	724	90,446	-	-	145	43,393	-	-	37,296	7,610,312
Mobulidae		8,485	1,103,101	1,005	185,755	-	-	21,547	3,878,400	-	-	31,037	5,167,256
Rhinobatidae	Guitarfishes/Skates	771	92,571	-	-	-	-	-	-	-	-	771	92,571
Total others		1,317,152	193,322,122	328,331	35,984,802	109,441	15,617,437	110,132	24,752,265	47,632	4,651,812	1,912,688	274,328,439
Crustaceans													
Palinuridae	Lobsters	54,672	71,970,631	44,222	37,433,363	286,242	538,659,352	4,174	2,587,729	592	372,762	389,901	651,023,836
Portunidae	Crabs	32,913	758,187	68,813	51,317,817	56,005	37,561,133	2,515	364,750	2,267	158,667	162,514	90,160,554
Penaeidae	Prawns/Shrimps	8,700	5,141,494	16,699	16,699,127	8	5,724	19,895	7,861,012	174,533	116,772,730	219,834	146,480,087
Total crustaceans		96,285	77,870,312	129,734	105,450,307	342,256	576,226,209	26,584	10,813,491	177,391	117,304,159	772,249	887,664,478
Molluscs													
Octopodidae	Octopus	1,054,408	192,849,348	870,259	132,105,471	41,034	6,066,755	94,226	17,984,342	2,720	408,000	2,062,648	349,413,916
Loliginidae	Squids	36,375	8,931,670	18,129	3,831,964	-	-	9,454	2,683,095	-	-	63,959	15,446,729
Sepiidae	Cuttlefishes	46,314	3,446,783	18,170	4,190,441	-	-	5,067	1,034,065	-	-	69,551	8,671,288
Holothuridae	Sea cucumber	139	11,991	5,940	4,933,124	317	41,229	-	-	-	-	6,396	4,986,344
Total molluscs		1,137,237	205,239,792	912,498	145,061,000	41,352	6,107,983	108,748	21,701,502	2,720	408,000	2,202,554	378,518,277
Total Marine		12,211,074	2,204,516,919	5,010,815	874,315,399	4,774,938	1,023,511,051	1,725,858	622,176,971	551,661	152,810,139	24,165,023	4,877,326,851

*Mixed NEI. Are marine species Not Elsewhere Included

3.2.2 MARINE INDUSTRIAL LANDINGS

3.2.2.1 Trawling

The catches from industrial fishery in 2016 were from trawlers and a longliner. During the year under review, three trawlers operated in the shallow water prawn fishery. Shallow water prawn fishing is an important marine fishery in Kenya, providing a high value product mainly targeting the export market. The fishery is composed of a small scale fishery carried out throughout most of the coastline and the semi-industrial trawl fishery. This section covers the industrial trawling fishery. The semi industrial prawn trawling has evolved through various stages driven by economic, social and ecological considerations, during the last four decades. The existence of fishable shallow water shrimp stocks in the bay was established by several surveys conducted during the 1960's and 70's by the Kenya Government during surveys carried out under United Nations Development Programme (UNDP) and FAO fishery development programs.

Since inception, between 4 and 20 commercial bottom shrimp trawlers have operated in the bay with most of the fishing effort concentrated within the mouths of the two main rivers discharging into the bay; namely the Sabaki River around Malindi and the Tana River within the Kipini area. Prawn Fishery Management Plan (PFMP of 2010) is used to regulate the fishery with a closed season from 1st November to 31st March. The annual landings are estimated at 400 t (Mwatha 2002). During the year under review, the semi-industrial fleet had 3 licensed trawlers. A total of 413 tons of prawns, assorted fin fish species, others and trash with an estimated ex-vessel value of Kshs. 186 million Kshs. were landed by the industrial trawlers (Table 9, Figure 11). This production reflected an increase of 67.2% in total catch and 171% in catch value from last year's (2015) production of 247 tons with an ex-vessel value of Kshs. 68.9 million Kshs. The notable increase in value and catch was due to trawling in the deeper waters after the closure of the shallow fishing season where deep water prawns and lobsters are the main targets.

Table 9: Monthly catch weights (ton) and total catch value (Million Ksh.) of trawl fisheries in 2016

Months	**Prawns**	**Finfish**	**Lobsters**	**Others**	**Weight (Ton)**	**Value (M' Kshs)**
April	8.8	31.0	0	0	39.8	18.1
May	10.9	24.0	0	0	34.9	18.1
June	11.4	43.9	0	0	55.4	24.6
July	11.7	52.4	0	0	64.1	27.4
August	14.1	37.3	0	0	51.4	25.3
September	11.8	62.6	0	0	74.3	30.5
October	7.2	27.4	0	0	34.6	15.4
November	0.0	13.4	6.9	3.2	23.6	11.9
December	1.3	24.7	5.5	3.5	34.9	15.2
Total	**77.2**	**316.6**	**12.4**	**6.8**	**413.0**	**186.6**

Figure 11: Trawler monthly landings in weight and value

3.2.2.2 Longlining

During the year under review one (1) Kenyan flagged long liner was licensed to operate in the EEZ. The vessel landed a total of 150.4 ton of assorted pelagics with an estimated ex-vessel value of Kshs 75.2 million (table 10). The catch was dominated by yellow fin tuna (33%) followed by bigeye (19 %), sword fish (13%), Black Marlin (7%), hammer head shark (6%) and the other species constituted about 22 % (Figure 12). The monthly landings showed that the vessel landed more fish in May (36.9 ton) valued at Kshs 18.5 million, followed by July (22.6 ton) valued at Kshs 11.3 million and the rest of the recorded months the landings were less than 20 ton (Figure 13).

Table 10: Monthly catch and value by species for long line fisheries in 2016

Month	Catch by Species (Ton)							Value (M' Kshs)
	Bigeye Tuna	Black Marlin	Hammer head shark	Sword fish	Yellow fin Tuna	Others	Total catch (ton)	
April	0.0	0.2	2.3	0.0	2.9	5.1	10.5	5.2
May	3.7	4.8	1.3	2.4	22.4	2.3	36.9	18.5
June	5.1	1.8	0.7	0.7	5.0	3.1	16.5	8.2
July	0.0	0.5	3.7	2.6	5.9	10.0	22.6	11.3
August	1.4	0.3	0.2	2.2	1.7	3.9	9.7	4.9
September	10.9	0.1	0.1	4.1	0.7	1.5	17.3	8.7
October	2.7	1.0	0.0	3.4	1.2	1.6	9.9	5.0
November	4.0	1.3	0.1	2.6	4.1	2.3	14.4	7.2
December	0.4	1.1	0.5	1.4	6.3	2.8	12.6	6.3
Grand Total	**28.1**	**11.1**	**8.8**	**19.4**	**50.2**	**32.7**	**150.4**	**75.2**

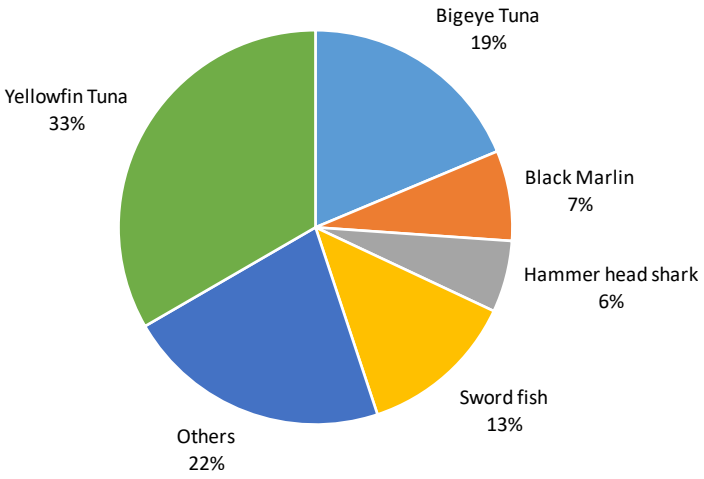

Figure 12: Percentage fish landing by species by flagged longliner in 2016

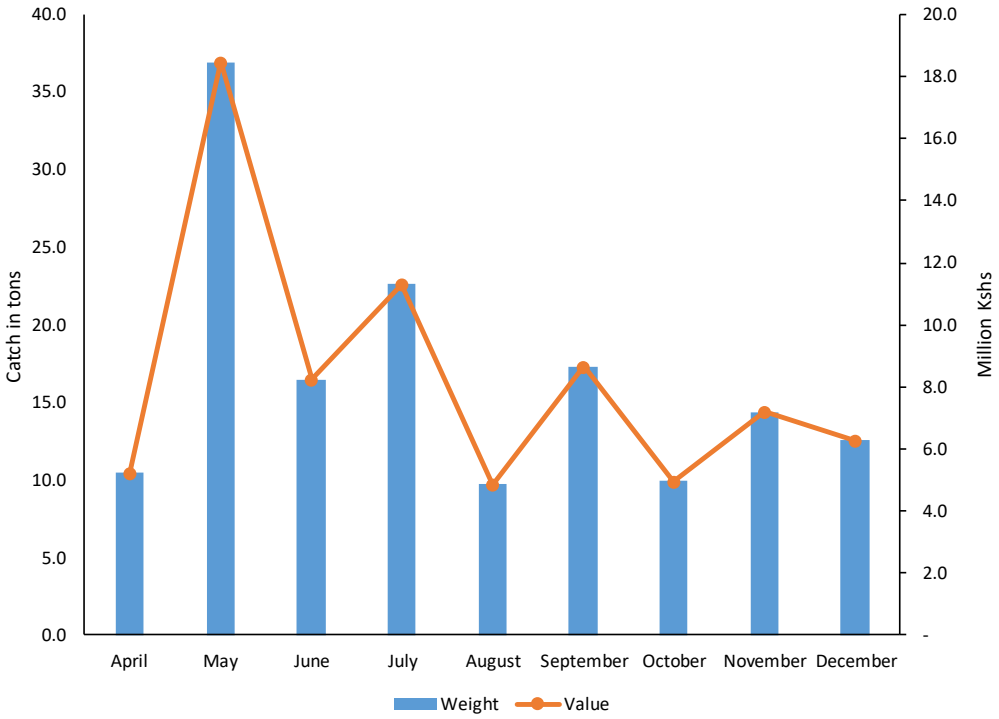

Figure 13: Comparative longline monthly fish landing by weight and value in 2016

3.3 LAKE TURKANA FISHERY

Lake Turkana is Africa's fourth largest lake by volume and Kenya's largest inland lake measuring about 249 km long by 48 km at its widest part, with a delta extending into Ethiopia. It lies in a closed basin 365 meters above sea level. The lake has three volcanic islands namely the north, central and south islands. The central island has three saline crater lakes known for endemic species of tilapias. The islands are listed as UNESCOs world heritage sites.

Over 90% of the annual water discharge by volume is from river Omo originating from the Ethiopian highlands while the rest is from seasonal rivers Kerio and Turkwel. River Omo drains a large portion of the south western highlands of Ethiopia and therefore influences fluctuations in the lake's water level, which in turn affects the amount (or abundance) of fish stocks and hence fish production from the lake. With no surface outlet, the water budget is a balance between river inflow and evaporation which imposes special physical chemical conditions making the lake saline. Therefore any activities dealing with water abstraction or damning that interferes with the natural discharge rates of river Omo has a negative effect on the lake volume levels.

The lake has about 48 species of fish with a dozen supporting a commercial fishery. The species exploited commercially include, Nile perch (*Lates niloticus),* Tilapia *(Oreochromis niloticus),* Catfish *(Clarias gariepinus), synodontis schall, Hydrocynus forskalii, Labeo horie, Bagrus spp, Distichodus niloticus, Citharinus spp, Barbus spp* and *Alestes spp* The fishery is characterized by bust cycles in fish landings associated with fluctuations in lake levels due to the dynamics of the climatic conditions especially precipitation leading to filling and drying up of the Ferguson's gulf. The filling up of the Ferguson's gulf is associated with boom in fish catches especially tilapias. The peripheral communities entirely rely on fishing directly supporting about 7,000 fishers and 6,500 fish traders and transporters.

During the year under review, a total of 7,926 metric tons of fish were landed with an ex-vessel value of Kshs. 576 million from both sides (Turkana and Marsabit counties) of the lake (Figure 14). This years' production was a decrease of 25% in quantity coupled with a decrease of 22 % in ex-vessel value compared to 2015 production of 10,605 metric tons and an ex-vessel value of Kshs 736 million. The trends in annual fish catches from Lake Turkana are determined by the lakes' water level and for that the catches have been unpredictable for a long time. But there has been a continuous decline in the catches since 2009 apart from the increase in 2015 catches which has now declined in 2016.

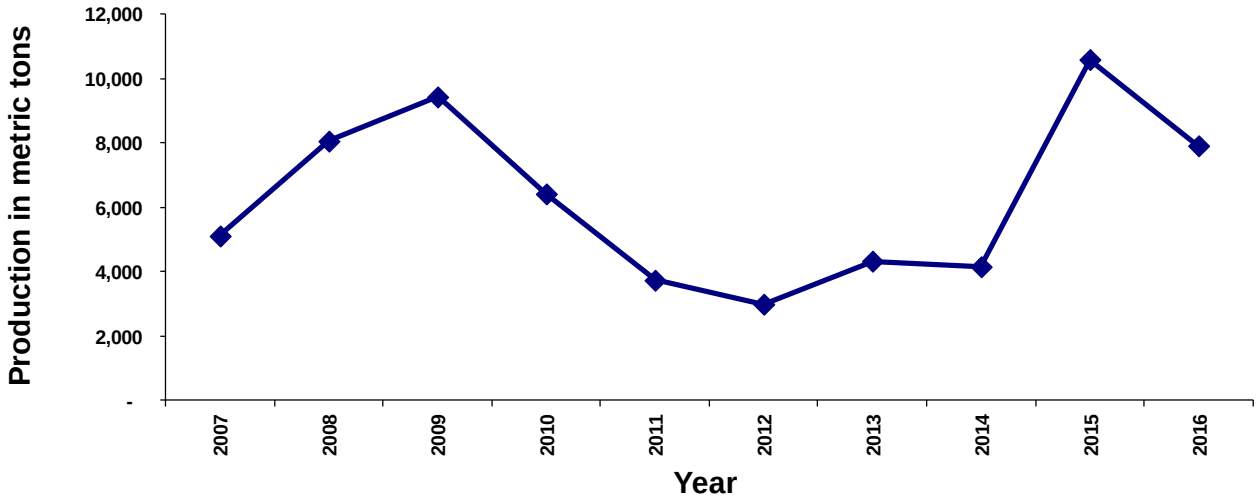

Figure 14: Trends in annual fish landings from Lake Turkana fishery 2007-2016

During the year under review, *Tilapia spp*. dominated the landings by contributing 6,170 Metric tons compared to 8,523 metric tons landed in 2015 representing 78% of the 2016 catch, followed by *Labeo spp.* of 558 metric tons (7%), *Alestes spp*. of 430 metric tons *Distichodus spp.* of 391 metric tons each representing (5%), *Citharinus spp*. of 246 metric tons (3%), *Lates niloticus* 35 metric tons (1%) while 96 metric tons of other species represented 1% of the catches (Figure 15). Recently, the contribution of nile perch has declined drastically considering that in 2014, the catches of nile perch were 560 tons representing 13% of the total lake catches. The monthly contribution of catches in tons and value is shown in table 11.

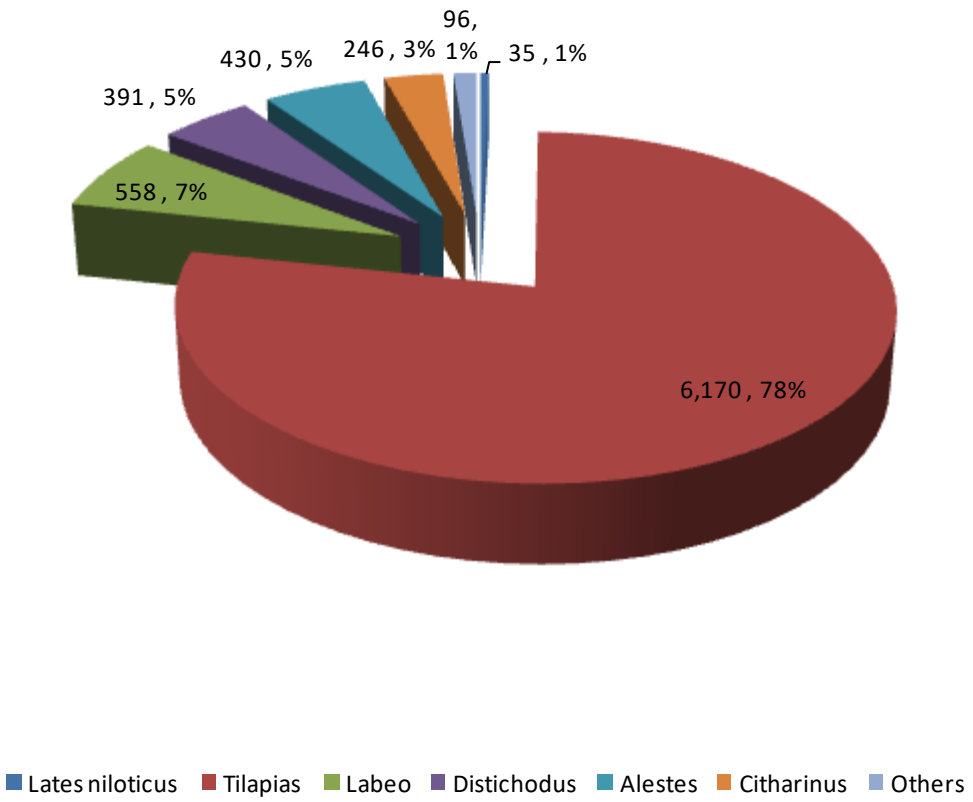

Figure 15: Species composition in catches of Lake Turkana Fishery 2016

Table 11: Lake Turkana monthly fish landings by Weight and Value 2016

	Tilapia		Labeo		Alestes		Others		Total	
MONTH	Tons	'000 Kshs	Tons	'000 Kshs	Tons	'000 Kshs	Tons	'000 Kshs	Tons	'000 Kshs
Jan	1,026	76,212	157	14,034	108	12,936	250	17,059	1,540	120,241
Feb	821	62,409	71	8,176	46	5,452	87	4,054	1,025	80,092
Mar	824	53,582	84	9,800	45	5,340	122	6,739	1,075	75,462
Apr	406	8,115	20	399	30	591	54	1,186	509	10,291
May	347	28,702	25	2,843	6	706	19	1,446	397	33,697
Jun	204	16,709	1	91	10	1,232	11	487	227	18,519
Jul	158	10,045	28	3,348	14	1,603	22	2,438	222	17,435
Aug	821	62,409	71	8,176	46	5,452	87	4,054	1,025	80,092
Sep	100	5,802	2	185	21	2,568	8	461	130	9,016
Oct	821	62,409	71	8,176	46	5,452	87	4,054	1,025	80,092
Nov	351	21,921	20	1,994	44	5,268	8	423	422	29,605
Dec	292	18,414	9	748	17	2,016	12	776	329	21,954
TOTAL	**6,170**	**426,728**	**558**	**57,972**	**430**	**48,616**	**768**	**43,177**	**7,926**	**576,493**

One of the major challenges in the exploitation of the Lake Turkana fishery is lack of cold storage facilities within reach forcing all fishers to sale almost all their catches as dried or smoked products which are inferior products and consequently fetch highly reduced market prices per nominal unit weight.

There is also need to evaluate the data collection system in the region due to the expansiveness of the lake shoreline and build capacity of the local fishers groups and Beach Management Units (BMUs) through training to effectively undertake primary data collection.

Some of the main challenges still facing Lake Turkana fishery which need to be addressed include the following:

- Lack of appropriate fish handling and preservation facilities that usually lead to post-harvest losses and poor quality of fish and fishery products;
- Poor state of landing site access roads, which make marketing impossible at some landing sites such as Todonyang and Namukuse;
- Armed conflicts between the Turkana in Kenya and the Dasenach in Ethiopia over fishing and grazing grounds in the River Omo delta. Many lives have been lost especially on the Kenyan side;
- Weak and unfavorable fish marketing systems along the fish landing sites;
- Rampant insecurity in the lake which make resource Monitoring, Control and Surveillance a risky affair;
- Insufficient funds for training Beach Management Units in data collection

There is an urgent need to develop a sound management plan for Lake Turkana fishery. The State Department of Fisheries should strengthen community participation in Fisheries resource management, utilization and conservation in the entire lake through:

- Capacity building of BMU officials and fishers from both sides of the lake;
- Train fishers on appropriate hygiene and sanitation, fish handling, processing and fish value addition.

3.4 LAKE BARINGO FISHERY

Lake Baringo is one of the Rift valley lakes with a surface area of 130 Km^2 and a mean depth of 5.6 metres. The lakes has rivers El Molo, Perkerra and Ol arabel as the main inlets but with no obvious outlet and the waters are assumed to seep through to the underground bedrock which is believed to be volcanic. The fishery of Lake Baringo is currently based on four species including *Oreochromis niloticus* (Tilapia), *Barbus gregorii*, *Clarias mossambicus* and *Protopterus aethiopicus* which was introduced in the lake.

The fishery was previously based on the tilapiine species, however owing to changes in the lakes biophysical processes such as siltation and species introductions, the fishery is currently dominated by *Protopterus aethiopicus.* During the year under review a total of 141 tons of fish with an ex-vessel value of Kshs 49.2 million were landed. This was a decrease of 20.0% in quantity and a corresponding decline of 10.4% in ex-vessel value compared to last year's production of 176 tons valued at Kshs. 54.9 million.

The species catch composition was dominated by *Protopterus aethiopicus* contributing 68% (96 metric tonnes) followed by *Tilapia spp* 20% (29 metric tonnes), *Barbus spp* 7% (10 metric tonnes) and *Clarias spp* with 5% (6 metric tonnes), figure 16 and table 12.

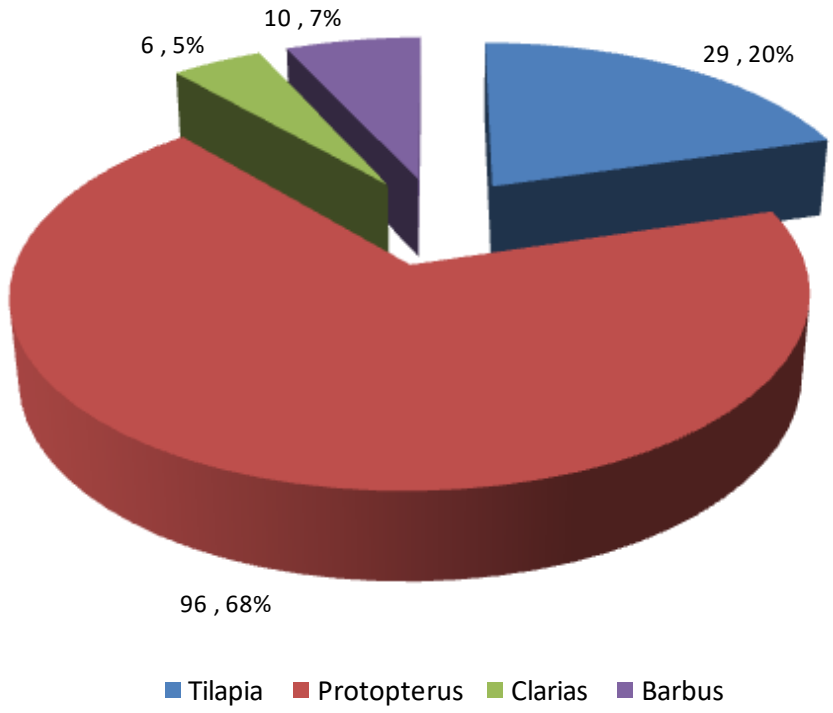

Figure 16: Percentages catch by species composition in Lake Baringo in 2016

Table 12: *Lake Baringo Monthly fish landings by Species, Weight and Value 2016*

	Tilapia		Protopterus		Clarias		Barbus		Total	
MONTH	**Kgs**	**Kshs**	**Kgs**	**Kshs**	**Kgs**	**Kshs**	**Kgs**	**Kshs**	**Kgs**	**Kshs**
Jan	1,892	756,800	5,890	2,061,500	810	202,500	1243	310,750	**9,835**	**3,331,550**
Feb	2664	1,065,600	5,560	1,946,000	500	125,000	545	136,250	**9,269**	**3,272,850**
Mar	2560	1,024,000	8,789	3,076,150	377	92,248	932	233,000	**12,658**	**4,425,398**
Apr	2560	1,024,000	5,678	1,987,300	439	439	489	122,250	**9,166**	**3,243,300**
May	3005	1,202,000	8,678	3,037,300	687	171,750	696	174,000	**13,066**	**4,585,050**
Jun	2449	979,600	6,789	2,376,150	1305	326,250	540	135,000	**11,083**	**3,817,000**
Jul	2616	1,046,400	10,650	3,727,500	489	122,250	1365	341,250	**15,120**	**5,237,400**
Aug	2772	1,108,800	9,456	3,309,600	254	63,500	1035	258,750	**13,517**	**4,740,650**
Sep	2393	957,200	8,567	2,998,450	377	94,250	799	199,750	**12,136**	**4,249,650**
Oct	2165	866,000	8,900	3,115,000	423	105,750	538	134,500	**12,026**	**4,221,250**
Nov	1981	792,400	7,900	2,765,000	467	116,750	749	187,250	**11,097**	**3,861,400**
Dec	1487	594,800	9,580	3,353,000	312	78,000	648	162,000	**12,027**	**4,187,800**
TOTAL	28,544	11,417,600	96,437	33,752,950	6,440	1,607,998	9,579	2,394,750	**141,000**	**49,173,298**
	Tilapia		Protopterus		Clarias		Barbus		Total	
	M. tonnes	**000 Kshs**	**M. tonnes**	**000 Kshs**	**M. tonens**	**000 Kshs**	**M. tonnes**	**000 Kshs**	**M. tonnes**	**000 Kshs**
	29	**11,417**	**96**	**33,753**	**6**	**1,608**	**10**	**2,395**	**141**	**49,173**

3.5 LAKE NAIVASHA FISHERY

The present fish population of Lake Naivasha comprises of the introduced species including largemouth bass (*Micropterus salmoides*) which was introduced in 1927, 1951 and 1956 from the United States of America, *Tilapia zilli* introduced from Lake Victoria in 1956. The introduction of *Tilapia zilli* also contained *Oreochromis leucostictus* and other tilapine species which are presently not encountered in the lake. The exotic rainbow trout (*Onchorhynchus mykiss*) occasionally strays into the lake from river Malewa while *Barbus amphigramma* migrates between the lake and river Malewa. The Louisiana red swamp crayfish (*Procambarus clarkii*) was introduced in 1970 as a source of food for the bass. The *Procambarus clarkii* and *Barbus amphigramma* are not under commercial exploitation currently in the lake.

The recent accidental introduction of Common carp (*Cyprinus carpio*) has created a shift in the fish production from the lake. The *Cyprinus carpio* is believed to have come through river Malewa from Nyandarua highlands during the El-Nino period of 1998-1999.

Species composition in the catches from the lake has drastically changed since the year 2002 where total catches were dominated by the *tilapiines*. However over the last thirteen years, *Tilapiines* contribution in catches has declined with the introduced *Cyprinus carpio* assuming greater prominence in the catches. The status has however changed lately with the restocking of the lake with tilapia where the species has now regained its prominence in the landings.

It is imperative for management and research to understand the implications of the *Cyprinus carpio* on the other fish species in the ecosystem. Besides, it is also important to understand the effects of the feeding habits of the *Cyprinus carpio* on the breeding grounds/nests of the *tilapiines* in the fishery.

During the year under review, a total of 1,063 tons of fish with an ex-vessel value of Kshs. 141 million were landed from Lake Naivasha. This was a slight decrease of 0.7% in quantity but an increase of 6% in value compared to 2015 landings of 1,072 tons valued at Kshs 132.6 million. Nile tilapia (*Oreochromis niloticus)* for the first time since 2002 was the most landed species constituting 528 tons representing 49.7% of the total catch. Common carp (*Cyprinus carpio*) was the next most dominant species accounting for 43.3% (461 tons) of the total catch. The other species contribution were Mirror carp accounting for 4.1% (44 tons), Black bass (*Micropterus salmoides*) and *Clarias gariepinus* 1% (10 tons) each, while lake 'Naivasha tilapia' (*Oreochromis leucostictus*) represented 0.9% (9 tons) of the total catch (figure 17).

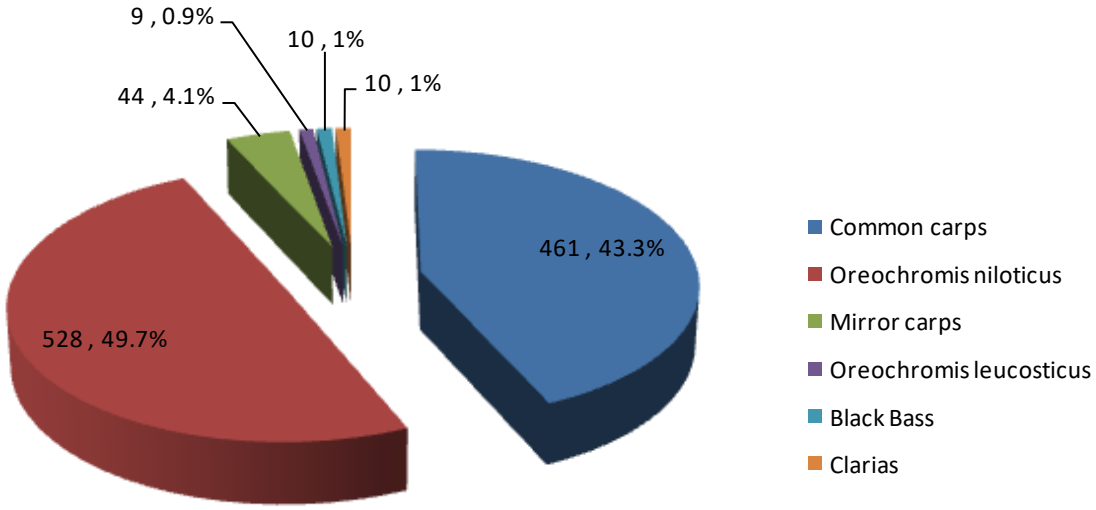

Figure 17: Lake Naivasha species composition landings in metric tonnes 2016

During the year under review, average monthly fish catches was 89.4 metric tonnes with a peak between February and May figure 18 and Table 13. A total of 50 fishing crafts were licensed to operate and these were operated by an average of 150 fishers per month.

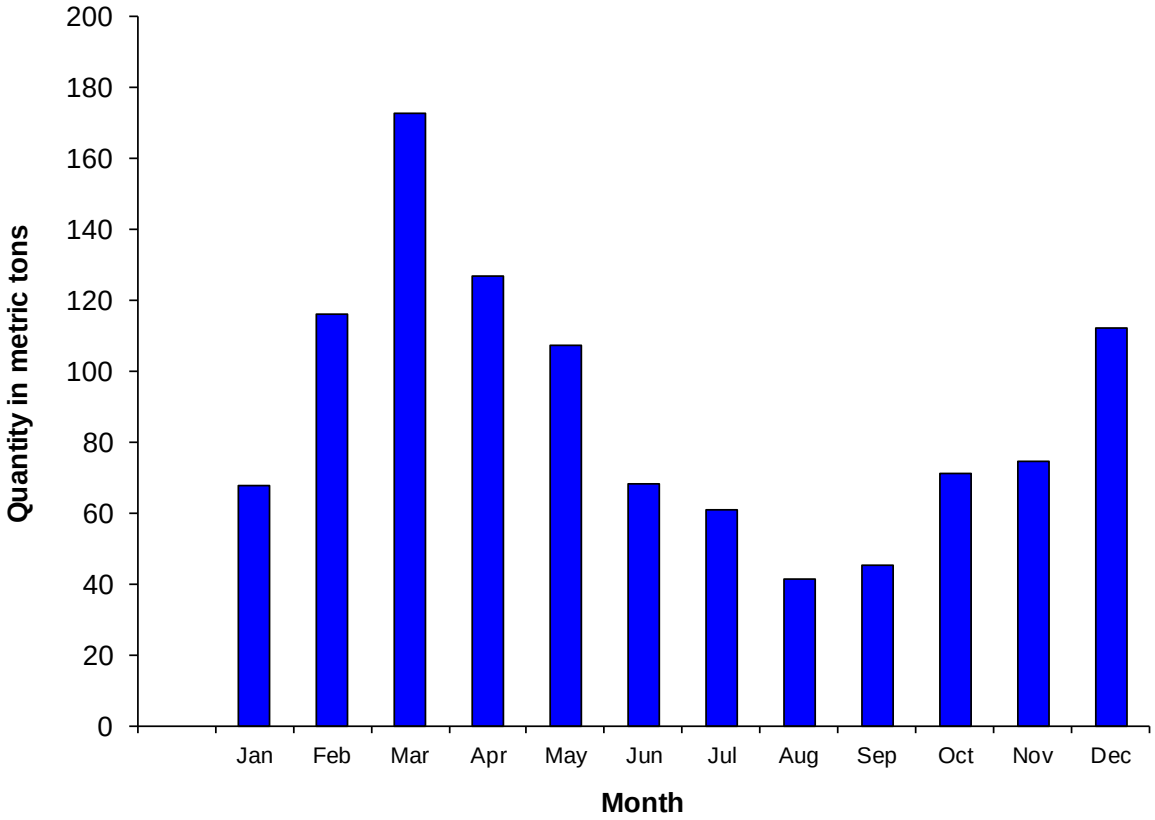

Figure 18: Lake Naivasha monthly catches in metric tonnes 2016

Table 13: Lake Naivasha Monthly fish landings by Species, Weight and Value 2016

	O. niloticus		*O. leucosticus*		*M. salmoides*		*C. gariepinus*		Mirror carp		*Common carp*		Total	
Month	**Kgs**	**Kshs**	**Kgs**	**Kshs**	**Kgs**	**Kshs**	**Kgs**	**Kshs**	**Kgs**	**Kshs**	**Kgs**	**Kshs**	**Kgs**	**Kshs**
Jan	10,162	1,409,850	677	21,310	279	17,580	66	3,790	5,543	262,066	51,026	5,898,411	**67,800.5**	**7,614,632.0**
Feb	35,591	4,057,116	1,958	66,321	2,073	87,692	1,897	103,352	6,893	505,150	67,544	8,036,012	**115,956.0**	**12,855,643.0**
Mar	115,731	6,842,515	767	62,099	2,052	84,499	1,850	106,387	6,269	522,494	46,298	6,123,382	**172,967.0**	**13,741,376.0**
Apr	58097	6655547	1933	61322	313	90713	1880	103868	6417	350728	58247	6594163	**126,887.0**	**13,856,341.0**
May	39730	5744559	731	56228	2057.5	83559	1921	112877	6489	528809	56321	6021928	**107,249.5**	**12,547,960.0**
Jun	31490	7379248	660	18760	239	12325	180	12769	4652.5	179050	30976	8017900	**68,197.5**	**15,620,052.0**
Jul	26264.5	5861701	1134	200540	2188	197656	1161	101081	6441.5	481837	23570	2616640	**60,759.0**	**9,459,455.0**
Aug	20386.5	3229815	671	62660	286	57850	288.5	20350	463.5	59625	18978.5	2810272	**41,074.0**	**6,240,572.0**
Sep	21431	3475430	574.5	86600	360	73465	303.5	20720	304.5	46810	22170.5	4040142	**45,144.0**	**7,743,167.0**
Oct	44927	7697725	75	11850	168	51105	235	14855	198	28135	25385	3101939	**70,988.0**	**10,905,609.0**
Nov	54017	10364200	89	7760	221	45690	272	19120	267	40156	19434	3989800	**74,300.0**	**14,466,726.0**
Dec	70633	10210855	23	4342	178	38045	273	20707	143	16105	41135	5664830	**112,385.0**	**15,954,884.0**
Total	528,460	72,928,561	9,292	659,792	10,415	840,179	10,327	639,876	44,081	3,020,965	461,085	62,915,419	**1,063,708**	**141,006,417**
	O. niloticus		*O. leucosticus*		*M. salmoides*		*C. gariepinus*		M. carp		C. carp		Total	
	M. tonnes	**000 Kshs**	**M. tonnes**	**000 Kshs**	**M. tones**	**000 Kshs**	**M. tones**	**000 Kshs**	**M. tones**	**000 Kshs**	**M. tonnes**	**000 Kshs**	**M. tonnes**	**000 Kshs**
TOTAL	**528**	**72,929**	**9**	**660**	**10**	**840**	**10**	**640**	**44**	**3,021**	**461**	**62,915**	**1,063**	**141,006**

3.6 LAKE JIPE FISHERY

During the year 2016, a total of 127 metric tons of both Tilapia and Clarias with an ex-vessel value of Kshs 22.8 million were landed from Lake Jipe. This reflected an increase of 4% in quantity and an increase of 8.4% in ex-vessel value compared to previous year 2015 production of 122 metric tons valued at Kshs 21 million. The only two species (Tilapia and Clarias) caught in the lake. Tilapia contributed 87% (111 metric tons) and Clarias 13% (16 metric tons), Table 14, figure 19.

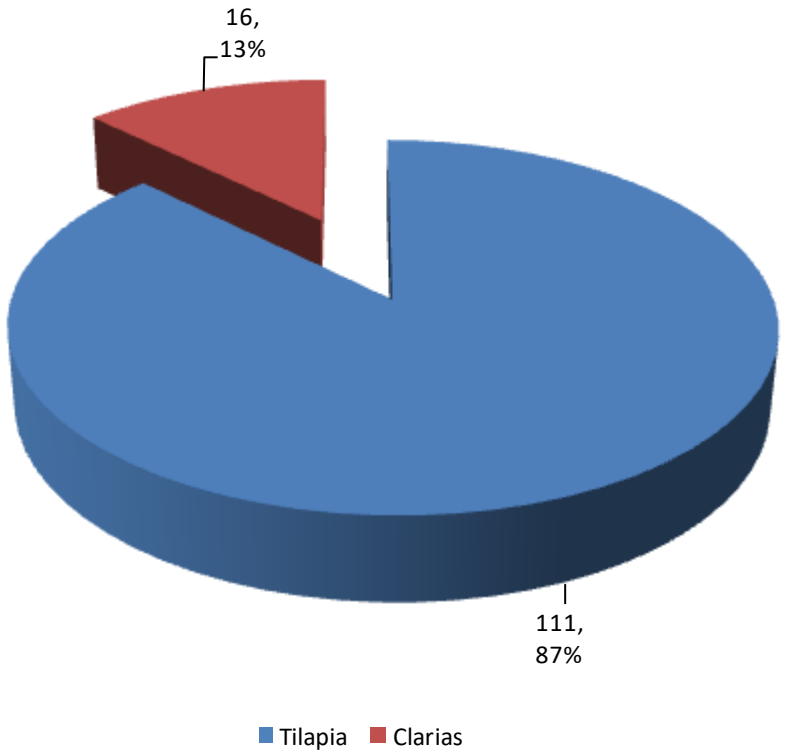

Figure 19: Percentages composition of species catch in Lake Jipe 2016

The challenges which faced capture fisheries in Lake Jipe during the year under review continued to included;

- Floating vegetation continued to stand out as the biggest problem faced by the fishers. The vegetation abstracts fishing crafts motion besides serving as hiding ground for the fish hence impacting substantially on the low production;
- Siltation – there is observable high rate of silt deposition in the lake's bed which is caused by among others sand harvesting activities on the banks of River Lumi and increased agricultural activities along the river course. The siltation has contributed to creation of a shallow inlet point in the lake which eventually brings about diversion of the river course off the lake and the water ends up in Nyumba ya Mungu resercoir in Mwanga district of Tanzania. The knock on effect accruing from this is and not limited to proliferation of water weeds, increased salinity and receding of the lake shoreline.

Table 14: Lake Jipe Monthly fish landings by Species, Weight and Value 2016

	Tilapia		Clarias		Total	
Month	**Kgs**	**000 Kshs**	**Kgs**	**000 Kshs**	**Kgs**	**000 Kshs**
Jan	9,554	1,433,100	1,646	197,520	**11,200**	**1,630,620**
Feb	9,322	1,398,300	1,524	182,880	**10,846**	**1,581,180**
Mar	9,050	1,357,500	1,303	156,360	**10,353**	**1,513,860**
Apr	8,948	1,342,200	1,243	149,160	**10,191**	**1,491,360**
May	8,853	1,327,950	1,342	161,040	**10,195**	**1,488,990**
Jun	8,590	1,288,500	1,269	152,280	**9,859**	**1,440,780**
Jul	8,323	2,080,750	1,153	230,600	**9,476**	**2,311,350**
Aug	8,995	2,280,750	1,088	217,600	**10,083**	**2,498,350**
Sep	9,361	2,340,250	1,028	205,600	**10,389**	**2,545,850**
Oct	9,648	2,412,000	898	179,600	**10,546**	**2,591,600**
Nov	10,053	2,513,250	1,743	348,600	**11,796**	**2,861,850**
Dec	10,177	2,544,250	1,854	370,800	**12,031**	**2,915,050**
Total	**110,874**	**22,318,800**	**16,091**	**2,552,040**	**126,965**	**24,870,840**

3.7 TANA RIVER DAMS FISHERY

A total of 444.5 metric tons of fish with an ex-vessel value of Kshs 72.2 million were landed from the main fishery water bodies of the Tana River dams of Masinga, Kamburu, and Kiambere compared to 852.3 metric tons of fish with an ex-vessel value of Kshs 115 million landed from the dams in 2015. This production reflected a decrease of 48% in quantity and a corresponding 37% decrease in ex-vessel value compared to 2015 figures (Figure 20).

The most important species in the catches in 2016 were *Tilapia spp*, *Cyprinus carpio* (Common carp) and *Clarias gariepinus.* Landings of *Cyprinus carpio* 178,975 Kgs (40.3%) were the highest at followed by *Tilapia spp* 133,810 Kgs (30.1%) and *Clarias gariepinus* 131,593 Kgs (29.6%). It can be noted that in the year 2015, *Clarias gariepinus* was the second highest landed species after *Cyprinus carpio* and *Tilapia spp* was the lowest landed then. The increased landings of *Tilapia spp* can be attributed to the restocking of tilapia in the year 2015 and early 2016. The other species (the *Eels*, *Barbus spp*, *Labes spp* and *Mormyrus)* combined contributed 103 kgs (0.02%). Tana River dam's fish production is determined by the level of water in the dams and this causes fluctuations of the total annual landing depending on the water level in the dams.

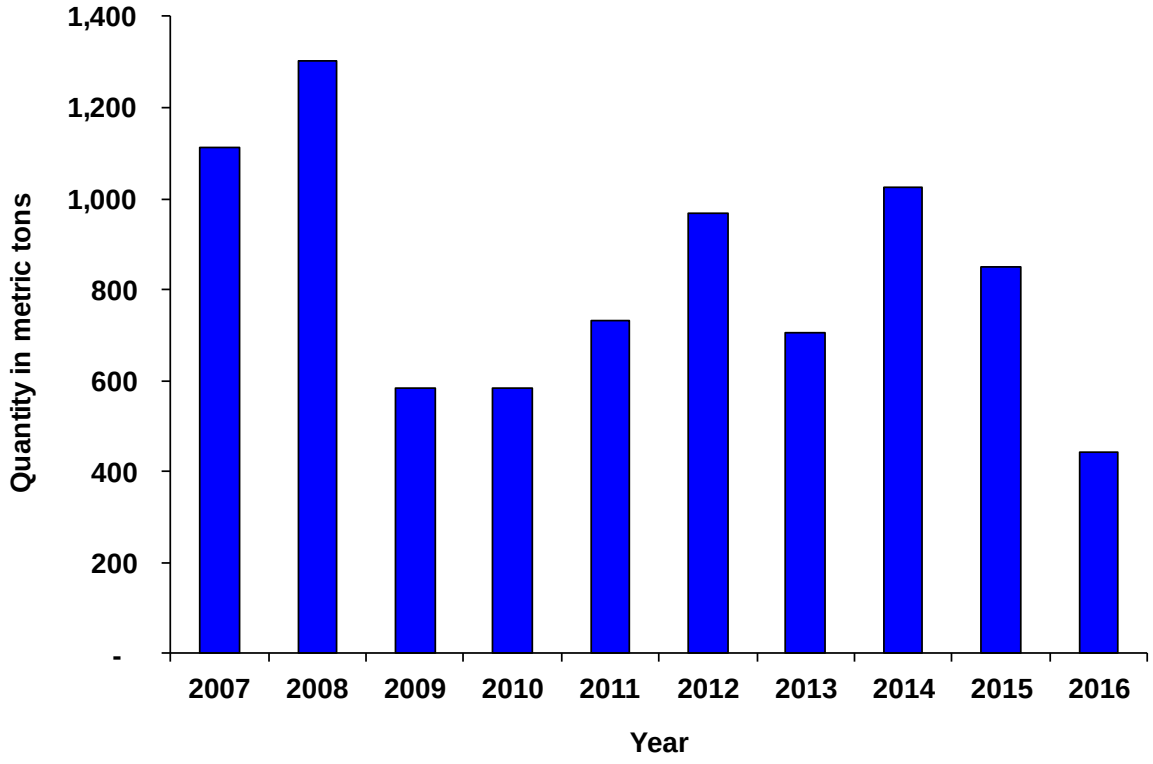

Figure 20: Tana River dams' fish catch trends in metric tonnes 2007 – 2016

Table 15: Tana River dams Monthly fish landings by Species, Weight and Value 2016

	Tiilapia		Common carp		Clarias		Others		Total	
Month	Kgs	Kshs	Kgs	Kshs	Kgs	Kshs	Kgs	Kshs	Kgs	Kshs
Jan	8,753	1,564,169	11,134	1,799,099	8,686	1,247,463	16	2,438	**28,588**	**4,613,168**
Feb	9,568	1,711,472	11,848	1,906,651	10,103	1,459,556	7	1,004	**31,526**	**5,078,683**
Mar	11,160	1,999,089	12,801	2,067,728	11,756	2,742,748	22	3,298	**35,739**	**6,812,864**
Apr	10,060	1,800,984	15,094	2,425,003	12,520	1,944,373	9	1,291	**37,682**	**6,171,651**
May	8,289	1,481,784	14,889	2,400,968	11,233	1,749,610	3	430	**34,413**	**5,632,793**
Jun	8,936	1,598,428	14,899	2,397,147	11,348	1,768,081	8	1,147	**35,191**	**5,764,802**
Jul	10,313	1,270,823	13,983	2,263,947	10,184	1,589,357	11	1,721	**34,492**	**5,125,849**
Aug	11,182	2,003,133	14,723	2,408,196	10,404	1,625,524	5	717	**36,314**	**6,037,569**
Sep	12,745	2,286,676	15,964	1,510,407	10,553	1,676,195	9	1,291	**39,270**	**5,474,569**
Oct	13,782	2,474,133	16,990	2,739,894	10,414	1,649,149	6	860	**41,192**	**6,864,037**
Nov	13,967	2,506,642	17,511	2,868,692	11,387	1,819,369	4	574	**42,869**	**7,195,276**
Dec	15,055	2,276,208	19,139	3,117,632	13,005	2,063,541	5	717	**47,205**	**7,458,098**
Total	**133,810**	**22,973,541**	**178,975**	**27,905,365**	**131,593**	**21,334,967**	**103**	**15,488**	**444,480**	**72,229,360**

3.8 LAKE KENYATTA FISHERY

During the year under review a total of 44 tons of fish with an ex-vessel value of Kshs. 4.6 million were landed from Lake Kenyatta in Lamu County of the coast province. This was a 25% decline in quantity of the fish landed and a corresponding decrease of 10.3% in ex-vessel value compared with 2015 figures of 64 tons with an ex-vessel value of Kshs 5.1 million. The catches of the lake declined and eventually collapsed in November after a prolonged draught. The catch composition from this lake comprised of three species namely, *Protopterus spp, Clarias spp* and *Tilapia spp*. *Protopterus spp* contributed the highest catches (45%) 21,673 Kgs of the total catch, *Clarias spp (*39%), 18,971 Kgs while *Tilapia spp* contributed (16%) 7,796 Kgs, figure 21 and Table 16. This was in contrast with 2015 wher Tilapia spp contributed 47.2% (24,142 Kgs) of the total catch, *Clarias spp*. 27.2% (13,933 Kgs) and *Protopterus spp* 25.6% (13,066 Kgs), The fishing effort was 120 fishers using 40 fishing crafts. Fishing was mainly passive with gillnetting, long line hooks and hand line hooks being the most common methods of fishing. During the final moments of the fishing when the lake was drying, the catches of protopterus were removed from the muddy pools that remained and this explains why *protopterus spp.* was the only fish recorded in October while the tilapia fishery collapsed in August and had been facing a consistent decline throughout the year (Fig 22).

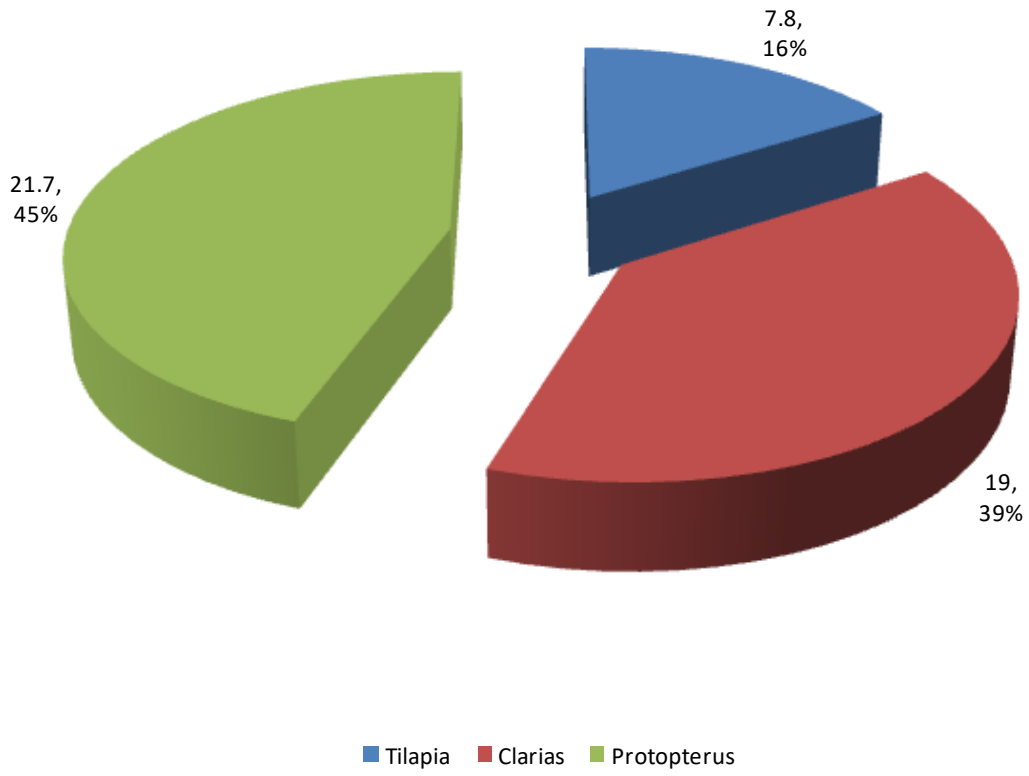

Figure 21: Percentages composition of species catch in Lake Kenyatta 2016

Table 16: Lake Kenyatta Monthly fish landings by Species, Weight and Value 2016

	Tilapia		Clarias		Protopterus		Total	
	Quantity (Kg)	Value (Kshs.)	Quantity (Kg)	Value (Kshs.)	Quantity (Kg)	Value (Kshs.)	Quantity (Kg)	Value (Kshs.)
Jan	1,845	172,507.5	1,658	164,142	1,497	134,730	5,000	471,380
Feb	1,623	151,750.5	1,834	181,566	1,583	142,470	5,040	475,787
Mar	1,464	136,884	2,015	199,485	1,654	148,860	5,133	485,229
Apr	1,259	117,716.5	2,117	209,583	1,789	161,010	5,165	488,310
May	854	79,849	2,315	229,185	1,845	166,050	5,014	475,084
Jun	413	38,615.5	2236	221,364	2326	209,340	4,975	469,320
Jul	230	21,505	2,539	251,361	2,872	258,480	5,641	531,346
Aug	108	10,098	2,714	268,686	3,345	301,050	6,167	579,834
Sep	0	0	1,543	152,757	4,342	389,180	5,885	541,937
Oct	0	0	0	0	420	42,000	420	42,000
Nov	0	0	0	0	0	0	0	0
Dec	0	0	0	0	0	0	0	0
Total	**7,796**	**728,926**	**18,971**	**1,878,129**	**21,673**	**1,953,170**	**48,440**	**4,560,225**
	M. tons	**000 Kshs**	**M. tons**	**000 Kshs**	**M. tons**	**000 Kshs**	**M. tons**	**000 Kshs**
Total	**7.8**	**729**	**19.0**	**1,878**	**21.7**	**1,953**	**48.4**	**4,560**

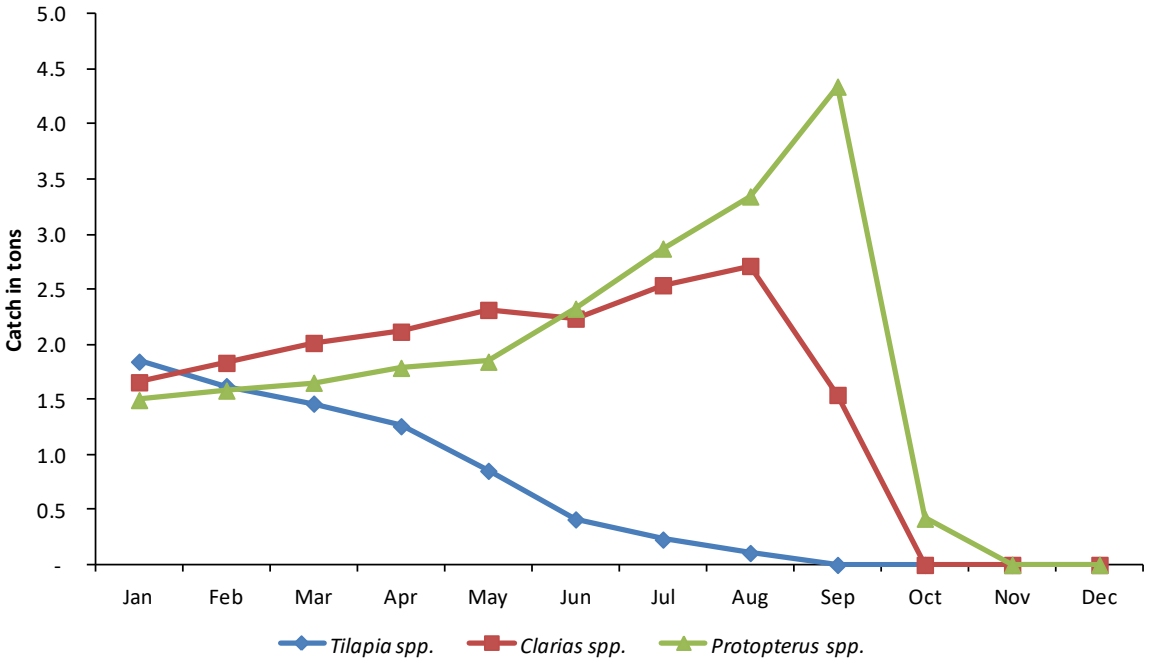

Figure 22: The catch trend of species in Lake Kenyatta in 2016

3.9 LAKE KANYABOLI FISHERY

Lake Kanyaboli is one of the satellite lakes of Lake Victoria and it is located in Siaya County. The fisheries of the lake are comprised of the following fish species: *Oreochromis niloticus, Protopterus aethiopicus, Haplochromis* and *Clarias spp*. A total of 262 metric tonnes with an ex-vessel value of Kshs 43.8 million were landed from the lake during the year under review. This was a 2.1% decrease in quantity of the fish landed but with a 13.8% increase in ex-vessel value compared with 2015 figures of 267 metric tonnes with a value of Kshs 43.8 million.

The main species in catches were Tilapia which contributed 55% (164.3 metric tons) of the total catch followed by Clarias 19% (19.3 metric tonnes), Protopterus 18% (18.5 metric tonnes) and Haplochromis 8% (7.7 metric tonnes), figure 23 and Table 17. The fishing activities were undertaken by 188 fishers operating 99 fishing crafts.

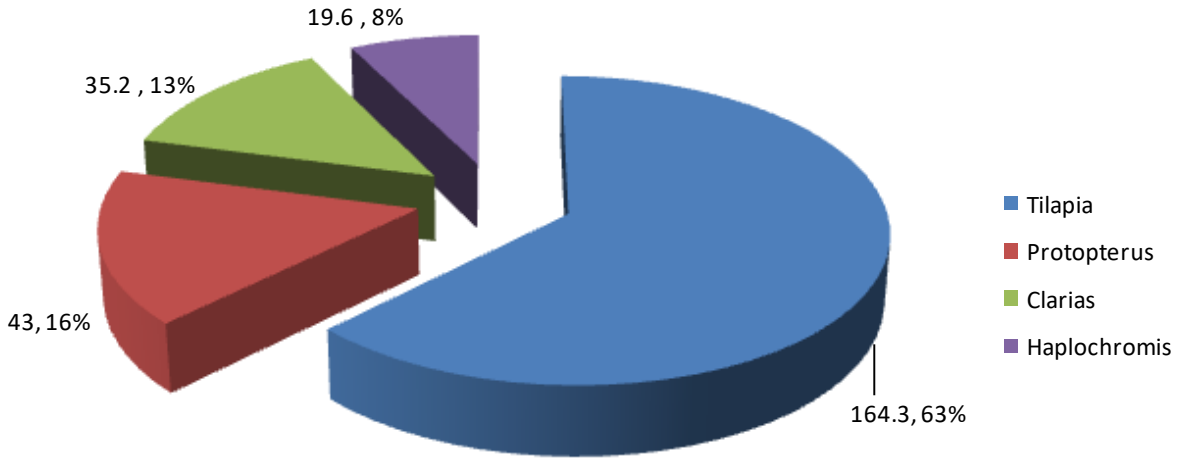

Figure 23: Percentages composition of species catch in Lake Kanyaboli 2016

Table 17: Lake Kanyaboli Monthly fish landings by Species, Weight and Value 2016

	Tilapia		Protopterus		Clarias		Haplochromis		Total	
	Kgs	Kshs	Kgs	Kshs	Kgs	Kshs	Kgs	Kshs	Kgs	Kshs
Jan	13,337	2,667,400	3,122	266,590	2,734	363,622	1,329	164,820	20,522	3,462,432
Feb	13,667	2,733,400	3,177	281,815	2,884	383,572	1,465	180,195	21,193	3,578,982
Mar	13,440	2,688,000	3,198	293,810	2,778	369,474	1,678	169,494	21,094	3,520,778
Apr		2,756,800							21,503	3,636,583

	13,784		3,323	335,685	2,799	372,267	1,597	171,831		
May	13,755	2,751,000	3,473	389,935	3,112	413,896	1,381	166,542	21,721	3,721,373
Jun	13,976	2,795,200	3,574	379,530	2,954	392,882	1,412	165,312	21,916	3,732,924
Jul	13,878	2,775,600	3,577	339,815	2,845	378,385	1,759	179,211	22,059	3,673,011
Aug	13,677	2,735,400	3,789	379,955	2,877	382,641	1,501	187,083	21,844	3,685,079
Sep	13,357	2,671,400	3,844	369,180	2,898	385,434	1,838	200,982	21,937	3,626,996
Oct	13,694	2,738,800	3,932	373,840	3,211	427,063	2,170	169,371	23,007	3,709,074
Nov	13,799	2,759,800	3,981	398,195	3,111	404,430	1,992	167,880	22,883	3,730,305
Dec	13,886	2,777,200	3,997	389,715	2,999	389,870	1,520	170,400	22,402	3,727,185
Total	**164,250**	**32,850,000**	**42,987**	**4,198,065**	**35,202**	**4,663,536**	**19,642**	**2,093,121**	**262,081**	**43,804,722**
	M. tons	**000 Kshs**	**M. tons**	**000 Kshs**	**M. tons**	**000 Kshs**	**M. tons**	**000 Kshs**	**M. tons**	**000 Kshs**
Total	**164**	**32,850**	**43**	**4,198**	**35**	**4,664**	**20**	**2,093**	**262**	**43,805**

3.10 TURKWEL DAM

Turkwel Dam is one of the major Hydro Electric Power Station in Kenya. It is situated in North West of Kenya, in the border of Turkana, West Pokot and Pokot North Sub-Counties. The dam was constructed under the control of Kerio Valley Development Authority (KVDA) from 1986 to 1991 and is still under the management of KVDA. The State Department of Fisheries has been working with KVDA and Moi University on the introduction of fish in this Dam for commercial exploitation since 2006. The dam has an area of 66 square Km with a capacity of 1,641 cubic metres. Data of fish landings from the dam were recorded for the first time in 2013.

During 2016 a total of 42 metric tonnes of fish with an ex-vessel value of Kshs 9.0 million were landed from the dam. This was a 50% increase in both quantity and value of the fish landed compared with 2015 figures of 28 metric tonnes with a value of Kshs 5.9 million. The fisheries of the dam are comprised of two species: Tilapia *(Oreochromis niloticus)* and *Clarias spp*. Tilapia landings contributed 93% (40.0 metric tonnes) while Clarias contributed 6% (3 metric tonnes) during the review period, figure 24. The monthly catches are shown in figure 25 and Table 18 where the lowest catches were recorded in June and July.

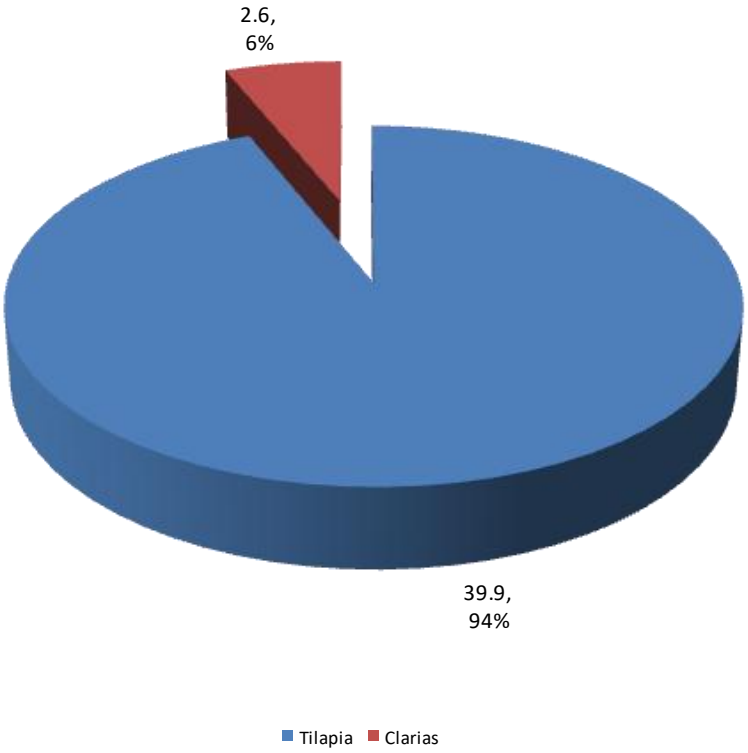

Figure 24: Percentages composition of species catch in Turkwel dam 2016

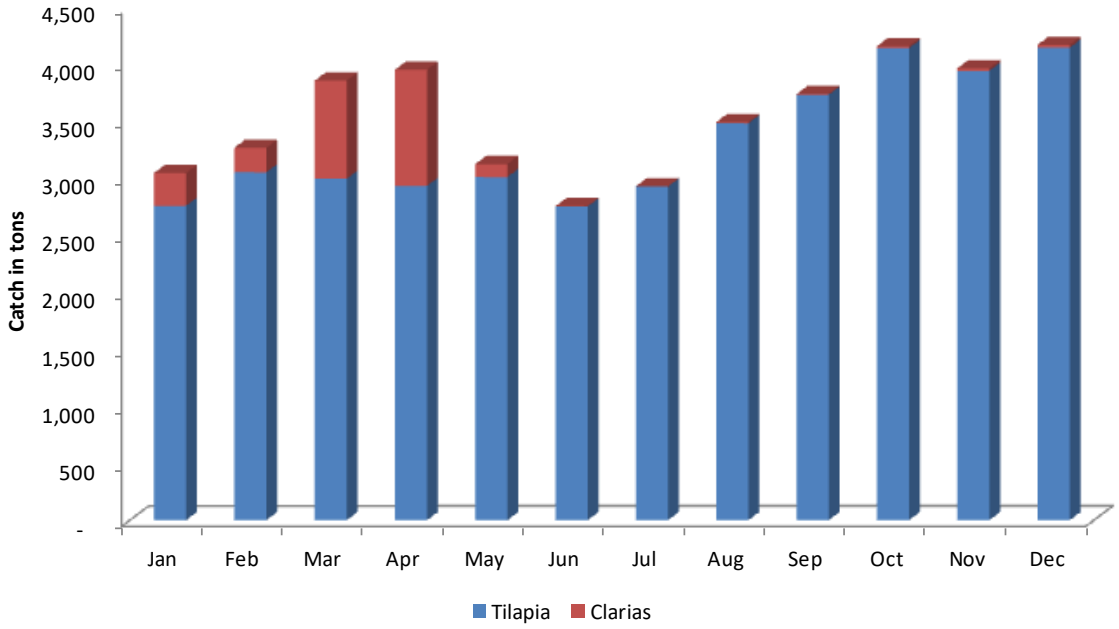

Figure 25: Turkwel dam monthly fish catches in metric tonnes 2016

Table 18: Turkwel dam Monthly fish landings by Species 2016

Month	Tilapia		Clarias		Total	
	Kgs	Kshs	Kgs	Kshs	Kgs	Kshs
Jan	2,760	593,339	287	61,646	3,047	654,985
Feb	3,054	606,189	215	46,235	3,269	652,424
Mar	2,997	593,859	861	184,937	3,858	778,796
Apr	2,936	631,098	1,019	218,842	3,954	849,940
May	3,012	647,279	114	24,658	3,126	671,936
Jun	2,754	591,798	3	771	2,757	592,569
Jul	2,930	629,557	2	186	2,931	629,742
Aug	3,485	748,994	11	2,312	3,495	751,306
Sep	3,735	802,935	6	1,232	3,741	804,167
Oct	4,145	890,780	17	3,698	4,161	894,478
Nov	3,945	847,936	21	4,623	3,966	852,559
Dec	4,148	891,550	26	5,548	4,173	897,098
TOTAL	39,899	8,475,314	2,579	554,688	42,477	9,030,002
	M tonnes	000 Kshs	M tonnes	000 Kshs	M tonnes	000 Kshs
Total	**40**	**8,475**	**3**	**555**	**42**	**9,030**

3.11 TANA RIVER DELTA

Fresh water fish landings from Tana River delta in Tana River County during the year under review amounted to 20 tons Kgs with an ex-vessel value of Kshs 1.97 million. This was an decrease of 63% in quantity of the fish landed coupled with a 59.1% decrease in ex-vessel value compared 54 tons with an ex-vessel value of Kshs 4.8 million landed in 2015. The landings comprised of *Clarias spp* 9.91 tons (50%), *Tilapiines* 5.2 tons (26%) and *Protopterus spp* 4.9 tons (24%), figure 26 and Table 19. The decline in catches is attributed to the failure of the rains in 2016 reducing the water levels in the Tana delta.

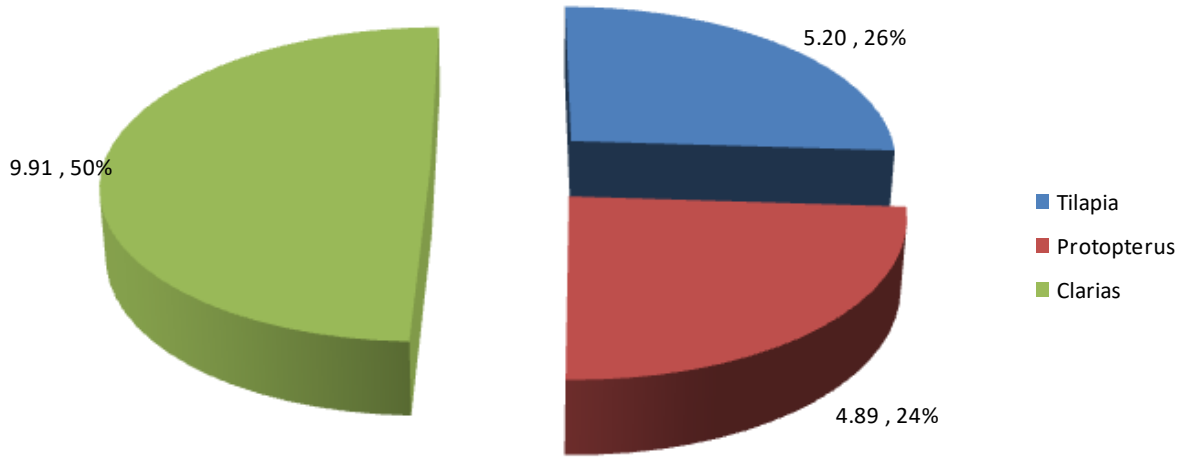

Figure 26: Percentages composition of species catch in Tana River delta 2016

Table 19: Tana River delta freshwater monthly fish landings by Species 2016

	Tilapia		Clarias		Protopterus		Total	
Month	**Kgs**	**Kshs**	**Kgs**	**Kshs**	**Kgs**	**Kshs**	**Kgs**	**Kshs**
January	610	54,442	706	80,483	216	26,084	1,532	161,009
February	574	48,080	672	75,149	294	35,290	1,540	158,519
March	529	44,834	884	68,598	324	37,800	1,737	151,232
April	343	32,390	888	93,280	407	38,885	1,638	164,555
May	403	37,909	1,206	94,254	378	40,100	1,988	172,263
June	461	41,033	666	83,424	322	38,040	1,449	162,498
July	495	42,615	929	85,927	289	34,198	1,713	162,740
August	392	35,094	844	88,518	264	33,135	1,501	156,747
September	370	33,205	904	112,631	916	66,165	2,190	212,000
October	399	35,955	1,098	104,297	255	28,797	1,751	169,049
November	328	27,804	794	83,369	929	70,580	2,050	181,754
December	309	31,492	316	49,853	298	36,446	923	117,791
Total	**5,213**	**464,853**	**9,909**	**1,019,782**	**4,891**	**485,522**	**20,011**	**1,970,157**
	M.tons	**000Kshs**	**M.tons**	**000Kshs**	**M.tons**	**000Kshs**	**M.tons**	**000Kshs**
Total	**5.2**	**465**	**9.9**	**1,020**	**4.9**	**486**	**20.0**	**1,970**

4.0 AQUACULTURE (FISH FARMING)

Freshwater aquaculture development in Kenya in recent years has been fast growing. Compared to an annual production of about 1,000 MT in 2006, production had increased to an estimated 18,656 MT in 2015. This has been mainly the result of a nationwide fish farming mass campaign as part of the Economic Stimulus Programme launched by the Government of Kenya (GoK) during the period 2009-2013. As a result, the area of fishponds has increased from 220 ha in 2009 to 1,873 ha in 2015 (introducing 7,700 new ponds) and other support has been provided along different aquaculture value chains. The main produced species were Nile tilapia (79%), African catfish (15%), Rainbow trout (4%) and Common carp and Ornamental fish (2%). Mariculture production of seaweeds is being practiced commercially, mainly at Kibuyuni in south coast and is planned for uptake in other areas, as it has demonstrated that seaweed production can succeed in Kenya.

Nevertheless, there is a lack of reliable data as regards aquaculture production at County and National level and estimates from different sources range from 10,000 to about 40,000 MT per year. Aquaculture sector is gaining momentum as production from catch fisheries decreases and demand increases due to population growth. There is already a significant gap (250,000MT in 2015), between the projected demand and production of fish, which is expected to increase and is projected to be 360,000 MT/year by 2025. This lack of supply has resulted in a continuous decline of per capita average consumption, due to rising prices and limited availability. This shows the significant domestic growth potential of the aquaculture sector. The import of frozen fish, predominantly from China, has grown rapidly from 2,664 MT in 2011 to 5,853 MT in 2015 to fill the gap in local supply, since fish catches from the wild are declining and pond farmers are not able to supply consistent quantity and quality. The GoK is looking into ways of promoting aquaculture and using fish products for food relief programmes as a means to enhancing food security and improving health.

In 2009, the Government of Kenya implemented an ambitious aquaculture development programme under Economic Stimulus Programme (ESP) over a four-year period (2009-2013) at a cost of USD 40 million. The programme supported construction of ponds (300 in 160 constituencies), improved infrastructure for fish feeds and seeds, and construction of four fish processing facilities in four regions (Nyeri, Meru, Migori and Kakamega) to serve aquaculture farmers within and the surrounding Counties. Part of the funds was used to map zones of high aquaculture potential in which viable investments can be promoted. In total, 48,000 fishponds were constructed under the programme. During early stages, it supported as well aquaculture in reservoirs that were constructed by the programme before it was abandoned later due to high investment costs and non-availability of lands for the programme to construct man-made reservoirs to be dedicated for aquaculture. The programme supported the provision of subsidized feeds and seeds for the newly established ponds. It is worth mentioning that farmers contributed land only, while the ESP supported digging of the pond.
After the devolution (2013), fish farming was one of the devolved functions and some of the Counties abandoned the programme as they focused resources in areas which were of priority. At present, several ponds are out of production due to issues with quality of feeds

and fingerlings, as well as poor selection of sites for some of the ponds. Some of the fingerlings farms, supported by the programme are getting out of business in certain areas due to low demand. This has consequently led to the observed decline in fish production from aquaculture.

Aquaculture Production

In 2016, fish farming production was 14,952 tons with a farm gate value of Kshs. 4,254 million compared to 18,656 metric tons valued at Kshs. 5,014 million in 2015. This production was from 55,750 ponds with an area of 16,725,120 metres square (1,673 hectares), 129 tanks measuring 18,468 metres square and 99 reservoirs with an area of 595,200 square metres throughout the country. The main species produced in 2016 were tilapia 80% (11,962 tons) and worth Kshs. 3,311 million. The rest of the species were catfish, 13%, trout 5% and carp 2% (Figure 28). Over the last five years, fish production has increased from 19,585 metric tonnes produced in year 2011 to the production of 24,096 metric tonnes in 2014 from which production has declined to the current 14,952, figure 27.

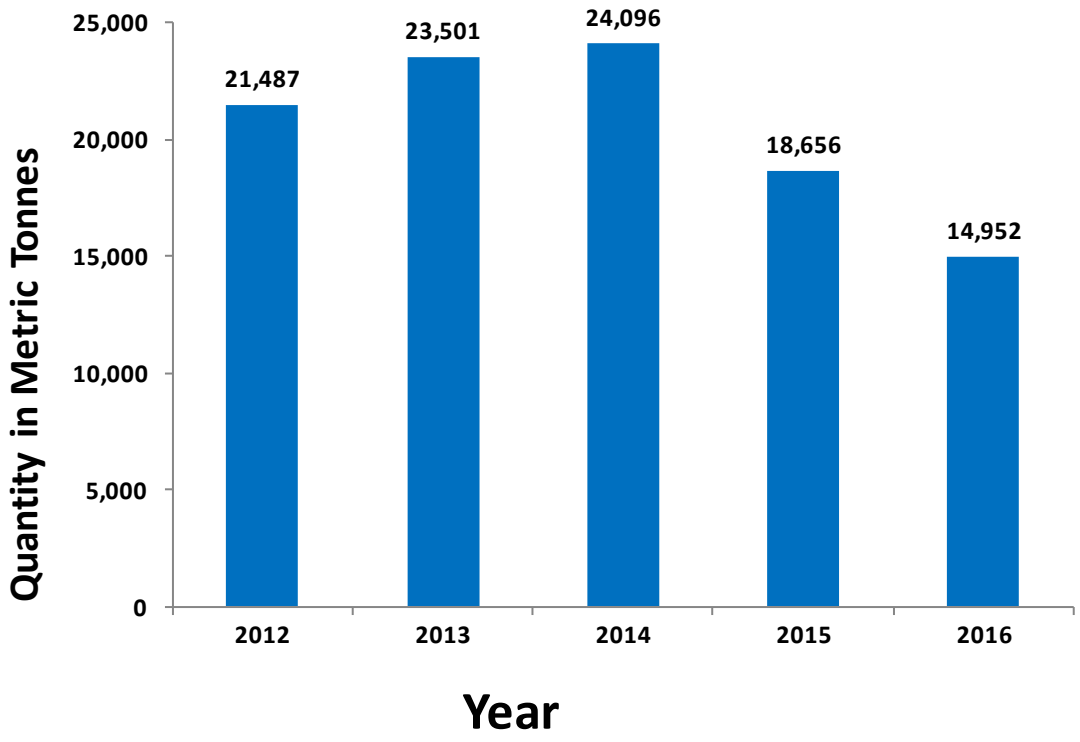

Figure 27: Aquaculture production for last five years (2012-2016)

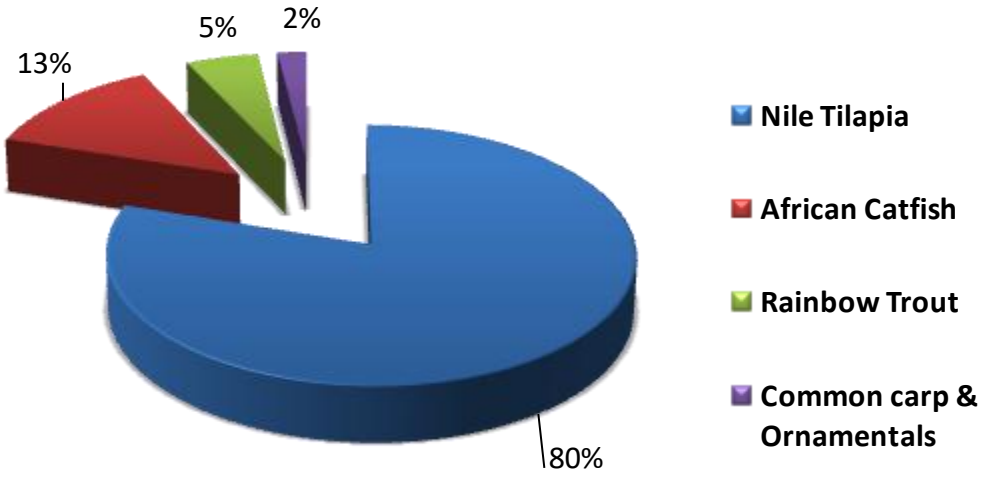

Figure 28: Aquaculture production by species in 2016

Fish feeds usually accounts for more than 50% of the total aquaculture production costs. This means that an efficient and effective feed is critical for the success of any aquaculture venture. In the past, fish farmers in Kenya has had challenges with accessing quality affordable feeds, and had to rely on own formulations using locally available ingredients which would not meet nutritional requirements, or purchase from well-established cottage industries at high cost, or buy expensive imported feeds. However, the narrative is to change following the establishment of a fish feed manufacturing line at Sigma Feeds Company. This is expected to supply quality affordable fish feeds in the Kenyan market. The government has also trained farmers on fish feed formulations so as to attain nutritional requirements.

The State Department for Fisheries and Blue Economy has aggressively been promoting aquaculture development in the country to counter the declining production from capture fisheries. Two donor funded projects are set to begin in the 2017/2018 financial year. Aquaculture Business Development Program is an IFAD funded program which will last for 7 years and is to cover 15 high potential aquaculture production counties. The program has two components focusing on promoting production by smallholder aquaculture farmers and developing Producer Public Private Partnerships along the value chains. This is aimed at increasing food and nutrition security, creating employment and enhancing livelihoods of Kenyans.

The second is Kenya Marine Fisheries Socio Economic Development Project which is World Bank funded and will last for 5 years. The project will cover the whole of the Coastal Kenya region. It will focus on strengthening governance for priority fisheries, developing and strengthening value chains, and promoting development of livelihoods through fisheries related activities. The project is also aimed at promoting mariculture development.

The following constraints continued to affect aquaculture activities during the year under review:

- Inadequate readily available and affordable quality fish seed (fingerlings);
- Inadequate good quality and affordable fish feeds;
- Poor adoption of fish husbandry techniques by some farmers even after being trained on basic pond management;
- Water scarcity due to other competing uses – industry, domestic and agriculture;
- Inadequate market information for use by fish farmers;
- Lack of good credit facilities and schemes for fish farmers;
- Security and safety of fish in ponds posed by thieves and predators;
- Poor book keeping and record management leading to inaccurate data from farmers along the aquaculture value chain e.g. input costs, management cost, quantities of fish harvested and value;
- Sub optimal staffing levels especially extension personnel;
- Inadequate facilitation in terms of transport and timely funds towards carrying out of fisheries extension service provision.

5.0 EXPORTS OF FISH AND FISHERY PRODUCTS

During the period under review, a total of 4,686 metric tons of fish and fishery products were exported earning the country Kshs. 2.1 billion in foreign exchange. This was a decrease of 3,855 metric tons from the previous year of 8241 metric tons. This decline was 46%. The main reason for the significant drop was occasioned by the decline of production in the tuna processing establishment and closure of three Nile perch processing plants based in Kisumu and Nairobi. The leading export products were 1,221 metric tons of frozen Nile Perch fillets valued at Kshs 633 million, 640 metric tons of Nile perch fillets valued at Kshs 336 million, 452 metric tons of headless and gutted Nile Perch valued at Kshs 195 million.

In the marine sub-sector only 86 metric tons of cooked tuna loins were processed compared to 1,915 metric tons in the previous year. The labour charge constituted Kshs 2,092,911,789. The cooked frozen tuna loins were trans-shipped through the port of Mombasa to Spain and Italy.

During the same period 911 metric tons of frozen Octopus valued at Kshs 343.3 million were exported which was an increase of 62% in quantity. Other exports were 2.7 metric tons of

frozen cuttlefish valued at Kshs 1.8 million and 61 metric tons of frozen prawns valued at Kshs 75.2 million.

The main markets for the marine ornamental fishes were the EU, USA, China and Japan (Figure 29).

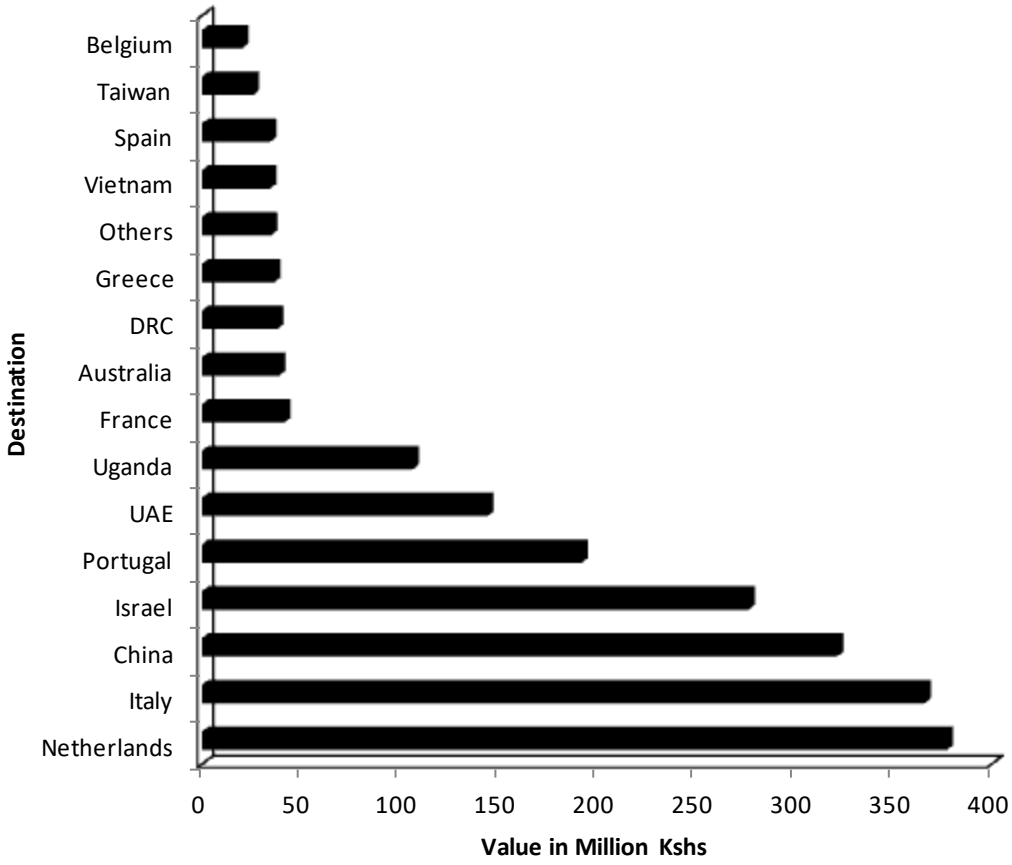

Figure 29: Exports Products by destinations- 2016

By product types, Nile Perch was the leading export product 969 million Kshs representing 46% of the total export value from Kenya. Octopus, fish maws and headed and gutted fish represented 16%, 14% and 9% of the export respectively for 2016. Other export products were lobsters, prawns and dried tilapia representing 4%, 4% and 2% of the export values respectively. The rest of the products fetched 4% of the export value (Figure 30).

The main constraints faced by all exporters of fish and fishery products during the year under review were international market competition and insufficient supply of raw materials.

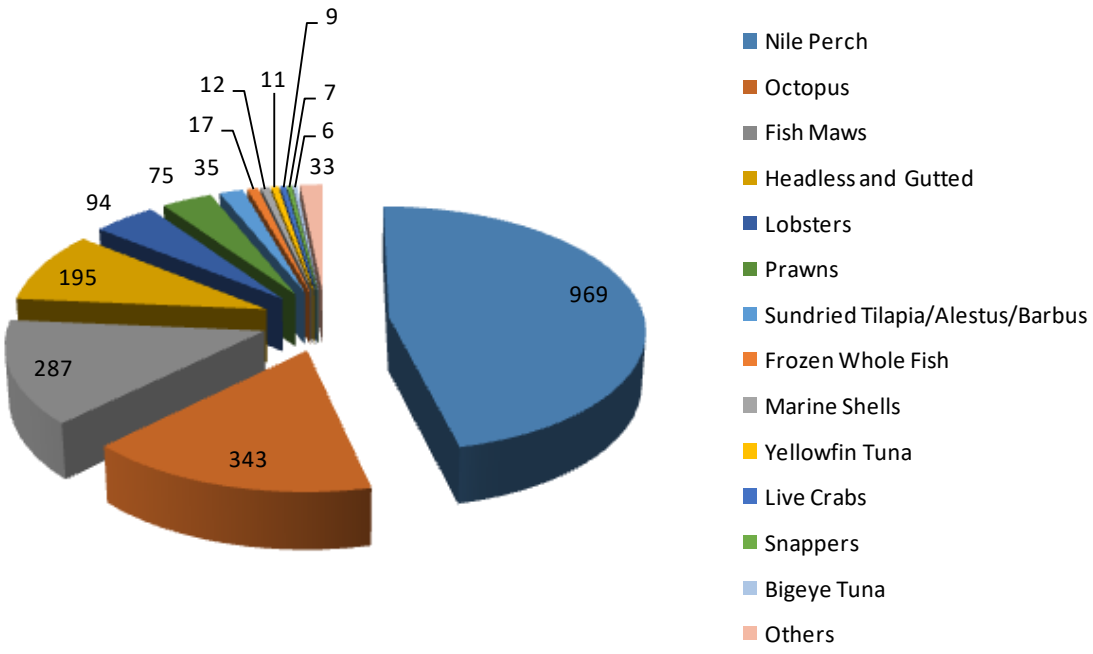

Figure 30: Exports value of fish by product type in millions of Kshs. during 2016

Table 20: Exports of Fish and Fishery Products 2016

Commodity	M. Tons	000Kshs	% Quantity	% Value
Frozen Nile Perch Fillets	1,222	633,331	26.1	30.3
Frozen Octopus	912	343,289	19.4	16.4
Sundried Tilapia/Alestus/Barbus	732	35,286	15.6	1.7
Chilled Nile Perch Fillets	641	336,038	13.7	16.1
Headless and Gutted	453	195,430	9.7	9.3
Marine Shells	180	12,134	3.8	0.6
Frozen Whole Fish	82	16,542	1.7	0.8
Fish Maws	66	286,542	1.4	13.7
Frozen Whole Prawns	62	75,205	1.3	3.6
Frozen Yellowfin Tuna	57	10,897	1.2	0.5
Frozen Mixed Fish	35	7,066	0.7	0.3
Frozen Bigeye Tuna	30	5,857	0.6	0.3
Frozen Spiny Lobsters	26	37,132	0.6	1.8
Live Crabs	21	8,600	0.5	0.4
Frozen Swordfish	21	3,102	0.5	0.1
Frozen Whole Lobsters	19	17,969	0.4	0.9
Frozen Black Marlin	18	2,695	0.4	0.1
Frozen Sharks	16	2,230	0.3	0.1
Frozen Slipper Lobsters	15	15,719	0.3	0.8
Frozen H&G Jobfish	14	2,788	0.3	0.1
Live Lobsters	11	8,968	0.2	0.4
Frozen Jobfish Fillets	9	4,930	0.2	0.2
Frozen Whole Deep Sea Lobsters	8	14,283	0.2	0.7
Frozen Snappers	7	3,227	0.2	0.2
Frozen Snapper Fillets	5	3,519	0.1	0.2
Others	27	10,134	0.6	0.5
Sub Total	**4,687**	**2,092,912**	**100**	**100**
Live Fish	**Number (Thousands)**	**Value, 000 Kshs.**	**% Quantity**	**% Value**
Marine aquarium fish	292	12,960	66.2	82.9
Marine aquarium invertebrates	149	2,672	33.8	17.1
Total	**441**	**15,632**	**100**	**100**
GRAND TOTAL	**5,128**	**3,136,698**		

Marine Aquarium exports

Aquarium fish

In 2016, 292,270 aquarium fish were exported compared with an average of 230,465 fish exported in 2015. This represented a 26.8% increase in the volumes of aquarium fish exported. The trend of aquarium fish export between 2010 and 2016 is shown in Figure 31. Twenty species made up 60.2% of the total exports, with the top 5 species being *Chromis viridis* (9.0%), *Pseudanthias squamipinnis* (7.8%), *Labroides dimidiatus* (5.2%) *Centropyge acanthops* (5.0%), *Paracanthrus hepatus* (4.1%) and *Salarias fasciatus* (3.1%) as shown in Annex 1. The dominance of these species in the export market is similar to that of 2015. *Chromis viridis* dominated the exports throughout the year followed by *Pseudanthias squamipinnis*. The lowest exports volume for the main species was between April and September while the highest exports recorded in March and October (Fig 32).

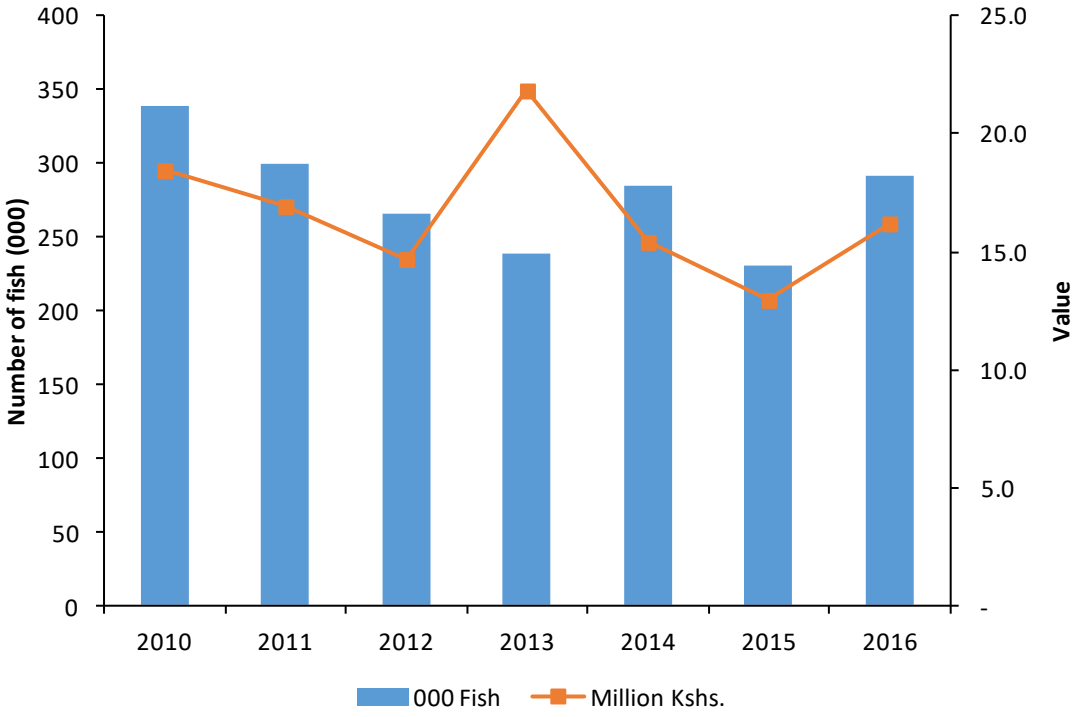

Figure 31: Annual trends of aquarium fish exports in numbers and value in during 2010 - 2016.

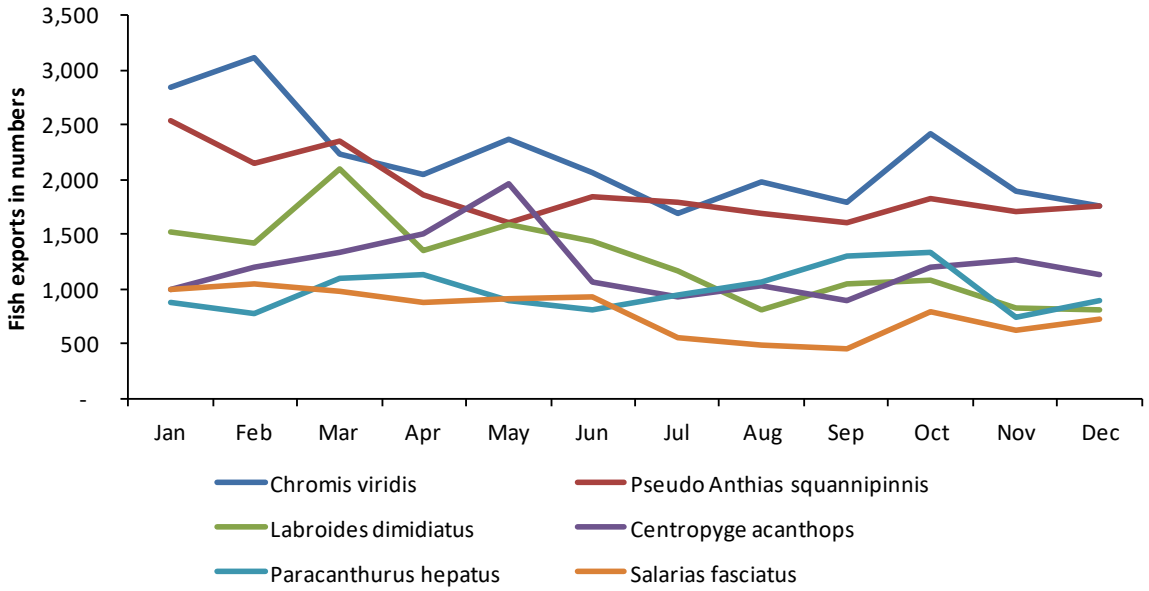

Figure 32: Monthly export trends of top six marine aquarium fish in 2016

Invertebrates

The number of marine invertebrates exported in 2016 was 146,186 which was an increase of 57% from compared to 94,480 invertebrates exported in 2015 (Figure 33). The export value however increased to 2.7 million Kshs. compared to 1.9 million Kshs. in 2014. The export figures are higher than the 2010 exports where approximately 131,000 fish worth 6.4 million Kshs were exported. Twenty species made up 81.8% of the invertebrates exports, with the top 5 species being *Clibinareus sp*. (12.2%), *Nerita sp*. (11.8 %), *Cerithium caeruleum* (snail) 10.3%, *Nerita polita* (turbo snail) (9.9), and *Calcinus laevimanus* (9.2%) (Annex 2).The monthly trends of the exports showed a higher volume in the first half of the year with the latter part of the years having monthly exports of less than 10,000 pieces except for October. The monthly fluctuation in exports for the invertebrates is however more than that of the aquarium fish (Figure 34).

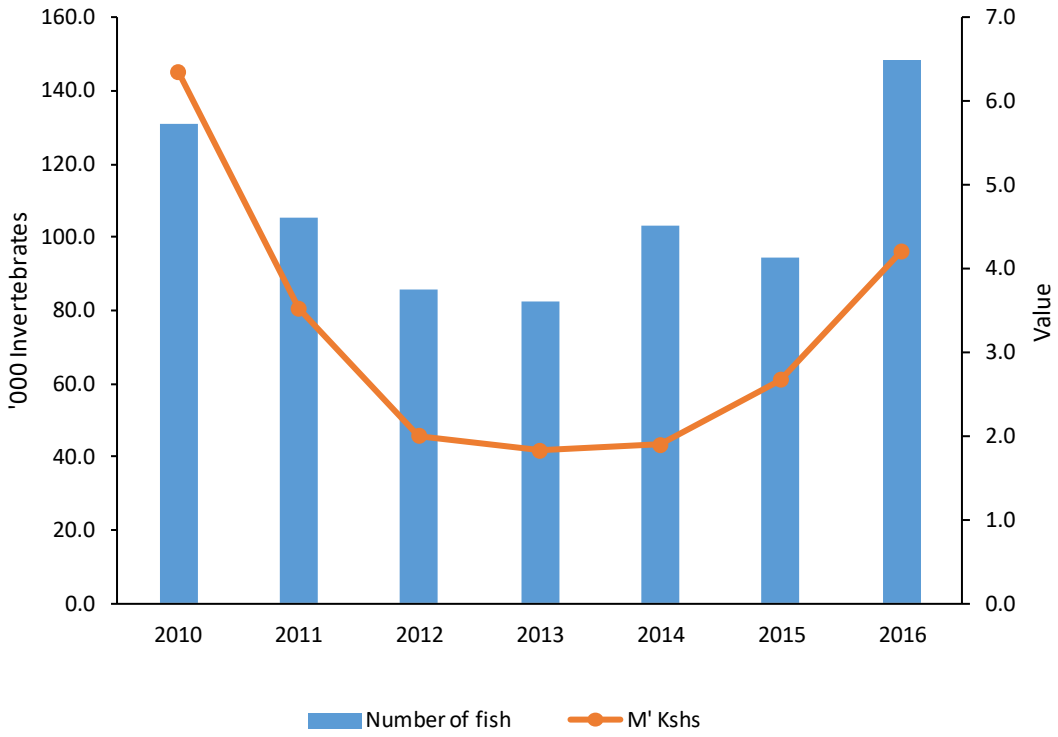

Figure 33: Annual trends in the marine invertebrates' exports in numbers and value during 2010 – 2016

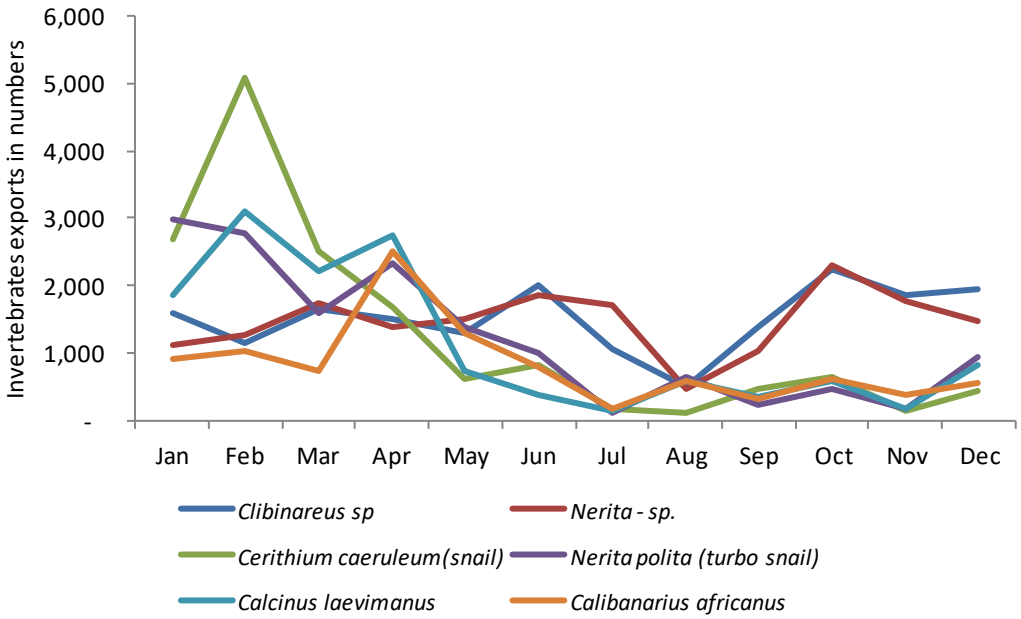

Figure 34: Monthly export trends of top six marine aquarium invertebrates in 2016

6.0 IMPORTS OF FISH AND FISHERY PRODUCTS

In 2016, Kenya imported 16,475 metric tons of fish and fishery products worth Kshs 1.6 billion (Table 21). The value of imported fish was 0.5 billion Kenya shillings less than the exported fish. In terms of quantities in weight, the imports were four times the exported volume. This means that fish Kenya exported high priced products compared to the low priced imports. The imports were mainly composed of *Oreochromis niloticus* 8,419 metric tons (52%) of the total fish and fishery products imported during the year. These were followed by frozen Mackerels with 5,292 metric tons which was 33%. The two species composed 85% of all the fish imports into the country. Fish waste, fish feed and tuna fish meal all the three used for fish feed production were the next products imported composing 4%, 3% and 1% of the total imports (Fig. 35). The imports originated largely from Asian countries, notably China, Japan, Korea and Vietnam with most of the *Oreochromis niloticus* was imported from China. Uganda and Tanzania were the second and fourth most important countries we import fish from respectively (Fig 36).

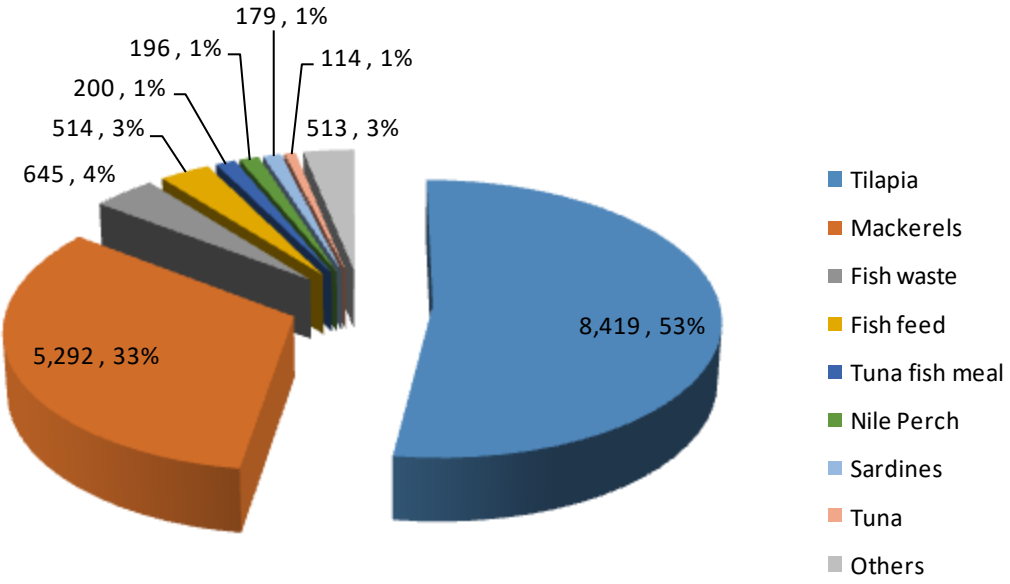

Figure 35: Import of fish and fish products 2016

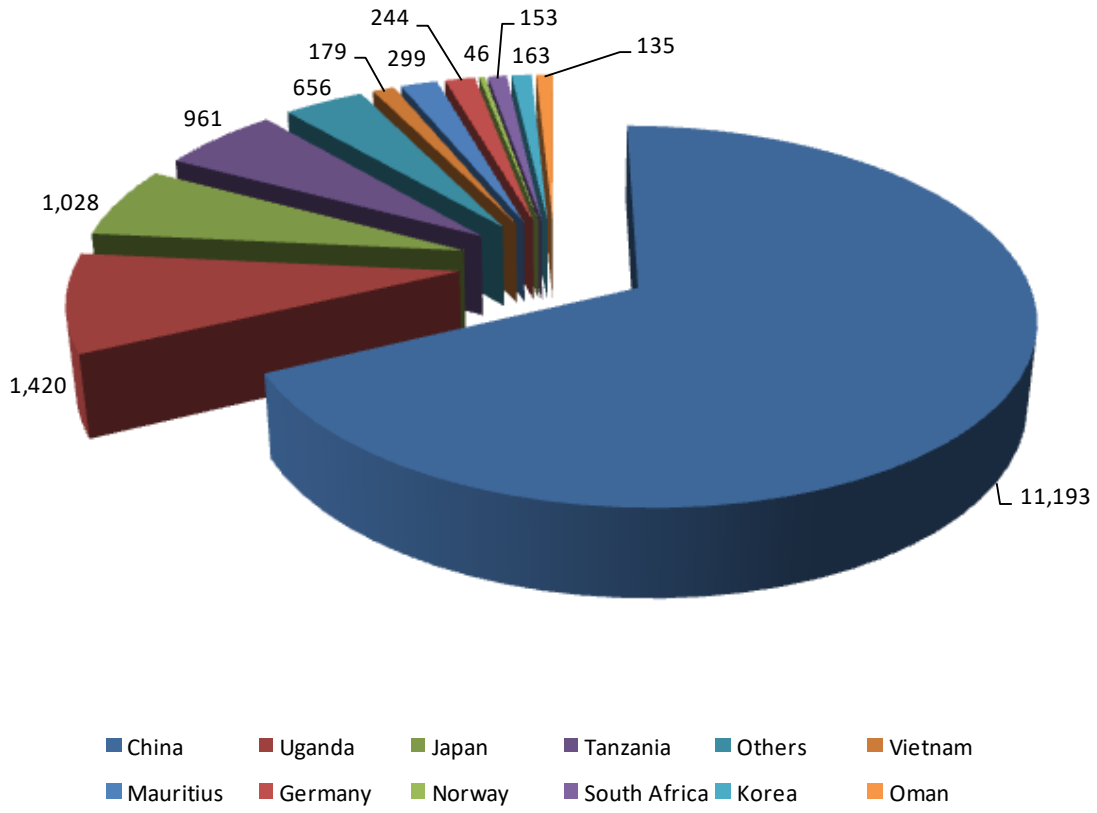

Figure 36: Fish imports in tons by Country of origin

Table 21: Imports of Fish and Fishery Products 2016

Product	Quantity (M. Tons)	Value ('000Kshs)	% Quantity	% Value
Frozen whole tilapia	6,635	569,442	41.3	35.0
Frozen Mackerels	5,292	416,693	32.9	25.6
Fresh Tilapia	1,325	288,065	8.2	17.7
Fish waste	645	12,900	4.0	0.8
Fish feed	514	36,657	3.2	2.3
Tilapia fillets	459	106,192	2.9	6.5
Tuna fish meal	200	20,070	1.2	1.2
Nile Perch heads/chest/offcuts	133	15,329	0.8	0.9
Frozen Sardines	133	9,035	0.8	0.6
Frozen Tuna	109	21,650	0.7	1.3
Frozen Bogue	80	4,969	0.5	0.3
Frozen Pangasius Fillets	77	7,790	0.5	0.5
Frozen Mixed Fish	57	6,274	0.4	0.4
Nile Perch fillets/trimmings	55	6,286	0.3	0.4
Sardines	47	11,496	0.3	0.7
Omena	43	4,582	0.3	0.3
Salmon	36	16,261	0.2	1.0
Assorted fish products	36	20,181	0.2	1.2
Others	198	54,994	1.2	3.4
Grand Total	**16,073**	**1,628,868**	**100**	**100**

ANNEXES

Annex 1. The monthly composition of the top 20 most exported marine aquarium species in 2016

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Grand	%
Chromis viridis	2,847	3,121	2,242	2,052	2,375	2,062	1,692	1,974	1,790	2,421	1,896	1,760	**26,232**	**9.0**
Pseudo Anthias squannipinnis	2,547	2,152	2,356	1,865	1,602	1,840	1,795	1,683	1,602	1,826	1,706	1,767	**22,741**	**7.8**
Labroides dimidiatus	1,526	1,419	2,105	1,354	1,595	1,437	1,169	818	1,043	1,084	823	807	**15,180**	**5.2**
Centropyge acanthops	990	1,196	1,336	1,509	1,965	1,056	929	1,023	890	1,197	1,261	1,134	**14,486**	**5.0**
Paracanthurus hepatus	879	772	1,097	1,134	902	809	937	1,067	1,305	1,327	746	896	**11,871**	**4.1**
Salarias fasciatus	993	1,055	980	880	907	932	551	481	459	793	624	722	**9,091**	**3.1**
Ostrcion sp.	656	703	925	701	846	775	613	623	712	782	630	787	**8,753**	**3.0**
Nemateleotris manificia	520	607	829	804	993	807	552	291	390	810	557	505	**7,665**	**2.6**
Chromis Vanderbilt	423	630	319	384	235	573	416	350	595	827	1,277	942	**6,971**	**2.4**
Halichoeres iridis	506	542	668	545	522	472	443	364	480	520	574	440	**6,076**	**2.1**
Ecsenius midas	529	588	594	536	616	522	458	335	434	421	485	417	**5,935**	**2.0**
Valenciennea strigata	946	751	377	270	145	263	465	352	496	551	468	577	**5,661**	**1.9**
Amphiprion allardi	574	407	521	529	516	589	317	301	247	369	357	317	**5,044**	**1.7**
Macropharyngodon bipartitus	413	412	553	418	342	416	294	328	375	422	530	540	**5,043**	**1.7**
Acanthurus leucosternon	456	442	532	290	381	373	342	410	441	524	333	461	**4,985**	**1.7**
Pterois volitans black	583	412	436	371	332	338	295	403	374	391	371	348	**4,654**	**1.6**
Pseudocheilinus hexataenia	681	571	448	325	435	272	344	385	299	360	254	273	**4,647**	**1.6**
Cirrhilabrus exquisitus	316	225	371	290	425	360	302	299	317	381	321	314	**3,921**	**1.3**
Doryhamphus excisus	45	0	110	190	115	220	481	415	461	603	417	476	**3,533**	**1.2**
Labroides bicolor	28	52	33	55	55	890	449	71	847	456	492	55	**3,483**	**1.2**
Others	9,295	8,921	11,451	9,004	9,128	8,687	8,647	10,742	9,504	11,079	9,448	10,106	**116,298**	**39.8**
Total	**25,753**	**24,978**	**28,283**	**23,506**	**24,432**	**23,693**	**21,491**	**22,715**	**23,061**	**27,144**	**23,570**	**23,644**	**292,270**	

Annex 2. The monthly composition of the top 20 most exported marine invertebrate species in 2016

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Grand	%
Clibinareus sp	1,590	1,145	1,635	1,495	1,295	2,020	1,070	495	1,375	2,255	1,865	1,950	**18,190**	**12.2**
Nerita sp.	1,103	1,264	1,725	1,390	1,500	1,870	1,720	460	1,020	2,300	1,755	1,465	**17,572**	**11.8**
Cerithium caeruleum(snail)	2,700	5,080	2,495	1,690	605	834	160	121	473	629	133	446	**15,366**	**10.3**
Nerita polita (turbo snail)	2,995	2,775	1,580	2,335	1,393	993	118	655	218	473	179	939	**14,653**	**9.9**
Calcinus laevimanus	1,855	3,115	2,220	2,735	724	368	124	580	331	591	180	828	**13,651**	**9.2**
Calibanarius africanus	895	1,025	740	2,520	1,280	780	180	585	329	624	380	565	**9,903**	**6.7**
Dolabella	397	348	308	347	385	382	366	410	353	424	302	390	**4,412**	**3.0**
Lysmata grabhanii	540	315	305	182	155	325	295	149	331	325	616	410	**3,948**	**2.7**
Hippolysmata grabhami	1,053	756	462	145	209	246	135	168	106	114	49	191	**3,634**	**2.4**
Heteractis Magnifica	239	148	149	213	156	249	268	280	373	341	329	341	**3,086**	**2.1**
Hymenocera picta	296	287	232	239	239	161	179	115	145	164	146	197	**2,400**	**1.6**
Protogaster linckii	171	125	122	105	115	65	305	241	258	250	236	235	**2,228**	**1.5**
Trochus maculatus	44	277	560	428	44	28	208	238	27	57	140	68	**2,119**	**1.4**
Lunella coronata	410	205	185	770	100	10	90	44	50	64		60	**1,988**	**1.3**
Petrolisthes sp.	235	160	70	50	60	75	194	195	220	205	137	146	**1,747**	**1.2**
Diadema Urchin sp.	165	85	200	150	155	140	120	154	129	114	91	65	**1,568**	**1.1**
Tectus pyramis	351	495	372	77	6	21	16	0	71	36	15	15	**1,475**	**1.0**
Capnella sp.	112	114	70	86	71	83	41	113	91	84	235	179	**1,279**	**0.9**
Dolabella auricularia (Sea hare)	103	121	114	172	116	36	32	99	55	224	22	59	**1,153**	**0.8**
Sarcophyton sp.	69	68	76	75	97	109	65	72	79	86	108	80	**984**	**0.7**
Others	1,938	1,991	2,137	1,987	1,652	2,590	1,876	2,769	2,247	3,293	2,054	2,796	**27,330**	**18.2**
Total	**17,261**	**19,899**	**15,757**	**17,191**	**10,357**	**11,385**	**7,562**	**7,943**	**8,281**	**12,653**	**8,972**	**11,425**	**148,686**	