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Analysis of fish catch data from 1985 to 1994 in the Kenyan inshore marine waters

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ABSTRACT

Fish landing data collected by the Kenyan Fisheries Department from the nearshore coastal marine waters from 1985 to 1994 were statistically analyzed to determine trends in the traditional fisher's catch. Over the ten year period a significant decline occurred for total catch and for catches of seven commercially important fish families: Lethrinidae, Siganidae, Lutjanidae, Scaridae, Carangidae, Scombridae and Mullidae. 1994 registered the lowest catch over ten years. The total catch for all the fish declined from a mean annual catch of 6150 metric tonnes in the 1980's to a mean of 5141 metric tonnes in the 1990's with the catch for 1986 being 2 times higher than that of 1994. Although Mombasa district had the highest mean annual landing, its total landings like that of Lamu and Kwale districts decreased over the years. However, Kilifi district showed a steady increase in catches over the years. The changes in fish landings is thought to be caused by lack of appropriate fishing regulations, leading to overfishing of the lagoonal reefs beyond their maximum sustainable yields.

INTRODUCTION

The Kenyan nearshore fishery covers an estimated area of 800 km^2. This area forms the major fishing zone supporting roughly 8,000 artisanal fishers that contribute greater than 80% of Kenya's coastal fish catch of around 8000 metric tonnes annually (BROCHMAN, 1984). Recent studies indicate that the catch per fisher is low and that the number of fishers has reduced drastically in most of Kenya's beaches because of low returns on investment (McCLANAHAN & KAUNDA-ARARA, 1996). Sustainable fish yields of the lagoonal reefs in which the artisanal fishing takes place are not known and the reefs may already be over fished as reflected by the low catch rates. The Kenya Fisheries Department collects data on fish landings along the Kenya coast in the districts of Mombasa, Kwale, Lamu, Kilifi and Tana. A time series analysis of catches is important in highlighting the trends in a fishery and may reveal periods of high fishing pressure, especially, in the absence of stock assessment studies as is the case for Kenya's coastal marine fisheries. The combined fish landing from 1985 to 1994 for four districts were analysed to determine if any statistical differences existed for total catch and catches of seven major fish families: Lethrinidae, Siganidae, Lutjanidae, Scaridae, Carangidae, Mullidae and Scombridae.

MATERIALS AND METHODS

Mean monthly catches for seven major fish families were tabulated in metric tonnes for the period 1985 to 1994 (except for 1987 and 1990 when data was not categorized according to families) and means, variance and standard deviations calculated. Due to the heteroscedasticity of standard deviations, a logarithmic transformation in base 10 of the catches was utilized to permit the use of Model 1 ANOVA in order to determine if any significant differences existed among the years for each of the fish family and for the total catch. If differences existed among the years, then an equal sample size Student Newman-Keules (SNK) multiple comparison test was performed to determine exactly which years were different. A time series analysis of total catch was done for each of the major fishing districts (Mombasa, Kilifi, Lamu and Kwale, Fig. 1) and for all the districts combined. Tana district was not included in the analysis because of the discontinuity of data. All statistical analysis was done following Zar (1975).

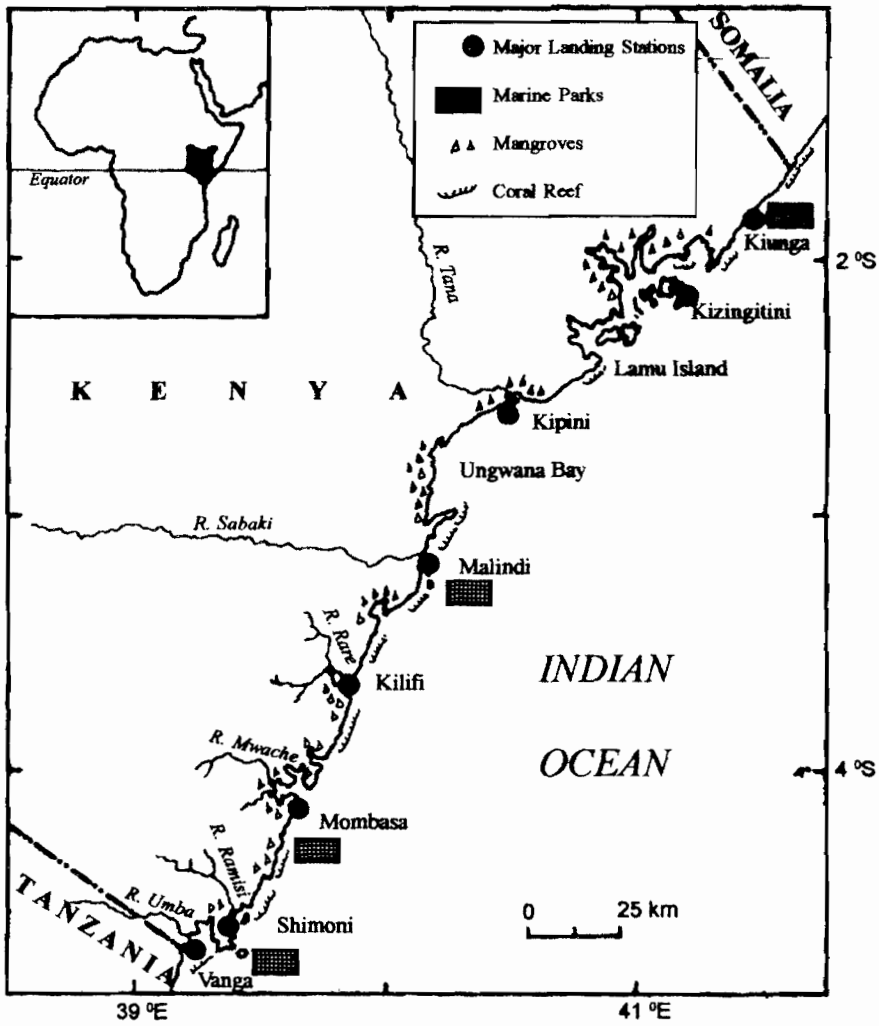

Fig. 1 Kenya's coastline showing the major fish landing points and the associated coastal habitats.

RESULTS

Table 1 shows the mean monthly values of fish landings for the commercially important families in metric tonnes and F calculated values. The values have been ranked from highest to lowest. The underscored lines indicate which mean values are the same (connected by a continuous line, e.g. 92, 93, 94 and which ones are significantly different (discontinuous line, 89, 88, 92, 93, 94), computed from the results of SNK test.

The following are the summarised differences between the families:

1. The total catch combined for all the seven fish families declined progressively from high catches in the 1980's to the lowest value in 1994. The mean total catch for 1986 for all the families combined was 1.5 times significantly higher than that of 1994. All the fish families registered a peak catch in 1991, this probably corresponds to improved management practices such as the creation of the Mombasa Marine Park in 1990 leading to a 'spill-over' effect in fished areas. It is not clear why the landings subsequently declined from 1992 to 1994.

2. The rabbit fishes of the family Siganidae were landed in large quantities in 1980's with a peak catch in 1986. However, this catch progressively dropped in subsequent years (with the exception of 1991) to the lowest catch registered in 1994. The 1986 catch was more than 1.5 times significantly higher than that of 1994.

3. The Lethrinidae (scavenger fishes) which are commercially the most important group (Fisheries Department, unpublished data) recorded peak catch in 1991. This catch was, however, not significantly different from that of 1986 and 1985. The catch in 1989 was nearly 2 times higher than that of 1994.

4. The quantity of Lutjanidae (snappers) caught in 1994 was about 1.5 times lower than that in 1989. However, the catch in 1993 was not significantly different from the mean catch in 1980's.

5. The pelagic families (Scaridae, Carangidae, Mullidae and Scombridae) showed a fluctuating pattern of decline over the year although, the pattern is not clearly defined among the families. The Clupeidae are left out of this analysis because of their very high but episodic catches.

Table 1. Mean monthly catches (metric tonne), F-calculated values and significant differences among years, 1985-94, for major families landed from Kenyan inshore marine waters.

				Total Catch					
Year	91	86	85	89	88	92	93	94	F
Mean	2370	2165	2061	1978	1914	1653	1408	1398	11.03*
				Siganidae					
Year	91	86	85	89	88	92	93	94	
Mean	58.9	54.8	52.8	47.4	44.4	41.8	36.7	30.4	11.85*
				Lethrinidae					
Year	91	88	86	85	89	92	93	94	
Mean	55.5	52.3	51.3	55.1	48.9	39.8	36.8	29.4	23.88*
				Lutjanidae					
Year	91	89	86	85	88	92	93	94	
Mean	20.2	14.9	14.8	14.7	13.4	13.1	10.8	9.6	4.31*
				Scaridae					
Year	91	86	94	89	85	88	92	93	
Mean	26.2	24.4	23	19.9	19.2	17.4	14.9	13.9	3.17*
				Carangidae					
Year	86	88	89	85	91	92	94	93	
Mean	20.7	18.8	17.3	16.4	14.6	11.8	6.1	5.7	6.97*
				Mullidae					
Year	91	89	92	93	86	94	88	85	
Mean	13	10.6	9.8	9.7	9.6	9	8.3	8.8	4.17*
				Scombridae					
Year	91	94	92	89	86	85	88	93	
Mean	9.2	8.6	6.6	5.8	5	4.8	4.8	3.8	5.18*

*Significant difference among years at 5% level of significance.

Total Fish Landings

The trend in total catch of all the fin fish species landed from the Kenyan inshore marine waters is shown in Figure 2. The total catch declined from a mean annual catch of 6150 metric tonnes in the 1980's to a mean of 5141 metric tonnes in the 1990's with the catch for 1986 being 2 times higher than that of 1994. A rather unusual high catch of about 9000 metric tonnes was recorded in 1990. The catches of demersal fishes comprising mainly the Lethrinidae, Lutjanidae and the Siganidae, formed about 74% of the total landings with a mean annual catch of 2889 metric tonnes compared to 996 metric tonnes for the pelagic fishes. The catches for the demersal fishes showed a fluctuating trend over the years while that of the pelagics remained fairly steady (Fig. 2).

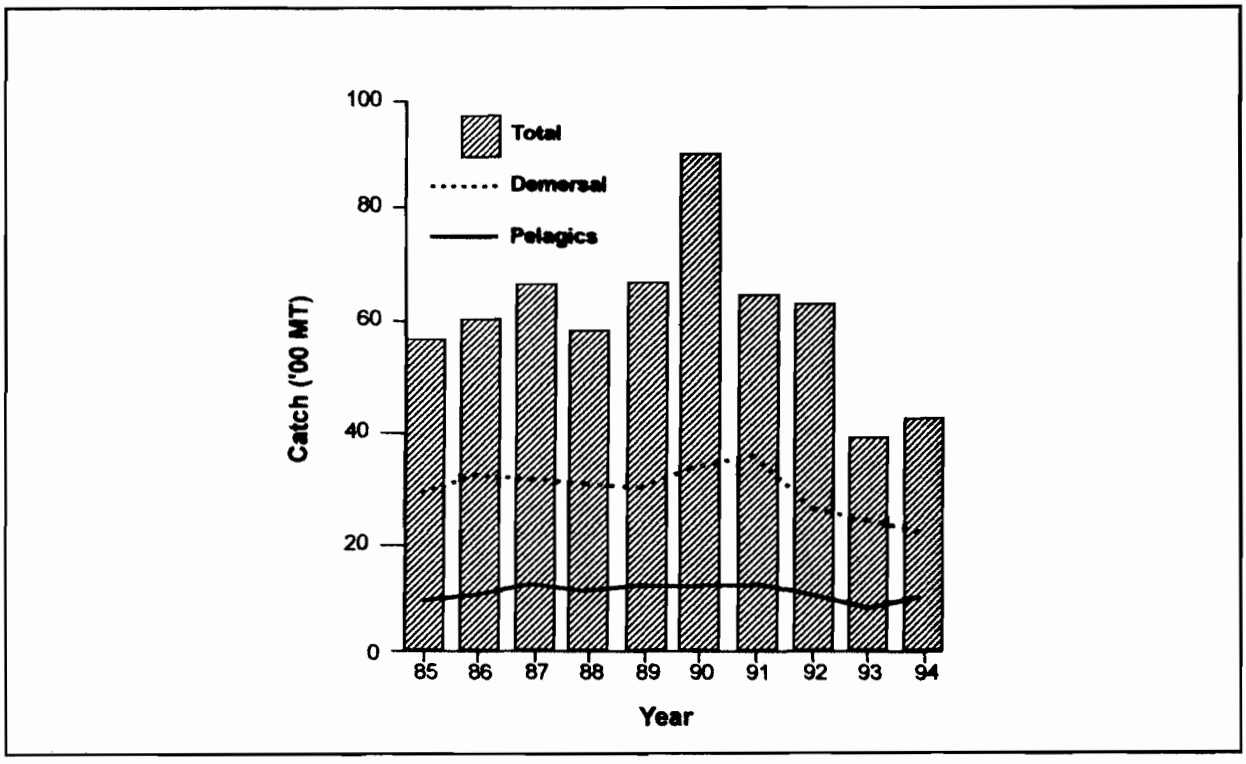

Fig. 2. The variation of total fish, demersal and pelagic fish landed from Kenya's inshore marine waters from 1985 to 1994.

Fish landings per district

The fish landings recorded per district over years is shown in Figure 3. Mombasa district had the highest mean annual catch (3192.5 metric tonnes) followed by Lamu (1164.7 metric tonnes), Kilifi (877 metric tonnes) and Kwale (795 metric tonnes). Although Mombasa district recorded the highest mean annual fish catch, the landings from the district showed a gradual decline with the 1993-94 catches being nearly 3 times lower than that of 1985-86. The district recorded a rather unusually high catch in 1990 (6248 metric tonnes). Kilifi district showed a steady increase in fish landings from a low value in 1985 (700 metric tonnes) to a modest peak in 1994 (1187 metric tonnes). Although the quantity of fish landed in Lamu and Kwale districts fluctuated over the years, Lamu district registered substantial decline in catch from 1988 to 1989 and from 1993 to 1994. The 1986-88 landings was 1.2 times higher than that recorded for 1993-94 period in Kwale district.

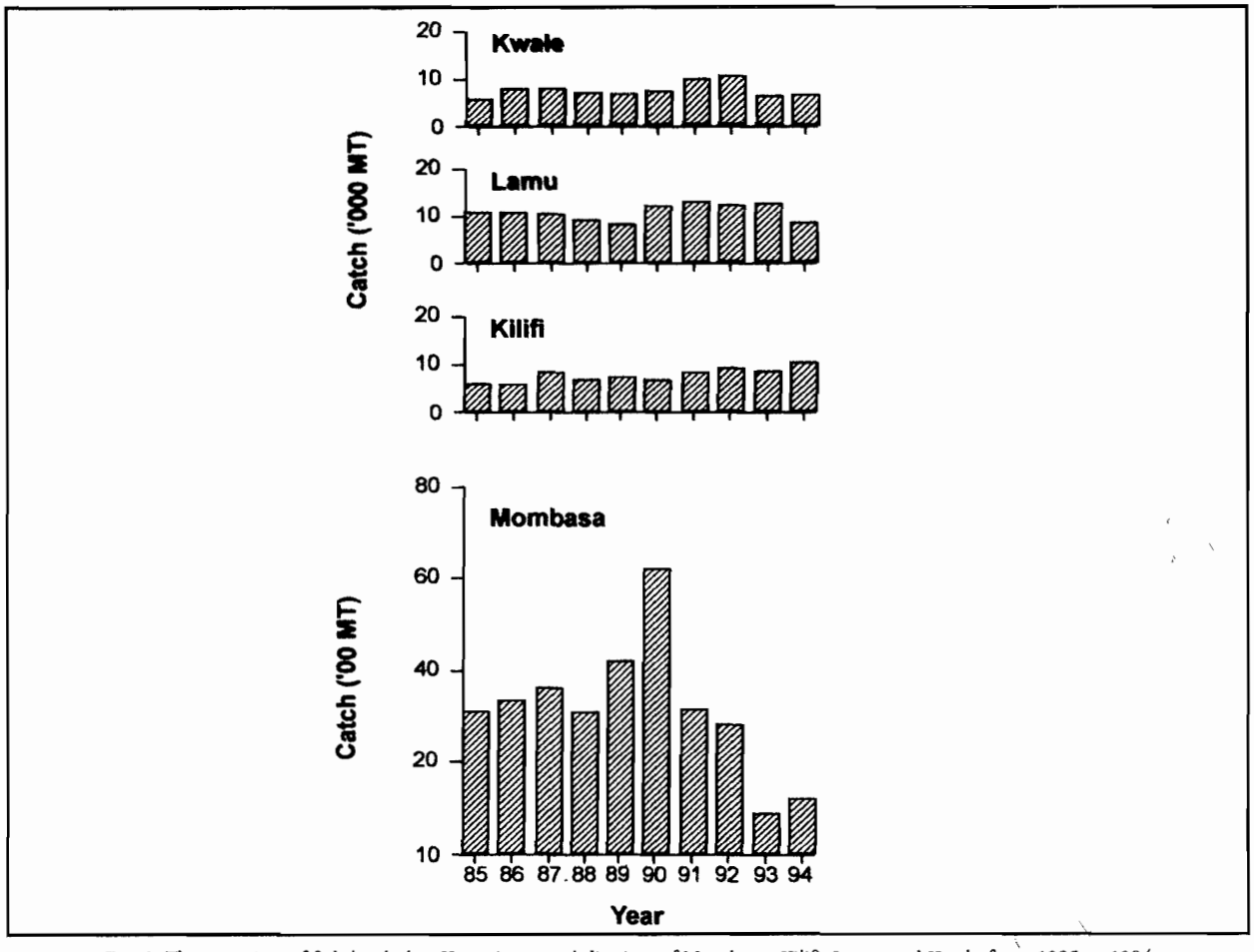

Fig. 3. The variation of fish landed in Kenya's coastal districts of Mombasa, Kilifi, Lamu and Kwale from 1985 to 1994.

DISCUSSION

The general decline in fish catches over the ten year period indicates that Kenya's marine fisheries resources have been under great pressure from the fishers. Although data on gear usage in Kenya's coastal waters is lacking, it is possible that as catch declined the fishers changed their gear to catch the immature fish thereby resulting in decline in both recruitment and catch in subsequent years as happened in Lake Victoria fishery (GARROD, 1960). Additionally, the destructive fishing methods such as pull-seining and dynamiting practiced by the *Wapembas* (illegal fishers originating from Pemba Island) in the Kenyan coastal waters in the early 1990's (SANDERS *et al;* 1990) could have contributed to the decreased catches in the 1993-94 period. The actual mean annual catch is probably 2 times higher than the reported 8,000 metric tonnes (Fisheries Department, unpublished data) or 6,000 metric tonnes as established in this paper. This difference may be due to inadequate data collection system and the high percentage (20%) of catches that is not reported by the fishers (WERU, unpublished data).

The current fishing activities in the traditional fishing grounds in Kenya's coastal waters are believed to exceed sustainable yields (MARTENS, 1995; McCLANAHAN and KAUNDA-ARARA, 1996). There is therefore need to quantify the maximum sustainable yields of these reefs, together with enactment of policies aimed at regulating the activities of the fishers. The regulations could include: minimum mesh-size specification, allowable catches and fishing effort regulation amongst others. While policies exist for Kenya's lacustrine fisheries, they are lacking for the marine fisheries. The enactment of legislation should, however, be coupled with effective enforcement from the Fisheries Department.

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