Artisanal fishing gears impact on King Mackerel (*Scomberomorus commerson*) along the Kenyan Coast line.

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Abstract:

An analysis was undertaken to ascertain the impact of various artisanal fishing gears on King Mackerel (*Scomberomorus commerson*). The study covered 41 landing sites covered by catch assessment survey exercise. This involved recording the frequency of landing King Mackerel and other species caught by artisanal fishing gear combination returning from fishing voyages. The combinations included gill nets with mashua (GNM), handlines with dau (HLD), Trolling lines with dau (TLD), Long lines with dau (LLD)and long lines with mashua (LLM), gillnets with hori (GNH).

Materials; Species identification charts, Personnel, Tablets or Android phones and Laptops.

Methodology; Enumerators were trained on interviewing techniques to be applied during the survey and species identification to ensure they recorded responses in relation to King mackerel versus other species caught.

Survey Area; The survey covered landing sites that are used for catch assessment survey (Figure 1.0). This involved administering oral interviews as well as Questions to respondents (Fishermen) on the gear's combination applied to catch King mackerel (*Scomberomorus commerson).* **Results;** The survey showed Gillnets operating from Mashua's had the highest frequency of targeting King mackerel (Figure 1.1), followed by gillnets with dau then hand lines operated from dau's. Gill nets, hand lines and long lines are predominantly used by artisanal fishers while Trolling lines are used by sport fishers. The highest concentration of gillnets was in Kilifi, Tana River and Lamu Counties.

Conclusion: Artisanal fishers operating gillnets with Mashua had the highest impact on King mackerel followed by a combination of Dau with gillnets. There is need to map the fishing grounds frequented by Gill net fishers using Mashua and dau, stock assessment for King Mackerel is recommended, however the importance of understanding seasonal catch variation is significant to guide the management in making a comprehensive decision on management measures to be applied for the fishery.

Objectives of the catch assessment surveys

The overall objective of the Catch Assessment Survey data collection system was to test if data collection through CAS would generate data for monitoring trends in King mackerel catches, fishing effort, and economic value for use in management planning, policy formulation and decision making. Specifically, the aims of the CAS were to:

- Monitoring trends in King mackerel fish catches
- Estimate annual total catch by weight of operating fishing fleets (craft- gear combination)
- Determine the impact of different gears on the size structure of King mackerel *(Scomberomorus commerson).*

METHODOLOGIES.

Catch Assessment Survey Process

Standard Operating Procedures (SOP) and Training Manual for CAS

Data enumerators trained revised CAS Standard operating procedures (SOPs) and manual. The manual contains training modules that covers species identification, morphometric measurements and sampling design and the data recording during interviews. A sampling form was developed and transformed into electronic mobile data format.

The Catch Assessment Survey Design

The CAS employs a two-stage sampling design. Within each county, a sample of Primary Sampling Units (PSU), in this case landing site is first selected, and then, at each PSU, samples of Secondary Sampling Units (SSU) (fishing craft gear) are selected based on total number of fishing crafts per landing site and the spatial distribution along the coastline was also considered.

Table.1.0. Graft and gear type combination sampled.

		Main Gear Types		
Fishing Craft Type	Code	GN	HL	TL
Mashua (A craft pointed on one end V-shaped bottom) MS.	MS	x		
Hori (Flat bottomed fishing boat pointed at both ends) HR.	HR	x		
Dau (Flat bottomed fishing craft) DA.	DA	x	x	x
Notes; *GN= Gillnet, HL= Handlines, TL= Trolling line, X= combination applied*				

Landing sites for Catch Assessment Survey selected from the five counties namely Lamu, Tana River, Kilifi, Mombasa and Kwale are as illustrated in Fig 1.0. Fishing gears and boat combination used for sampling are shown in table 1.0.

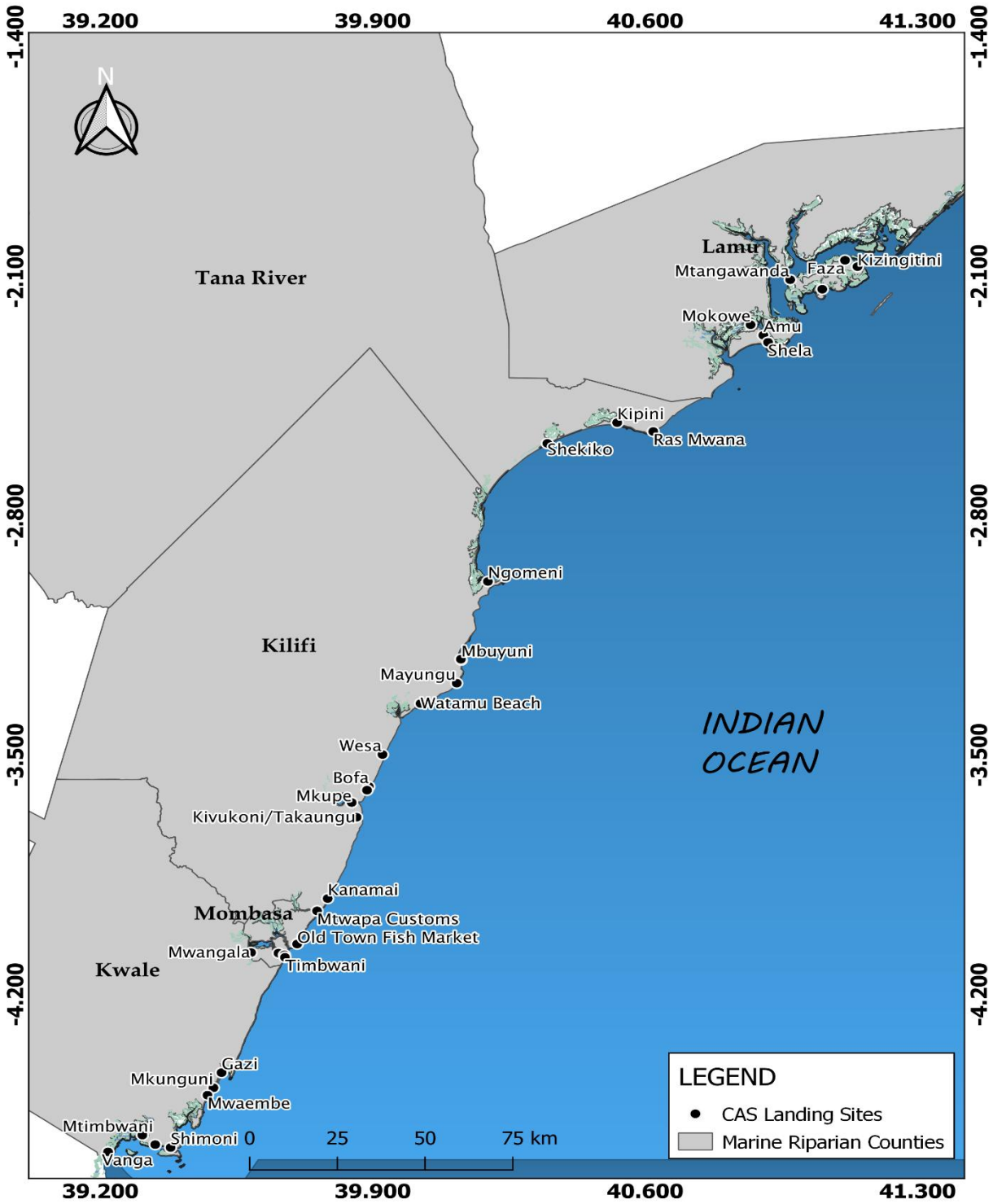

Figure 1.0. Cas landing sites sampled.

Table 1.1. Boat gear combination and frequency of landing King Mackerel per landing site.

Landing site	Boat and Gear combination	Frequency of landings	Explanation
Watamu	TLD	5	TLD=Trolling lines + Dau
Mbuyuni	HLD	8	HLD= Handlines + Dau
Mbuyuni	GND	5	GND= Gillnets + Dau
Ngomeni	GND	32	GND=Gillnets + Dau
Pwani toto	GNM	31	GNM=Gillnets + Mashua
Mvundeni	GNH	5	GNH=Gillnets + Hori
Mtangawanda	GND	5	GND= Gillnets + Dau
Mtangawanda	GNM	28	GNM= Gillnets + Mashua
Mkoko	TLD	8	TLD= Trolling lines + Dau
Mayungu	HLD	15	HLD= Handlines + Dau
Bwana saidi	GNM	20	GNM= Gillnets + Mashua
Kipini	HLD	8	HLD= Handlines + Dau

Catch Assessment Survey (CAS) Data Collection and Analysis

A hybrid method of physical and electronic data collection forms was used in collecting data at the selected landing sites. The data items collected included composition by species and size, fishing gears/methods and craft type as well as fishing frequency. The catch weight was measured using weighing scales while measuring tapes were used in measuring craft lengths.

Estimation of fishing effort

Fishing effort per time unit = Fishing capacity*activity level
or
Fishing effort = F*BAC x A

where,

a. **F= no of boats from frame survey**
b. **BAC= average no of active boats/no of boats from frame survey,**
c. **A=no of fishing days**

Table:1.2 BAC, CPUE (catch/fisher) and number of counts by Craft-Gear category

Craft-Gear Type	BAC	CPUE_Craft-gear	CPUE_Fisher
Dau-Handline	0.6	31	10.4
Dau-Gillnet	0.9	40	10.0
Mashua-Gillnet	1.5	79	15.8
Hori-Gillnet	0.1	5	1.8
Dau-TrollingLine	0.3	13	4.3

Within the marine artisanal fishery, Mashua registered the highest catch rate per vessel per trip of 79kg/craft/trip and 15.8kg/fisher/trip, indicating high productivity and efficiency due large space accommodation of more crews with a BAC of 1.5 suggests a strong likelihood of consistent fishing activity. Dau which is predominant craft with highest counts has an average catch rate of 28kg/craft/trip and 8.23kg/fisher/trip with a BAC of 0.6 signifies high fishing activity.

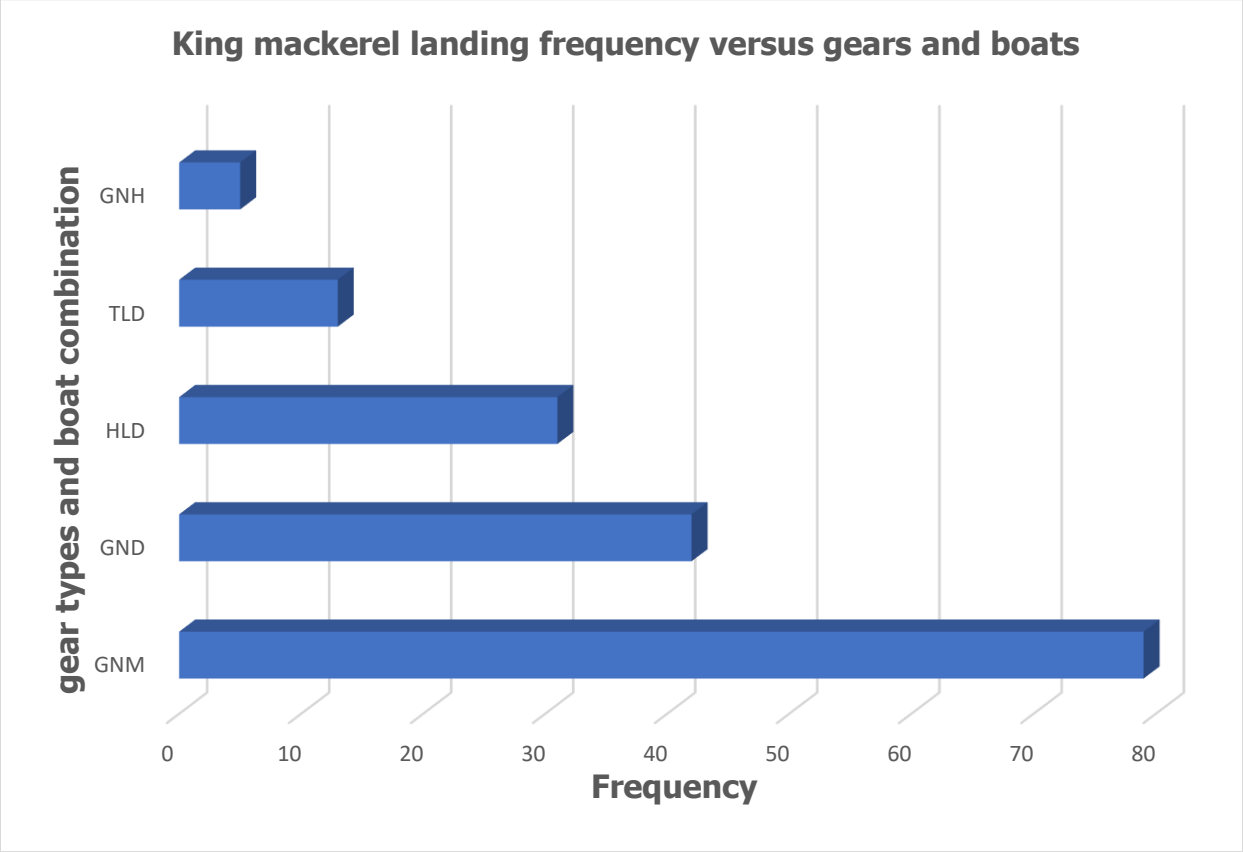

Figure.1. 1. Gear types and boat combination versus frequency.

The survey showed Gillnets operating from Mashua's had the highest impact on King mackerel (Figure 1.1), followed by gillnets with dau then hand lines operated from dau's. Gill nets, hand lines and long lines are predominantly used by artisanal fishers while Trolling lines are used by sport fishers. Landing sites that recorded the highest concentration of gill nets with Mashua were Mtangawanda in Lamu County and pwani toto in Kilifi County (Figure 1.2). Ngomeni landing site recorded highest concentration of gillnet dau combination.

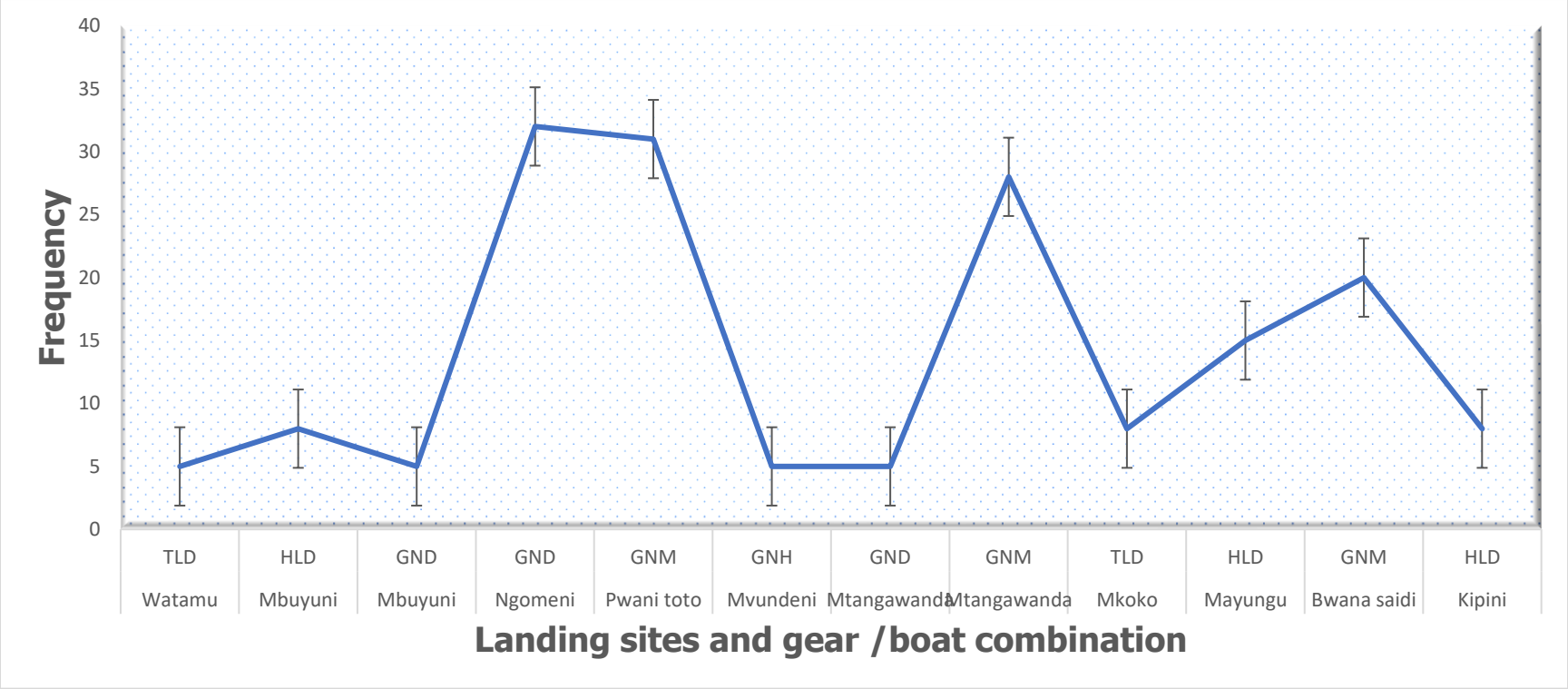

Figure.1. 2. Gear types and boat combination versus landing sites.

Seasonal variation

Most fishing crafts mark the North East Monsoon (NEM) period as the one with the highest CPUE for crew, with mashua showing the highest CPUE (10.3) followed by Dau (9.2). This implies that there is greater catch rate during the NEM season than the South East Monsoon season (SEM) season. Nevertheless, Hori's CPUE levels are higher in the SEM (8.9) than NEM (7.9) period an indication that the approach may be more relevant during the SEM season. These findings emphasize the importance of understanding seasonal catch variation for effective fisheries management.

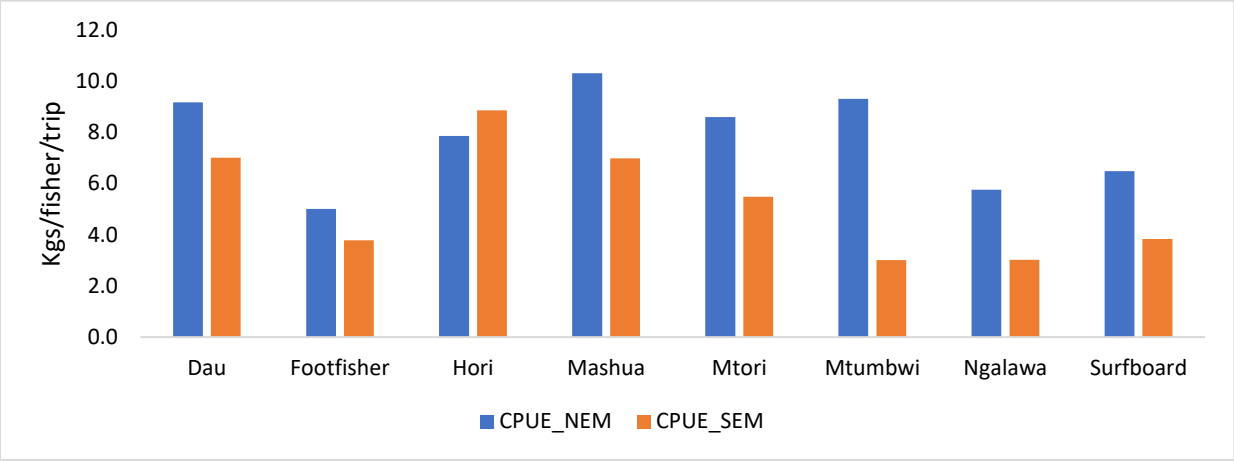

Figure.1.3. Seasonal Catch rate by Craft type.

Conclusion;

Gillnets combined with mashua had the highest impact on king mackerel (*Scomberomorus commerson*) followed by gillnets combined with dau. There is need to map the fishing grounds frequented by Gill net fishers using Mashua and dau, stock assessment for King Mackerel (*Scomberomorus commerson*) is recommended, however the importance of understanding seasonal catch variation is significant to guide the management in making a comprehensive decision on management measures to be applied for the fishery.

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