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EVALUATION OF FISH HANDLING TECHNIQUES EMPLOYED BY ARTISANAL FISHERS ON QUALITY OF *LETHRINIDS* AND *SIGANIDS* FISH GENERA AT LANDING TIME ALONG THE KENYAN COAST USING SENSORY AND MICROBIOLOGICAL METHODS

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ABSTRACT

In artisanal fishery, traditional handling methods such as tossing fish onto the boat bottom or into woven mat baskets and gunny bags after capture are commonly employed. These practices accelerate fish spoilage due to cross contamination and exposure to high ambient temperature. This study aimed at investigating the effect of non-icing (onboard handling methods) on the quality of *Lethrinids* (Emperor fish, local name: Changu) and *Siganids* (Rabbitfish, local name: Tafi) landed along the Kenyan coast in comparison to iced fish. Monthly, samples were assessed by sensory methods using Quality Index Method (QIM), Total Viable Counts (TVC) and hydrogen sulphide (H_2S) producing bacteria considered as specific spoilage organisms (SSO) counts for raw fish; Quantitative Descriptive Analysis (QDA) and Torry score for cooked fillets. Iced fish was characterised by better freshness quality attributes at landing time compared to non-iced at both landing sites. According to the QIM, iced treatment recorded better quality scores that were significantly different from non-iced groups ($p<0.05$) throughout the study with regard to fish genera. Cooked fillets showed both treatments to be within human consumption limits although non-iced fish were characterised by marginal quality attributes. Microbial assessment depicted TVC to be on average 10^2- 10^3 CFU/g and 10^3- 10^4 CFU/g in iced and non-iced *Lethrinids* respectively at both sampling sites. In *Siganids* higher numbers of 10^4- 10^5 CFU/g were recorded in non–iced group, with H_2S producing bacteria constituting a higher proportion of TVC. Iced *Siganids* recorded 10^2- 10^3 CFU/g throughout the study. Fish quality was reported to be inconsistent over the sampled month which reflects the large pressure systems of the Western Indian Ocean and the two distinct monsoon periods considered to differ in warmth. The major cause of deteriorated fish quality observed at landing time in the fishery was attributed to bacterial proliferation accelerated most importantly by non-icing onboard handling practises reported such as tossing fish onto the boat bottom or into woven mat baskets and gunny bags employed by the fishers. Sensory evaluation of cooked fillets and microbiological analysis showed fish was acceptable for human consumption regardless of handling method employed. This assures consumers of acceptable fish quality at landing time as long as good hygienic practices are observed at subsequent stages to consumption.

Key words: *Lethrinids*, *Siganids*, Quality, Sensory, Handling

INTRODUCTION

Fishing and fisheries related activities contribute greatly to the livelihoods of Kenyan coastal communities. Small-scale agriculture, mangrove harvesting, tourism, and trade also contribute substantially to the coastal economy [1]. There are about 8,000 registered fishers, mainly within the artisanal fishery sub-sector where fishing is technologically restricted [2]. In this fishery, caught fish is mishandled, losing quality with exposure to ambient temperatures during fishing and transportation to landing sites. However, food safety and food quality are important issues nowadays all over the world [3, 4].

The storage life of fish under ambient tropical conditions, noted to be less than a day [5], depends on factors like handling conditions, species, quality of fishing ground, season, sexual and nutrition status [6]. It is usually limited by microbial activities, that are greatly influenced by storage temperature [6, 7, 8]. The extension of shelf life of fresh fish and fishery products is of importance so as to allow transport of the products to distant markets [9]. This enables fishermen and fish sellers to plan and control marketing price in long term, thus ensure higher returns. Ice is the most important and ideal medium used for preserving fresh fish in both tropical and temperate climates [10]; unfortunately ice is expensive and inadequate to serve the fishers.

As a result, spoilage of fish is rife, leading to economic and aesthetic value of fish loss, and rendering products unacceptable for human consumption. The spoilage of fish is largely influenced by the degree of processing and preservation, storage temperatures and level of cross contamination, which works synergistically in enhancing microbial spoilage, biochemical spoilage or a combination of both [11, 12] with the most prevalent spoilage in fresh fish being microbial spoilage [13, 14].

Since loss of freshness and spoilage of fish are complicated processes, there is no single spoilage or freshness indicator for fish that can be used, but rather a combination of selected indicators representing the different changes occurring during spoilage [14]. Sensory assessment of the outer appearance, odour and texture of fish and evaluation of cooked fish is the most convenient and successful method for assessing fish freshness today [15, 16].

In East African coastal waters, *Siganids* and *Lethrinids* are among the most heavily targeted reef-fish species with a catch composition of 63% in some areas [17]. The Fisheries Statistics Year Book of 1996 [18] lists those two genera as the most important marine fish landings along the East Africa coast. The interest in extending shelf life of fresh fish has prompted research on optimizing handling, chilling, and transport practices, as well as packaging methods to maintain high quality and safety of fish and fish products. The aim of this study was to evaluate onboard fish handling methods employed by artisanal fishers and the influence on quality at landing time of *Lethrinids* and *Siganids* fish genera.

MATERIALS AND METHODS

Study area

The study was carried out at two fish landing sites along the Kenyan coast, *viz.* Gazi on the south coast and Bamburi (Kenyatta) in the north. Both landing sites were purposively selected based on laboratory proximity.

Methodology

Preliminary survey (interviews)

Three hundred (300) artisanal fishers at six landing sites were interviewed in one month (March 2007) using designed and pre-tested questionnaires to determine onboard fish handling methods, type of fishing vessels, average landings, time out for fishing and landing time. The survey was done to identify practices causing losses in fish quality prior to landing.

Experimental design

On a monthly basis (April 2007 to January 2008) two batches (2 kg each) of the two commercially important fish genera (*Siganids* and *Lethrinids*) were purchased in the morning (9 to 12 hours after capture) at landing site from four randomly identified fishers per site. The same was done with two fishers that were supplied with plastic cooler boxes and block ice to put their catch in, except that in this case 4 kg per fish genus was purchased instead of 2 kg from each fisher. Obtained samples were placed in sterile polyethylene bags, labelled, put in insulated fish boxes and within 1-4 hours of sampling transported to the laboratory for analysis.

Sensory Evaluation

Sensory evaluation of raw fish (QIM)

Prior to the study, 10 panellists were trained in three sessions in the use of QIM scheme. Following the training, panel members under the guidance of an experienced panel leader, developed a QIM scheme for *Lethrinids* and *Siganids* used in the study (Tables 1 and 2). On each evaluation day, six to ten trained panellists evaluated 4 whole fish per treatment from each genus coded with three digit numbers that did not indicate treatment. The panellists individually evaluated changes in skin, eyes, gills, texture and odour in accordance with the QIM scheme.

Sensory evaluation of cooked fillets (Quantitative descriptive analysis (QDA) and Torry)

Sensory evaluation of the cooked *Lethrinids* and *Siganids* was performed parallel to QIM evaluation to determine the sensory characteristic changes of cooked fish. The panel members were trained according to international standards [19] on using QDA, including detection and recognition of tastes and odours prior to the study. An unstructured scale from 0 to 100 % [20] was used, to describe the intensity for the QDA attributes developed based on the Torry scale for cooked lean fish [4]. About 2-2.5 cm long and 2-3 cm wide pieces of cut loins were wrapped with aluminium foil and blind coded with 3 digit numbers. The samples were then cooked separately with respect to treatments and genus in boiling water for 15- 20 minutes. Each Panellist evaluated duplicates of samples in a random order for both treatments. The 10 attributes evaluated using QDA were related to: Odour /Flavour (characteristic, seaweed, sweet, neutral, sour, milk jug, condensed milk, insipid, Trimethylamine (TMA) and turnipy or bitter).

Microbiological analysis
Three samples for microbiological analysis of each treatment and genus were taken from the flesh of the anterior-dorsal region. Samples of minced flesh weighing 25g each were placed in stomacher bags containing 225 Butterfield's Buffer solution to obtain a 10-fold dilution. Blending was done in a stomacher for 1 minute. Aliquots were plated in triplicate on Iron Agar [21], with the exception that 1% NaCl was used instead of 0.5%. Enumeration of total viable counts (TVC) and counts of specific spoilage organisms (SSO) was performed after aerobic incubation at 17˚c for 4-5 days. Black colonies were recorded as SSO (hydrogen sulphide producers) as reported in an earlier study [21].

Data analysis
Data on fish handling time, method and landing was entered into preformatted databases using Microsoft excel spread sheets. The format of the databases was based on the information on the questionnaire with a reference section created for harmonized entry of categorical data. Data were analysed using the Statistical Analysis System software (SAS, version 9.1.3). The mean values of QI, TVC and counts of SSO were plotted separately against sampling time for both treatments using Microsoft excel (2007). QDA data was corrected for level effects [22] prior to multivariate analysis. Multivariate comparison of different sensory attributes and samples were performed with Principal Component Analysis (PCA) on mean level corrected sensory attribute values using full cross validation. Multivariate Analysis was performed using the statistical program Unscrambler ® (Version 8.0, CAMO, Trondheim, Norway). The difference was described with 95% confidence interval.

RESULTS

Fish handling methods in the artisanal fishery
The preliminary survey (Figure 1) showed three categories of fishing vessels (dugout canoes, non-motorized dhows and motorized dhows) and handling methods (boat bottom, gunny bags and mart baskets) used in this fishery. The most commonly used vessel type in the fishery is dugout canoes whereas, onboard handling practice commonly applied is simply tossing fish onto the bottom of the boat after capture. The study, moreover, shows that fish tossed onto bottom of the boat, spent more time in that state prior to landing compared to fish placed in mart baskets or gunny bags (Figure 2). The handling method that held more catch is preferred to the other methods (Figures 1 and 2).

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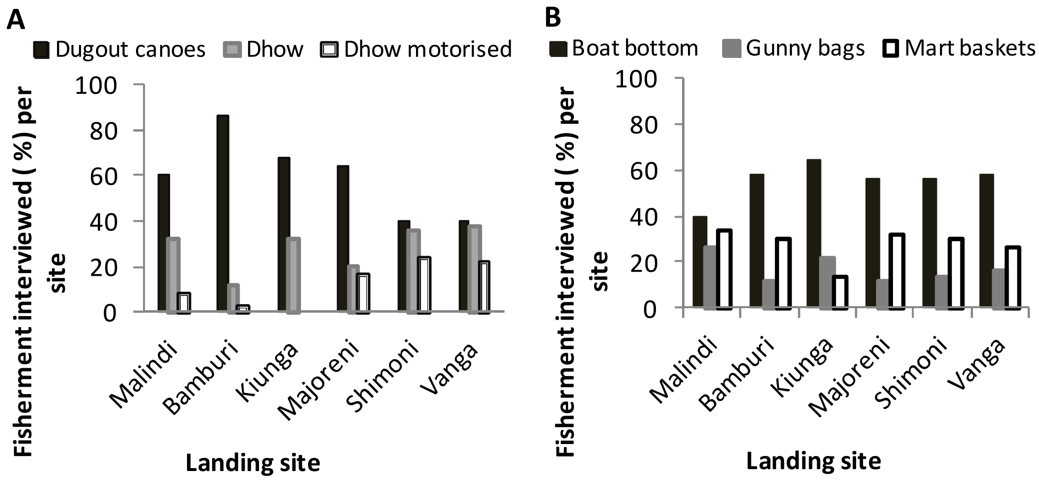

Figure 1: Composition of artisanal fishing vessels (A) and onboard fish handling methods (B) along the Kenyan coast

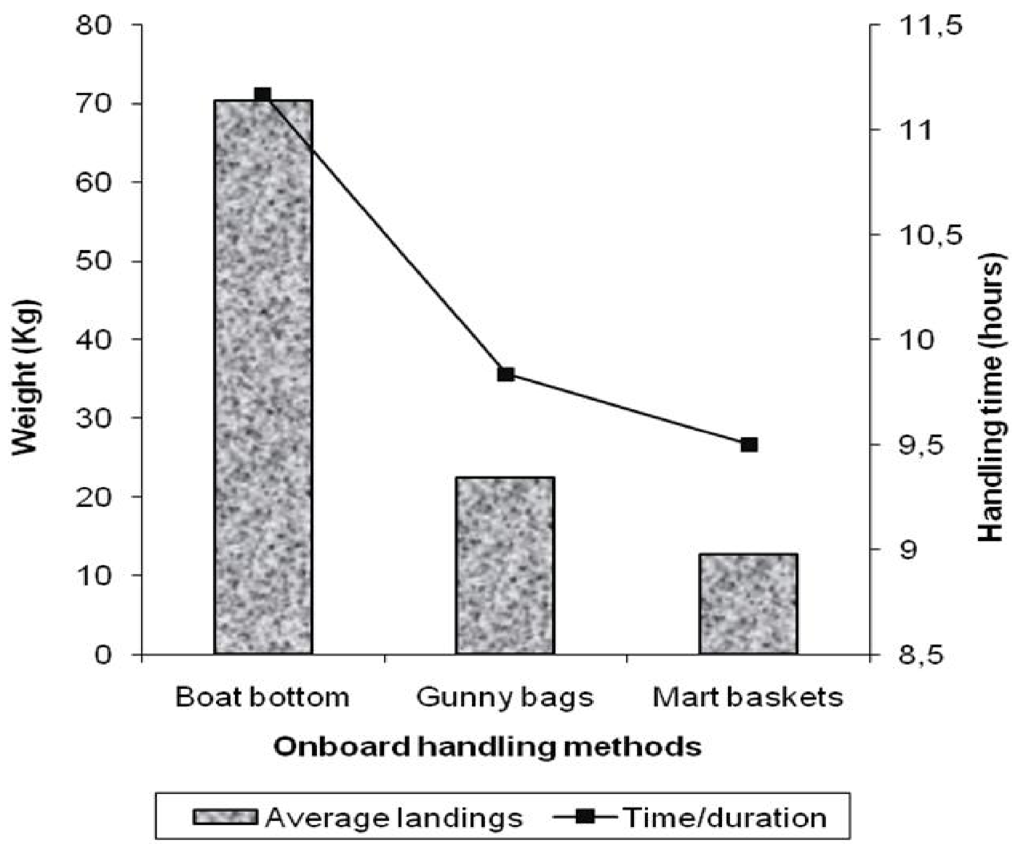

Figure 2: Average fish landings and onboard handling time in respect to handling methods

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Sensory evaluation of whole raw *Lethrinids* and *Siganids* (QIM)

Quality index (QI) based on averages of panellists and 4 fish per genus was calculated for each handling treatment per trial and results are presented in Figures 3 and 4. Landings at Bamburi site recorded lower QI scores than counterparts landed at Gazi site. Furthermore, iced fish were scored low (QI scores) compared to non–iced. On comparing QI scores over the months sampled, variations were noted in non–iced fish with higher scores observed in September to January (warmer months with an average temperature of 29°C) compared to April to August (cooler months with an average temperature of 26°C). In fish samples from Gazi, a sudden pick in microbial counts was noted in the month of October that was associated with delay in landing due to rough sea on sampling day and subsequent transportation to the laboratory.

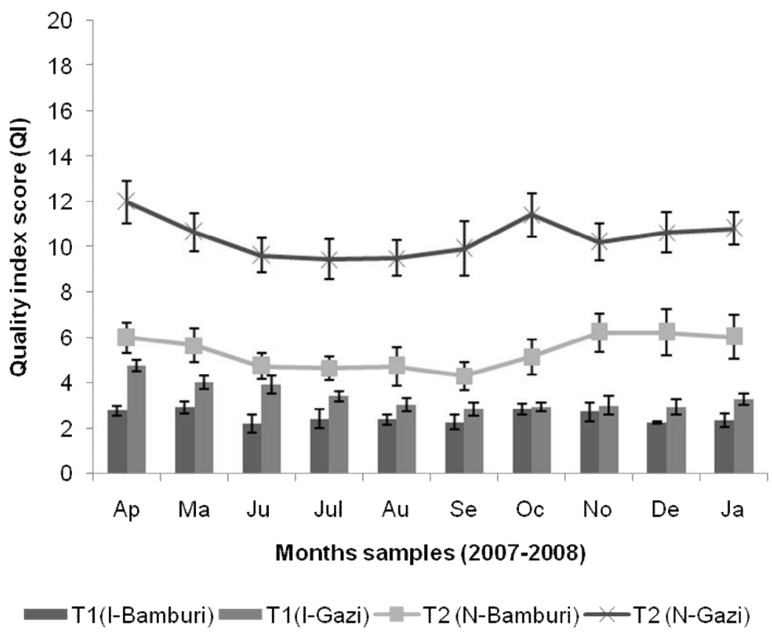

Figure 3: Quality index score for iced (I) and non-iced (N) un-gutted *Lethrinids* landed at Bamburi and Gazi; the scores are inversely correlated to freshness

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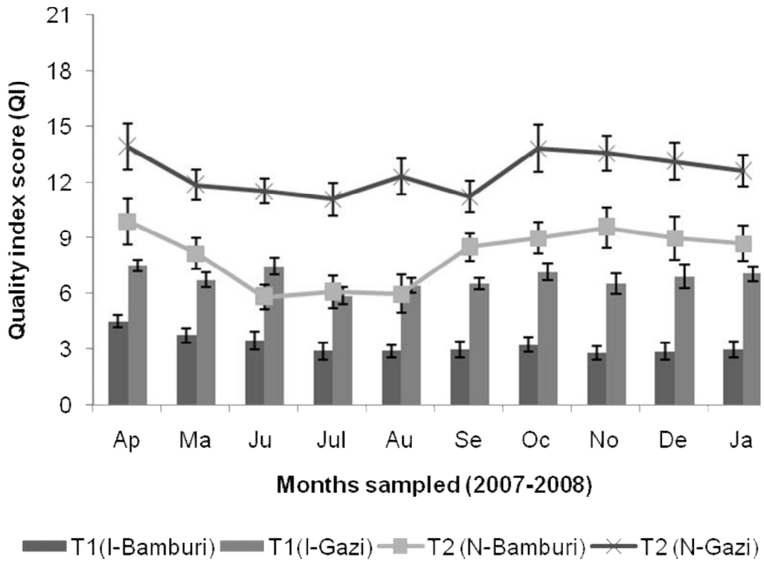

Figure 4: Quality index score for iced (I) and non-iced (N) un-gutted *Siganids* landed at Bamburi and Gazi; the scores are inversely correlated to freshness

Sensory evaluation of cooked *Lethrinids* and *Siganids* fillets (QDA and Torry score)

Figures 5 and 6 show how non-iced and iced *Lethrinids* and *Siganids,* respectively, were described by the sensory attributes in respect to sampling months. The attributes detected on the right hand side of the loading scores (sweet, seaweed and characteristic) along the 1st principal component (PC 1) were considered positive attributes. Consequently, attributes recorded on the left hand side (neutral, milk jug and slight sour) were considered as either marginal or negative attributes.

The samples varied mainly with respect to odour/flavour attributes along the 1st principal component (PC1), explaining 70% and 86% of the variation between the sample treatments for *Lethrinids* and *Siganids,* respectively. Samples also varied along 2nd principal component (PC2), explaining 9% and 6% for *Lethrinids* and *Siganids,* respectively, especially with regard to neutral attributes. Iced treatment was characterised by positive attributes in correlation loadings whereas, non-iced was characterised by marginal or negative attributes. Non-iced *Lethrinids* (Figure 5) was more characterised by neutral attributes and thus of marginal quality compared to counterpart *Siganids* which were characterised by both neutral and negative attributes. Attributes located within the inner eclipse (off-flavour, TMA, insipid, condensed milk and bitter) did not contribute significantly in characterising the treatments. In addition, results showed a distinctive pattern for non-iced treatments, with fish sampled in warmer season (September - January) being more characterised by neutral and negative attributes in comparison to other months in both genera with exception of *Siganids* in May. However, iced treatments did not reflect variations based on a

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particular pattern as sampled months were randomly distributed on the right hand side of the scores mapping.

In Torry score application, higher values indicate better quality, results from both sampled sites and treatments were above 5.5 score considered as consumption limit.

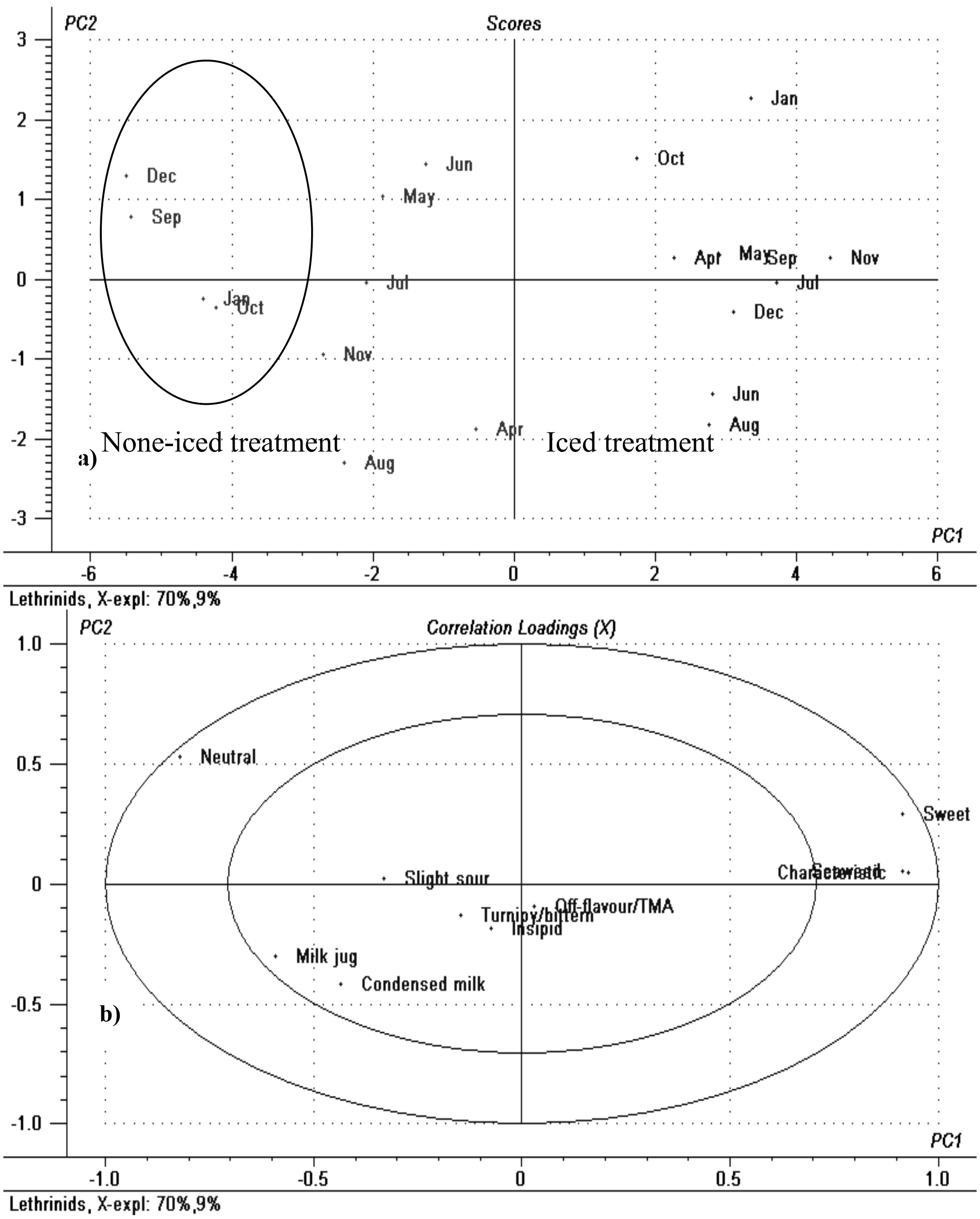

Figure 5: PCA; Scores (a) and correlation loadings (b) describing sensory quality of the *Lethrinids* as evaluated by a trained sensory panel. PC 1 (70%) vs PC 2 (9%)

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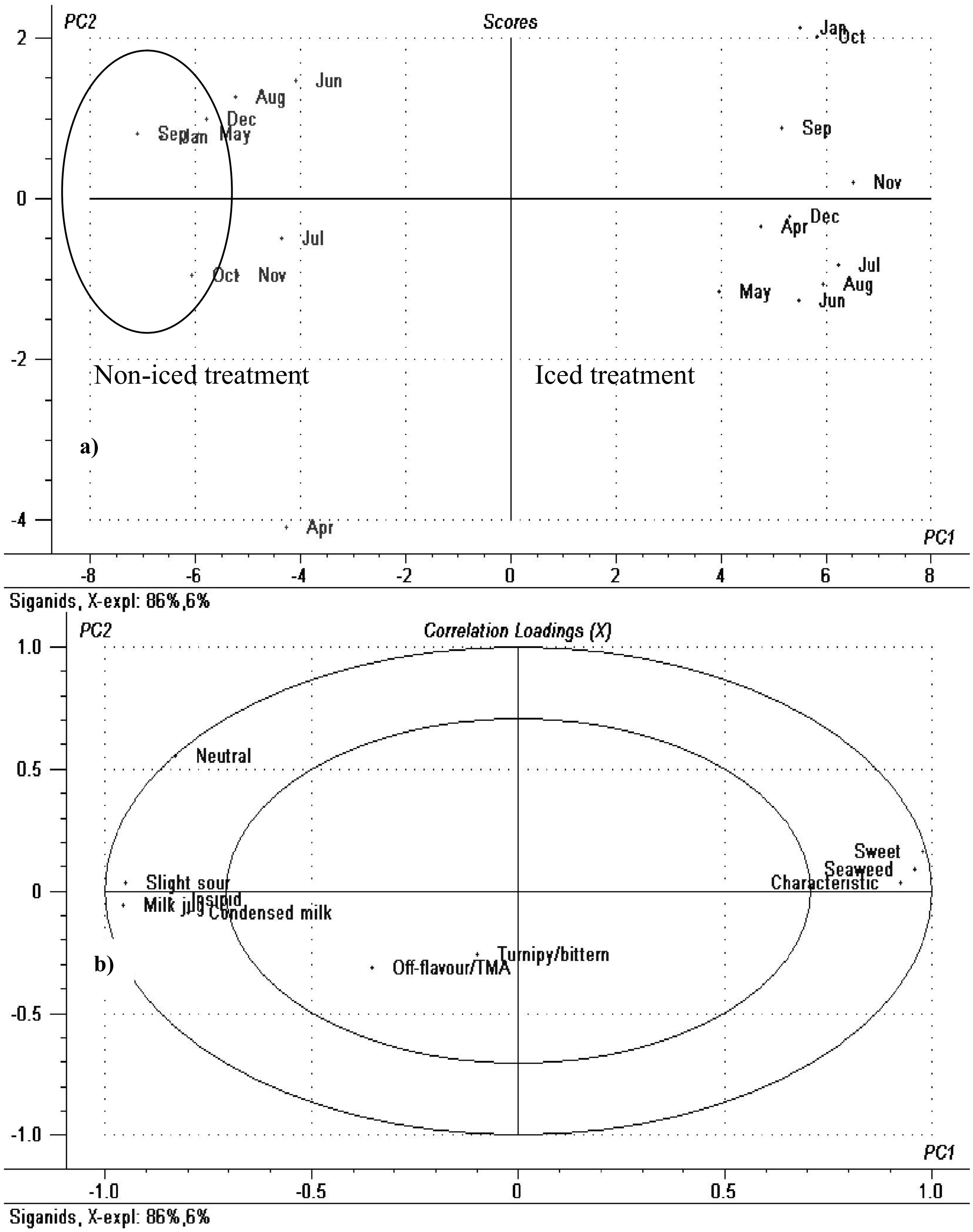

Figure 6: PCA; Scores (a) and correlations loadings (b) describing sensory quality of *Siganids* as evaluated by a trained sensory panel. PC 1 (86%) vs PC 2 (6%)

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Microbial counts

Table 3 showed lower bacterial counts, on average 1 log reduction in colony-forming units (CFU) g^{-1} for iced compared to non-iced fish throughout the study. The data indicate that fish landed at Bamburi recorded lower bacterial counts than counterpart landed at Gazi. In non-iced treatments, SSO (H_2S-producers) constituted a higher proportion of the total bacterial counts (CFU) than iced treatments. The highest proportion was in April and January of which SSO constituted about 1 log colony-forming units (CFU) less than total viable counts (TVC).The highest proportion was in April and January of which SSO constituted about 1 log colony forming units (CFU) less than total viable counts (TVC).

Iced treatment bacterial counts showed no specific trend or changes with respect to sampling months for TVC and SSO. The results depicted TVC counts to have varied between 10^3 and 10^2 throughout the study, whereas SSO recorded counts on average log 1 (10^1) in iced groups. On the other hand, bacterial counts in non-iced fish were lower in May, June and July compared to other months. This is in agreement with the sensory evaluation results for raw and cooked samples. Specifically, *Lethrinids* recorded on average 10^2 CFU g^{-1} and 10^2-10^3 CFU g^{-1} in iced and non-iced fish, respectively at both sampling sites. However, *Siganids* recorded higher counts of 10^3-10^5CFU/g in non-iced fish in comparison to *Lethrinids*.

DISCUSSION

In the present study three main on-board handling methods were reported as tossing the fish onto the boat bottom, into mat baskets and gunny bags. These conservative methods possess the risk of cross contamination of microbes, for example from the boat bottom to the fish as it is roughly handled and tossed around during fishing and transportation to landing sites. Besides, the methods expose fish to the air and high ambient temperatures for long periods of time (9 to 12 hours), thereby accelerating spoilage, contrasting industrialised fishery where precautionary measures are taken to freeze the catch or maintain it at a low temperature prolonging and maintaining high fish quality [6, 23].

It is evident that handling methods in this fishery are partly determined by quantity of fish caught, as mart baskets and gunny bags were found to have limited holding capacity in terms of landings during the study. On the other hand, onboard storage time reported to be on average between 9 to 12 hours was a function of catch quantity per boat/fisher and fish storage method used. However, holding fish under ambient tropical conditions for up to 12 hours could result in tremendous quality deterioration irrespective of the holding unit. Studies done during the FAO project in Kenya [24], showed that Nile perch (*Lates niloticus*) stored at ambient temperatures (20-30°C) spoiled rapidly and was unacceptable for human consumption after 11-17 hours, whereas chilled storage in ice ensured at least 28 days storage time. The time lapse of 9 to 12 hours prior to landing reported in this study, may restrict consumption of fresh fish within the fishing communities and deny the fishers bargaining power and access to well remunerating far and wider markets as fish landed is of marginal quality.

Further, delayed icing of fish to landing that is most often practised in the artisanal fishery, do change the attained marginal quality.

Analysis of post-catch fish quality at landing time from both sites using sensory and microbiological analysis depicted better quality in iced fish than non-iced fish for both genera. Iced treatments recorded significantly lower QI scores compared to non-iced fish ($P<0.05$). The findings are in agreement with how QIM schemes are constructed in that fresh fish or fish evaluated shortly after catch are given the lowest points that subsequently increase with quality deterioration reaching maximum scores at the end of shelf life [9, 25]. Similarly, H_2S-producing bacteria (SSO) comprised on average 53% and 50% of the total flora in iced fish, compared to 77% and 80% in non-iced *Lethrinids* and *Siganids,* respectively. This implies that microbiologically, the iced fish was of better quality than non-iced fish, since H_2S-producing bacteria associated with spoilage often constitute a major proportion of microbial flora of spoiling fish [9, 26]. These findings are in agreement with a similar study done on tropical fresh-water fish (Lake Victoria Nile perch) which reported an increase in shelf life of iced fish compared to delay in icing [27]. Total viable counts maximum limit of log 7 CFU g^{-1} has previously been used in fish as the limit for human consumption [28, 29]. In this study, TVC and H_2S producers (SSO) counts did not reach levels above reported to be human consumption limit which concurs with limits set by International Commission on Microbiological Specifications for Foods [30], indicating that *Lethrinids* and *Siganids* were within the consumption limit at landing time.

In QDA, sensory attributes including sour, condensed milk, off-flavour and neutral are considered negative whereas sweet, characteristic and seaweed attributes are considered positive, as they are indicators of spoilage and freshness respectively [25]. According to QDA results and also microbial counts, quality of non-iced fish landed at both sites varied with sampling months compared to iced fish. This could be associated with climatic changes at the Kenyan coast dominated by the large pressure systems of the Western Indian Ocean and the two distinct monsoon periods [31]. It has been observed that May to August months are characterised by South east monsoon winds ('Kuzi'), stable weather and comparatively cooler temperatures. It is during this time that non-iced fish at both landing sites recorded better quality. During that period non-iced fish were not defined by marginal or negative attributes located on the left, whereas variables near the centre on loading correlation that corresponded well to scores (months) are regarded as less important in PCA (Figures 5 & 6). On the other hand, from September to January, non-iced fish were more characterised by marginal and negative attributes owing to their positions depicted in QDA score and loading correlations. Similar observation was reported in non-iced treatment during the same period with other evaluation methods. This could be due to increased temperatures as September to March months are characterised by north-east Monsoon winds ('Kazkazi') [31].

Iced fish recorded on average good quality scores that did not depict seasonal variations (Monsoon winds). This implies little or no influence from external factors, especially temperature that is influenced mostly by season. The variations observed in iced fish could be because icing does not totally inhibit changes in fish quality since it only slows down bacterial and enzymatic activities involved in fish spoilage. Other factors such handling time and individual fish differences may also have contributed to the variations. At genus level, *Lethrinids* iced and non-iced were considered of better quality at landing time than *Siganids*. The differences in quality observed between the two genera at landing time may be due to differences in body chemical composition [6].

The higher variations observed in non-iced compared to iced fish could be associated with effects of varied handling methods employed by fishers from whom the samples were purchased. It could also be attributed to different fishing grounds from which the fish was caught [32], as fish in this treatment was purchased from different fishers. Nevertheless, iced treatment evidently recorded some variations during the study despite similar post catch handling conditions, which may be due to individual variations present in fish of the same species and storage time [33].

Although non-iced fish was of deteriorated quality, it is important to note that according to evaluation of cooked samples, non-iced treatment was of marginal quality and considered fit for human consumption. Similarly, microbial analysis for the treatment reported counts less than 10^6 log CFU g^{-1}set as a good indicator to end of shelf life [34] as afore discussed. This, therefore, indicates that fish were within human consumption limits at the time of evaluation. However, marginal quality reported in non–iced groups may restrict consumption of fresh fish within the fishing communities or nearby markets. This may hence, deny fish dealers in fresh fish value chain accessing well remunerating far and wider markets with acceptable quality fish especially in this era of increased consumer awareness. In general, the study depicted fish from Bamburi landing site to be of better quality than ones landed at Gazi site. The observation may be attributed to the time lapse prior to sample analysis due to long distance between Gazi and the laboratory where evaluations were carried out, resulting in further quality deterioration.

CONCLUSION

Sensory and microbial methods provided useful information about the freshness quality of *Lethrinids* and *Siganids* at landing time. The study revealed that fish landed by artisanal fishers, though of marginal quality was within recommended human consumption limits. The finding assures consumers of quality of fish at landing time as long as good hygiene practises are observed at subsequent stages to consumption. The onboard handling methods such as tossing fish on boat bottom, and use of gunny bags and woven mart baskets should be discouraged as they pose risk of accelerated microbial proliferation. Instead, boats should be equipped with fabricated cooler boxes made of locally available materials that are of food grade quality, to enhance the use of ice as a fish cooling medium in the fishery. A comprehensive shelf life study needs to be done to establish qualitatively and quantitatively the extent of delayed icing on fish quality in this fishery. Furthermore, studies need to be done to establish the effect of hygienic practices in fishery such as bleeding and gutting soon after capture have on quality in addition to icing.

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Table 1: QIM scheme developed for ungutted tropical *Lethrinidae* ('Changu')

Quality parameter		Description	Score
Skin	Colour/ appearance	Fresh bright	0
		Less bright	1
		Yellowish greenish, mainly near the abdomen	2
	Mucus	Clear, no clotting	0
		Milky, clotted	1
		Yellow and clotted	2
	Odour	Fresh sea weed	0
		Neutral, musty, grassy	1
		Ammonic, very sour	2
	Texture	In rigor	0
		Elastic/Finger mark disappears	1
		Very soft/Leaves mark over 3 sec.	2
Eyes	Pupils	Clear & back	0
		Opaque/ grey	1
		Dark grey	2
	Form	Convex	0
		Flat	1
		Sunken	2
Gills	Colour/ appearance	Red/ fresh blood	0
		Less coloured	1
		Grey-brown, brown,	2
	Mucus	Transparent/clear	0
		Milky, clotted	1
		Brown, clotted	2
	Odour	Fresh sea weed	0
		Metal, grassy	1
		Sour, mouldy	2
		Rotten/ammonic	3
Quality index (0-19)			

Table 2: QIM scheme developed for ungutted tropical *Siganidae* ('Tafi')

Quality parameter		Description	Score
Skin	Colour/ appearance	Fresh, bright metallic	0
		Dull metallic	1
		Dull yellowish near the abdomen	2
	Mucus	Clear, no clotting	0
		Milky, clotted	1
		Yellow and clotted	2
	Odour	Fresh sea weed	0
		Neutral, musty	1
		Hey, sour	2
		Rotten, ammonic	3
	Texture	In rigor	0
		Finger mark disappears	1
		Soft and Leaves mark	2
Eyes	Cornea	Clear	0
		Milky	1
		Clear & back	0
	Pupils	Opaque	1
		Grey	2
	Form	Convex	0
		Flat	1
		Sunken	2
Gills	Colour/ appearance	Bright light red	0
		Becoming discoloured/light brown	1
		Grey-brown, brown, grey, green	2
	Mucus	Transparent/clear	0
		Milky, clotted	1
		Brown, clotted	2
	Odour	Fresh seaweed	0
		Neutral/musty	1
		Sour, mouldy	2
		Rotten	3
Quality index (0-21)			

Table 3: Comparison of bacterial counts in iced (I) and non-iced (N) ungutted *Lethrinids* (A) and ungutted *Siganids* (B) landed at Bamburi and Gazi. TVC: total viable counts; and H_2S: hydrogen sulphide producers

A	**Bamburi**				**Gazi**			
Months	**TVC (N)**	**H_2S (N)**	**TVC (I)**	**H_2S (I)**	**TVC (N)**	**H_2S (N)**	**TVC (I)**	**H_2S (I)**
Apr.	1.2×10^3	3.0×10^2	2.5×10^2	2.0×10^1	4.2×10^3	8×10^2	7.2×10^2	3.2×10^1
May	9.8×10^2	1.5×10^2	2.1×10^2	1.0×10^1	2.0×10^3	1.5×10^2	6.6×10^2	1.7×10^1
June	6.5×10^2	6.0×10^1	1.9×10^2	1.0×10^1	8.2×10^2	1.5×10^2	1.9×10^2	1.0×10^1
July	9.0×10^2	1.2×10^2	2.4×10^2	1.0×10^1	1.1×10^3	1.2×10^2	2.2×10^2	2.2×10^1
Aug.	1.1×10^3	1.2×10^2	2.4×10^2	1.6×10^1	7.9×10^2	1.2×10^2	1.9×10^2	1.0×10^1
Sept.	1.1×10^3	1.5×10^2	1.9×10^2	1.0×10^1	1.0×10^3	2.0×10^2	2.2×10^2	2.0×10^1
Oct.	9.6×10^2	1.2×10^2	2.3×10^2	1.0×10^1	2.1×10^3	3.0×10^2	2.1×10^2	1.0×10^1
Nov.	$1.4.10^3$	1.9×10^2	2.3×10^2	1.0×10^1	3.2×10^3	4.8×10^2	3.2×10^2	1.0×10^1
Dec	1.1×10^3	1.5×10^2	2.4×10^2	1.0×10^1	2.5×10^3	4.0×10^2	3.0×10^2	1.6×10^1
Jan.	9.0×10^2	2.0×10^2	2.6×10^2	1.0×10^1	2.0×10^3	3.8×10^2	3.7×10^2	2.0×10^1
B								
Apr.	5.6×10^3	9.5×10^2	3.9×10^2	3.0×10^1	5.6×10^4	9.5×10^3	9.6×10^3	7.5×10^1
May	7.0×10^3	3.0×10^2	3.6×10^2	2.0×10^1	1.2×10^5	4.75×10^2	7.2×10^2	3.2×10^1
June	1.0×10^3	1.0×10^2	2.8×10^2	2.0×10^1	7.0×10^3	3.18×10^2	8.8×10^2	3.2×10^1
July	2.5×10^3	3.8×10^2	3.7×10^2	2.0×10^1	8.0×10^3	4.0×10^2	9.5×10^2	5.0×10^1
Aug.	4.2×10^3	3.8×10^2	2.8×10^2	2.0×10^1	1.0×10^4	5.0×10^2	9.9×10^2	4.0×10^1
Sept.	5.2×10^3	4.8×10^2	3.5×10^2	2.5×10^1	7.1×10^3	3.2×10^2	8.8×10^2	3.5×10^1
Oct.	6.6×10^3	6.2×10^2	3.8×10^2	2.2×10^1	1.3×10^5	5.9×10^2	9.5×10^2	4.6×10^1
Nov.	7.2×10^3	6.5×10^2	2.8×10^2	2×10^1	2.0×10^5	1.6×10^3	7.4×10^2	2.0×10^1
Dec	4.0×10^3	4.0×10^2	3.14×10^2	2.1×10^1	1.4×10^5	1.2×10^3	7.9×10^2	2.8×10^1
Jan.	2.5×10^3	4.9×10^2	3.52×10^2	2.5×10^1	9.8×10^3	1.0×10^3	1.0×10^3	4.0×10^1

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