Fishing and Fish Consumption in the Swahili Communities of East Africa, 700-1400 CE

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Summary

Historical and archaeological records of consumption practices indicate that people living along the Swahili coast relied largely on fish for subsistence; however, little research has been done to explore how aquatic subsistence strategies varied among different settlements in the region, both spatially and chronologically. Such questions are particularly interesting, as the communities were largely urban, and relied on fish for the bulk of their protein consumption.

We compared evidence of subsistence strategies and exploited fish habitats in two Swahili regions that represent different maritime landscapes. Because particular fish species generally inhabit different sections of the marine environment, the composition of these species at each site can be used to estimate the variable exploitation of these habitats. Overall, the analysed samples showed a heavy exploitation of fish found around coral reefs, but with varying proportions of other exploited habitats, such as estuary, mangrove, sandy/muddy, and outer reef zones. The general pattern indicates that samples from offshore islands have higher representations of fish from coral/rocky habitats while samples from near-shore islands show a lower reliance on coral species. Over time there is an increase at certain sites in the exploitation of oceanic and pelagic fish that coincides with the more frequent consumption of domesticated bovids. We discuss the historical and environmental implications of these variable patterns of aquatic subsistence strategies along the East African coastline, and propose that

there is a close link between their ability to exploit these marine resources, their success as urban settlements, and the development of feasting rituals.

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1. Introduction

The coastal fringe of the Indian Ocean along the East African continental shelf is a rich area of biodiversity. The large amounts of fish remains found at a majority of Swahili sites, dated between the 7th and 15th centuries CE, attest to the continued use of aquatic resources. Fishing along the east African coastline has been characterised as being largely inshore. Fishers in this area exploit a range of inshore habitats such as mangrove stands, mudflats, sea grass beds, and coral reefs. Although these habitats are interconnected, they are characterised by different sets of fish species that are exploited through unique strategies and tools. Several authors have linked identified fish remains from particular sites with the exploitation of various inshore habitats in that area (e.g. Mudida and Horton 1996; Fleisher 2003; Van Neer 2001). However, little work has been done to understand the connection between aquatic habitats, fishing strategies and exploited species across the region. This article explores aquatic subsistence strategies in relation to local environments and histories in a comparative regional context (Figure 1): a near-shore archipelago (Lamu archipelago, site of Shanga) and two large offshore islands (Zanzibar and Pemba, the sites of Unguja Ukuu, Fukuchani, Tumbatu, Ras Mkumbuu and Mtambwe Mkuu).

Figure 1: Map showing locations discussed in text

The Swahili coast of East Africa represents an exceptionally interesting area to study the relationship between maritime urban communities and the aquatic environment. The first archaeological evidence for coastal settlement dates to the very early first millennium CE, on Mafia and adjacent islands. These Early Iron Age sites contain substantial evidence for the exploitation of aquatic resources, including fish bones and shell-fish (Chami 2000; 2004; Crowther *et al*. 2012). Many more sites date from the 7th century onwards on both the coast and offshore islands; they are generally located on the shore or immediately behind. These form the basis of the subsequent Swahili urban culture, with extensive long-distance trade links with the Middle East, South and South-east Asia and China (Horton and Middleton 2001). The first evidence for Islam is late 8th century, and the adoption of stone and brick architecture dates to the 10th century; by this time larger sites with populations of several thousand existed among a number of much smaller village sites. Fish and shell-fish continue to be key components in the diet and enable these settlements to thrive in areas of relatively low agricultural potential. In this early period the key sites are Manda (Chittick 1984) and Shanga (Horton 1996) in the Lamu archipelago, Tumbe/Chwaka on Pemba (Fleisher and LaViolette 2013) and Fukuchani and Unguja Ukuu on Zanzibar (Juma 2004; Horton forthcoming).

The 11th century saw a major urban transformation, with many of the early sites being abandoned or severely disrupted, and new settlements developing nearby. At Shanga, this involved destruction of the older buildings and the burning down of the mosque. Unguja Ukuu and Tumbe were abandoned, and re-established at nearby Chwaka (LaViolette and Fleisher 2009) and Kizimkazi (Horton forthcoming; Kleppe 2001), while

new urban complexes developed at Ras Mkumbuu, Mtambwe Mkuu on Pemba, and Tumbatu Island (Horton forthcoming). These (and maybe over 400 others along the Swahili coast) developed a distinctive urban culture, with numerous stone houses, as well as mud houses, laid out in a tight landscape of houses and narrow streets; good examples of this from the 14th and early 15th century include Shanga (Horton 1996) and Songo Mnara (Wynne-Jones 2013; Fleisher and Wynne-Jones 2012), the subject of a major current research project. Fish remains an important element in these places, even though the populations are now substantial and widely distributed along the whole coast. The towns became successful trading ports, with many imports, and centres of craft and productive activity (especially iron working, cloth and bead making). The Portuguese arrival in 1498 left extensive descriptions but little lasting economic impact, and several of the port-cities survive as functioning entities into the 21st century, where fishing remains a very important element in the economy (Horton 2006).

2. Historical and Ethnographic Records of Fishing Methods

Classical, Arabic, Chinese and Portuguese accounts provide relatively rich descriptions of the East African coast, its inhabitants and their economic activities since the 1st century CE. Fishing, however, is rarely mentioned, as it must have been too mundane for special consideration. The mid-1st century *Periplus Maris Erythraei* usefully describes the canoes and fish traps that were commonly used: 'The [Menuthias, probably Pemba] island has sewn boats and dugout canoes that are used for fishing and catching turtles. The inhabitants of this island also have their own way of going after these with baskets, which they lower instead of nets around the mouths of [? rocky inlets]' (Casson 1989, 59–60). Interestingly, a type of fish trap known as *mgono* – a conical basket with a spring entrance placed in the channel between breakers – was still in use on Pemba in the 1920s (Ingrams 1924; 1931, 300).

Masudi, who visited the Swahili coast in 916 CE, recorded that 'there are many kinds of fish with all sorts of shapes' and describes using boats and harpoons to hunt for fish that apparently digest ambergris (Freeman-Grenville 1962, 14). Idrisi, in the mid-12th century, noted that at nearby

Malindi, the inhabitants 'obtain various kinds of fish from the sea, which they cure and sell (Freeman-Grenville 1962, 20). Ibn Battuta, who visited East Africa in 1332, left a detailed account of a meal he enjoyed in Mogadishu, which included a large dish of rice, and side-dishes of chicken, meat, fish and vegetable stew (Freeman-Grenville 1962, 29), suggesting that fish was often eaten as part of a mixed diet. In Mombasa he notes that the greater part of the local diet consists of bananas and fish (Freeman-Grenville 1962, 31), and that locals import their grain from the Swahili, by which is probably meant the trade of rice from Pemba. The Chinese record that horses at Molin (possibly Malindi) were fed dried fish (Filesi 1972, 19) in the 8th century. A 15th-century writer, Fei Xin, who was well-informed from the Chinese naval expeditions to East Africa recorded at Mogadishu, describes fishing with nets, and feeding dried fish to domestic stock (Filesi 1972, 36-40; Snow 1988, 26).

The only detailed ethnographic account of fishing practices recorded before the introduction of modern fishing methods was undertaken in the Bajun islands in southern Somalia during the late 1940s (Grotenelli 1955). The account includes several chapters on economic activities and techniques around the Kenya–Somalia border, and describes the principal fishing methods and the crafts for constructing fishing gear and vessels. These generally concur with the evidence from the Lamu archipelago, where Prins (1965) included a description of fishing methods in relation to the types of vessels and number of crew involved. In 1987, the Shanga project recorded how fish were caught and the fishing areas where they were found, along with the collection of fish species, which form the basis of the comparative collection in the National Museum of Kenya (Horton 1996, 382-3). This showed that fish were collected from a wide range of habitats – coral reefs, estuarine, mangrove swamps and offshore – using a variety of techniques – handlines, gillnets, cast nets, traps, spears, bottom trawls and occasionally longlines.

Figure 2: Photographs of the principal fishing gear recorded during 2009 and 2010 ethnographic fieldwork undertaken by Quintana Morales (2013a): a. *Uzio* trap, b. close up of local materials used for *uzio*, c. close up of fisher constructing *lema* trap, d. *Malema* fishing – collecting the catch from a large *lema* out at sea, e. *Mshipi* fisher catches a barracuda on an *ngalawa* boat, f. line and hook, g. *Nyavu* fishing – ring net hung out to dry, h. casting net by hand

Further south, there has been much less systematic recording of fishing techniques. W.H. Ingrams (1931), a colonial officer, was particularly interested in the shapes of fish traps on Zanzibar, types of sailing vessels and the rituals associated with fishing. Quintana Morales (2013a) undertook ethnographic fieldwork in the area around Vanga, during which she recorded the spatial distribution of fish consumption activities and the diversity of fishing methods (Figure 2). Other recent research has been related to debates about sustainable fishing on the coast. Glaesel (1997) divides traditional fishing gear into two categories: environmentally sustainable (hook and line, basket traps) and unsustainable (harpooning, fence traps, gleaning, poisoning), noting that sustainable methods have endured longer. Newer methods tend to be unsustainable (synthetic nets, spear guns). Studies of modern fishing methods include those on the coast of Kenya (e.g. Samoilys *et al*. 2011; McClanahan and Mangi 2004) and Tanzania (e.g. Darwall 1996). An important study is that of

Nakamura (2011), which divides the aquatic regions around Kilwa Island into 'ecological zones'. He associates these zones with distinct sets of resources and fishing strategies in order to understand the mechanisms of fishing practices connected to both social and ecological factors. We take a similar approach in our comparison of exploited aquatic habitats around past Swahili settlements.

3. Materials and Methods: Connecting exploited species, aquatic habitats, and fishing strategies

In the reconstruction of past aquatic adaptations along the east African coastline, fish remains are of particular importance as they represent the principal form of evidence of these practices. Very limited examples of fishing tools have been recovered from archaeological contexts in this region. Fish remains, on the other hand, are numerous and can be used to identify what species were exploited in the past. Furthermore, the connection between fish species and particular fishing strategies and exploited habitats allows us to reconstruct past fishing activities from archaeological fish remains samples.

Table 1: Summary of fish remains data included in comparative analysis. NISP=Number of identified specimens, NMK=National Museum of Kenya, Nairobi.

Location	Site	Excavation year	Size (ha)	Period	Sample size	Collection method	Reference collection	References
near-shore island (Lamu Archipelago)	Shanga	1983	5-15	8th to 15th c.	5999 NISP	5mm mesh	NMK	Mudida and Horton 1996; Horton and Mudida 1993
offshore island	Mtambw	1991	16	9th to 14th	43	5mm	NMK	Horton and Mudida

(Pemba)	e Mkuu			c.	NISP	mesh		forthcoming
	Ras Mkumbuu	1991	6	10th to 15th c.	25 NISP	5mm mesh	NMK	
offshore island (Zanzibar)	Fukuchani	1989	10	7th to 8th c.	19 NISP	5mm mesh	NMK	
	Tumbatu	1989–1990	20	12th to 14th c.	538 NISP	5mm mesh	NMK	
	Unguja Ukuu	1984	4	7th to 10th c.	380 NISP	5mm mesh	NMK	

We compared archaeological fish remains data from two Swahili regions that represent different maritime landscapes: a near-shore archipelago (Shanga) and large offshore islands (Zanzibar and Pemba sites) (Table 1). The Shanga faunal material is particularly exemplary because of the large size of the sample and its association with a long chronological timeline spanning the 8th to 15th centuries (Mudida and Horton 1996). The fish material analysed is from Trench 2, a deposit of domestic midden material; 6009 fish bones were identified to species or taxa of local marine fish (Mudida and Horton 1996, 380). Excavations on Pemba and Zanzibar islands produced five faunal assemblages yielding a total 1034 identified fish remains, summarised by Horton and Mudida (forthcoming). These samples provide comparative data of sites in this region for the 7th to 15th centuries: Fukuchani (7th–8th), Unguja (7th–10th) and Tumbatu (12th–14th) are found around Zanzibar Island while Ras Mkumbuu (10th–15th) and Mtambwe Mkuu (9th–14th) are found along the Pemba coastline. Both sets of faunal material were collected using 5mm mesh screens and analysed by Nina Mudida using the comparative osteological collection at National Museums of Kenya. Descriptions of the morphological features and criteria used to differentiate the represented fish taxa are available in the published sources of these data (for the

Shanga data, see appendix in Horton and Mudida 1993, 683-93 and footnotes in Mudida and Horton 1996; for the Pemba and Zanzibar data, see footnotes in Horton and Mudida forthcoming).

Site comparisons are possible because of the uniformity in the collection and identification methods among the fish remains assemblages. However, the sample sizes range from 19 identified specimens at Fukuchani to 5,999 identified specimens at Shanga. We acknowledge that the samples with less than 100 identified specimens (Fukuchani, Ras Mkumbuu, and Mtambwe Mkuu) should be interpreted with caution, since a small sample size limits how effectively it represents actual economic behaviours rather than taphonomic effects. Taken as preliminary studies, nonetheless, the patterns of habitat exploitation in these small offshore island samples are in line with those of the other offshore island samples that have more robust sample sizes (Tumbatu and Unguja Ukuu). Ongoing analyses of larger assemblages from Fukuchani and Unguja Ukuu (Prendergast and Quintana Morales in prep) can be compared to these patterns in the future.

Although there is overlap in the range of environments occupied by fish species, particular fish species generally inhabit certain sections of the marine environment, and the composition of these species at each site can be used to estimate the variable exploitation of aquatic habitats. Five aquatic habitats are used to represent the types of environments generally occupied by different types of fish along the East African coast: coral, estuary, sandy-muddy, outer reef, and various (a similar classification was used by Van Neer2001, and Nakamura 2011). The last category, various, includes fish species that inhabit several marine zones. These categories were chosen to represent typical coastal habitats along most of the East African coast, to be easily identified around coastal settlements through surveys and maps, to be relevant to local traditional fishing activities, and to be easily associated with populations of fish species according to the current fish ecology literature. Fish were classified into habitats using the most specific taxonomic category possible to account for the behavioural variability within each fish family. The analysis includes only the fish remains identified to species and genus, which make up 74–99% of the reported fragments from each site and represent 67 taxa overall (58 of which are unique species). The habitats associated with different species were identified using widely

used references on marine fish in the Western Indian Ocean (Fischer and Bianchi 1984; Froese and Pauly 2012). The summarised ecological information about each fish species in these references was used to determine its habitat category. Because the Shanga material represents a long sequence of phases, it was possible to analyse patterns of fish exploitation over time using the same analytical methods. Shifts in the representation of different aquatic habitats could be associated with a combination of social and environmental changes (Quintana Morales 2013b).

Table 2: Overview of the principal fishing gear used along the coasts of Kenya and Tanzania and their commonly exploited habitats and fish taxa. The table is based on data from Samoilys *et al*. 2011, with additional data from: 1) McClanahan and Mangi 2004; and 2) Darwall 1996, as well as Quintana Morales 2013a, and Mudida and Horton 1996.

Gear	Habitat	Target species	1	2
Malema/Madema (basket trap)	coral reefs and sea grass beds	*Siganus sutor, Leptoscarus vaigiensis, Lethrinus* spp.	*Leptoscarus vaigiensis, Scarus ghobban*	Scaridae, Acanthuridae, Lethrinidae, Lutjanidae, Siganidae, Balistidae
Uzio/zonga/utanga/rasaka/wando/tando (fence trap)	sheltered areas including sea grass beds, bays, small creeks, edges of mangroves and channels	*Sardinella* spp.		
Mshipi (handline/hook and line)	Rocky areas, coral reefs, reef edges/slopes, channels or offshore areas up to 40m depth	Lethrinidae, Lutjanidae, Serranidae, Carangidae, Scombridae	*Lethrinus xanthochilus, Lethrinus sanguineus*	Lethrinidae, Lutjanidae, Serranidae, Labridae Larger hooks: Carangidae, Scombridae, large Lutjanidae and Serranidae

Mshipi wa kurambaza (trolling)	offshore waters beyond reef	Scombridae,*Scomberomorus commerson, Scomberoides* spp. Sphyraenidae, Coryphaenidae, Istiophoridae		
Zulumati (longline)	near the surface in offshore waters	*Scomberomorus commerson*, Carcharhinidae, Scombridae, Xiphiidae, Istiophoridae		
Bunduki (speargun)	shallow waters near-shore, coral reefs	Scaridae, Lutjanidae, Serranidae, Siganidae		
Mkuki/njoro na shomo/mkondzo (spear and harpoon)	coral reefs and shallow near-shore waters	Myliobatiformes, Muraenidae	*Leptoscarus vaigiensis*	
Jarife-nyavu ya kutega (gill net – stationary)	reef lagoons and outer reef slopes, broad mangrove waterways	Carangidae,*Scomberomorus commerson*, Scombridae, Belonidae, Hemiramphridae, Lethrinidae, Siganidae, Myliobatiformes		Dasyatidae, Myliobatidae
Jarife-nyavu ya kuogelesha (gill net – drifting)	offshore open waters	Carcharhinidae, Scombridae,*Scomberomorus commerson*		
Nyavu ya mkano (monofilament gill net)	reef lagoons and outer reef slopes, broad mangrove waterways	Hemiramphidae, Mugillidae		
Nyavu ya kufunga (ring net)	offshore surface waters and outer reef	Carangidae, Scombridae, Sphyraenidae, Lutjanidae, Clupeidae, Engraulidae		

	slopes <20m, deep lagoons, inshore bays			
Kidima na kimia (prawn seine and cast net)	bays and sea grass beds, channels, estuaries, mangroves	Clupeidae, Engraulidae, Gerreidae		
Juya/nyavu ya kukokota (beach seine/reef seine net)	sea grass, reef lagoons, offshore reefs	*Leptoscarus* spp. Siganus spp. *Lethrinus* spp. Atherinidae, Hemiramphidae		Scaridae, Mullidae, Lethrindae, Siganidae, Nemipteridae
Kimia (scoop net/hand net)	shallow surface waters and rocky reefs	Mugilidae, Clupeidae		
Uduvi/tandilo (mosquito net)	shallow waters	Clupeidae, Engraulidae, and juvenile Labridae, Lethrinidae, Lutjanidae		

Various factors determine the catch composition of fish species, including the exploited habitat, season, fishing method and fishers' skill. To explore past exploitation strategies, we compared the dominant species in each habitat to the target species associated with artisanal fishing practices in this region. An aspect of fishing that is not often reported in the ethnographic and historical sources, the link between fishing strategies and fish catch is often studied by fisheries officers and marine biologists in order to manage and conserve coastal resources. We summarised three examples of these studies along with information we collected in the field in order to provide an overview of the common artisanal fishing gear used in this region and their target species (Table 2). We used this information to infer past fishing strategies from the composition of species in the sample assemblages, which allows us to explore the use of different fishing strategies within each habitat category.

4. Results: Comparative study of Shanga and the Zanzibar/Pemba sites

Overall, the analysed samples show a heavier reliance on fish found around coral reefs than other habitats; however, the proportions of exploited habitats vary among samples (Figure 3). Fish that are observed to inhabit various inshore habitats occur in high numbers (56% of total). This category is largely composed of emperor fish (*Lethrinus* spp., 55%), a diverse genus in this region that is also a very commonly exploited fish. It includes species from a range of inshore habitats, but without more detailed identification, the genus can only be classified in the 'various' category. It was included in the analysis because it represents a significant proportion of the exploited fish (32% of the total sample). The majority of fish taxa that can be associated with a particular habitat are found in or around coral and rocky substrates (24% of total). The proportion of these fish is greater in the samples from the offshore islands (40–84%) but much smaller in the sample from Shanga (17%). At Shanga, fish found in estuarine habitats are more common (21%) than at the other sites, although this habitat is also represented in some of the off-shore island samples: Ras Mkumbuu (12%), Unguja Ukuu (8%), and Tumbatu (2%). Fish from the outer reef and sandy-muddy floors are also present in some of the samples in smaller numbers. In particular, open sea species are only present in the samples with material from the second millennium.

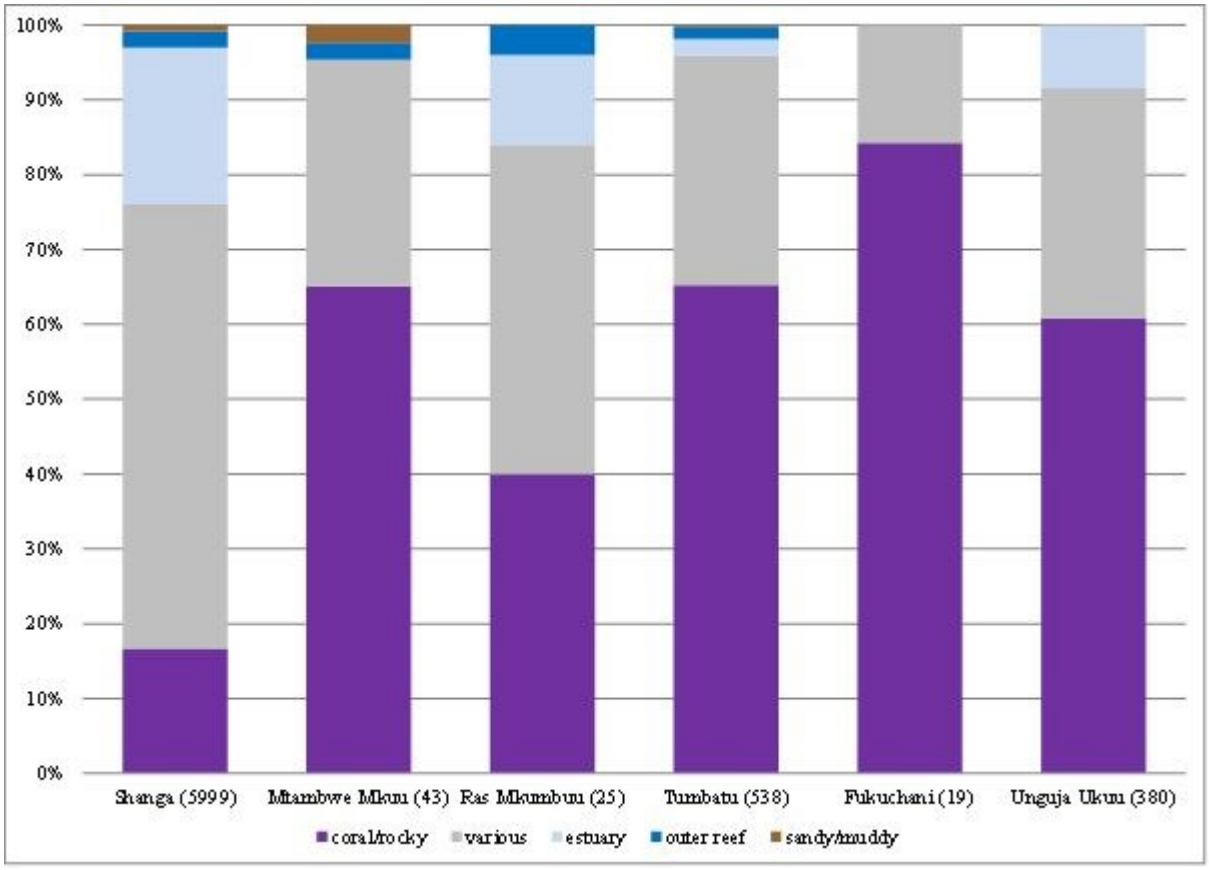

Figure 3: Relative percentage of habitats represented in each sample. The total NISP is in parentheses after each settlement name

The composition of fish taxa within the habitat categories reveals other differences in the exploitation of marine habitats. Common coral species vary across the samples: trevally (*Caranx* spp., 21%) is the most numerous coral-associated taxa at Mtambwe Mkuu; while parrotfish (*Scarus* spp.) dominate the coral category in the Shanga (36%), Unguja Ukuu (33%), and Fukuchani (38%) samples. Fishers use different fishing gear to exploit these fish species, particularly between parrotfish and trevallies: parrotfish are often caught in basket traps and seine nets while trevallies are caught with hand lines, stationary gill nets, and ring nets. The strategies fishers use to exploit emperor fish include hand lines, basket traps, and seine nets. Estuary fish at Shanga are mostly marbled parrotfish (*Leptoscarus vaigiensis*, 71%), a species found in sheltered bays, harbours, and lagoons that feeds on seagrasses and algae (Froese and Pauly 2012). The marbled parrotfish, which is a species only identified in the Shanga sample, is particularly associated with basket trap and spear fishing in the Lamu study. The large proportions of parrotfish species in the Shanga sample in both estuary and coral habitats suggest

that trap fishing was a particularly important fishing strategy in that region. Offshore island samples, all of which tend to have higher proportions of coralline fish, also show different patterns in exploitations strategies. At Mtambwe Mkuu, for example, the high percentage of trevally sets it apart from the other offshore samples. These differences could represent variability in the natural distribution of fish along the coastline, the use of different fishing technologies or a combination of both.

It was possible to compare the changing exploitation of habitats over time at Shanga because the data cover a longer period divided into a series of phases. Although the high proportion of *Lethrinus* spp. in this sample was classified in the 'various' category, it is clear that estuary and coral habitats were important fishing areas over time and that there is a significant increase in open sea/outer reef fish in the second millennium AD (Figure 4). The majority of fish in this category are grey sharks (*Carcharhinus* spp.) plus one occurrence of longfin mako (*Isurus paucus*), identified from a tooth (Horton and Mudida 1993, 692). Longfin mako is an oceanic shark species with an average size of 200cm in total length that approaches land to give birth; grey sharks are the most common type of shark found in this region and includes shark species that are known to venture closer to shore to feed (Froese and Pauly 2012; Fischer and Bianchi 1984). It is possible that these open-sea species were caught near the shoreline; however, they are associated with a different set of fishing strategies than most inshore fish: long lines and drifting gillnets that are used in offshore waters (Table 2).

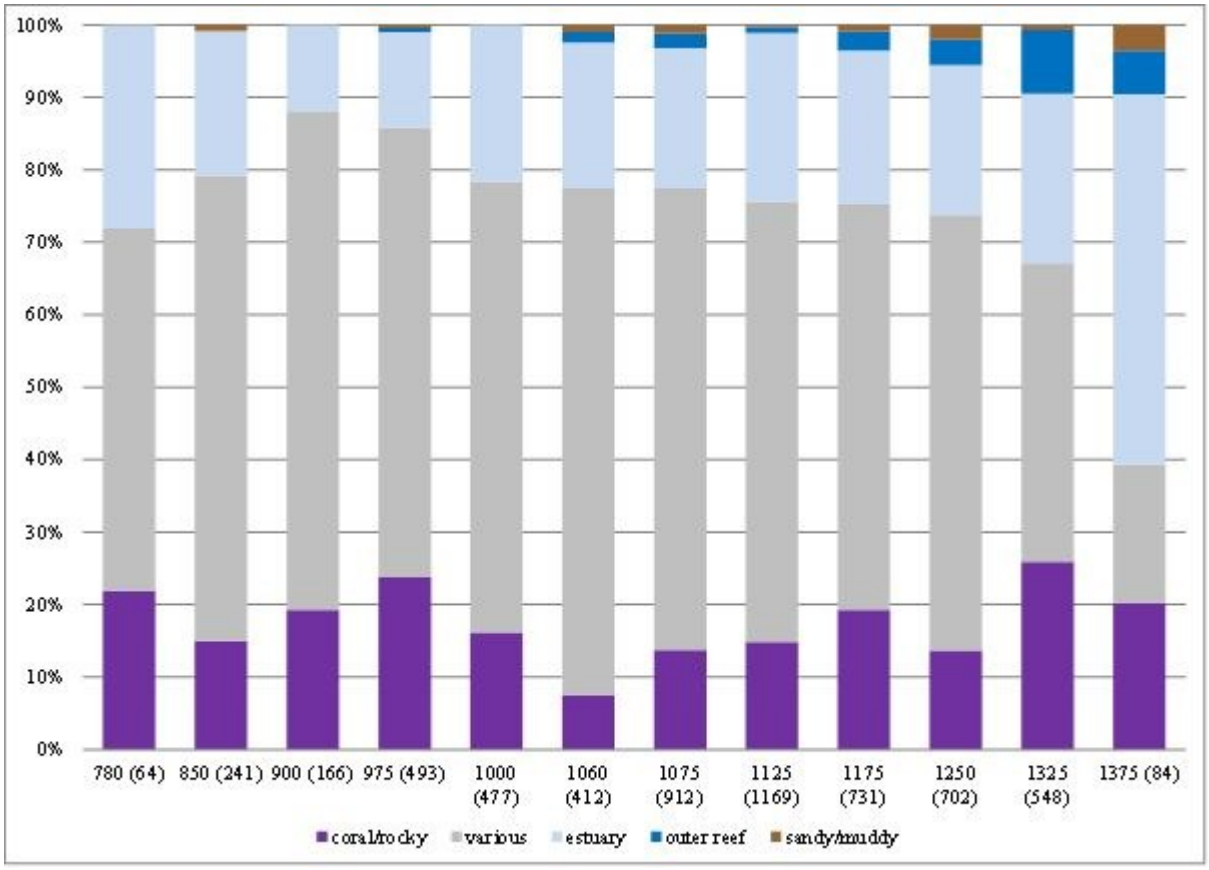

Figure 4: Relative percentages of habitats exploited across time in the Shanga sample. The total NISP is in parentheses after the approximate mid-point date of each period, set out in approximate calendar dates CE.

5. Discussion

The inter-regional comparison shows that similar habitats are exploited along the Swahili coast, although to different degrees. The general pattern indicates that samples from offshore islands have higher representations of fish from coral/rocky habitats. Shanga shows a heavier reliance on fish from estuary habitats than on coral species. This is not surprising given that these offshore islands are surrounded by extensive coral reefs, whereas Shanga lies on an island within an estuarine bay. Furthermore, the taxa exploited from these habitats overlap but are not the same in all samples, possibly as a result of different fishing strategies. The identification of fish taxa to genus or species level, whenever possible, is essential to understanding the dynamic interaction between fishers and the aquatic habitats they exploit. The results of the habitat

analysis reveal the complexity and variability of past aquatic subsistence strategies along the Swahili coastline and offer a framework for understanding the interrelated role of cultural and environmental effects on aquatic adaptations.

Our analysis of changing habitat use throughout the phases at Shanga indicates that open sea species were exploited only in the second millennium. Similarly, Horton and Mudida (1993, 679) deduced that offshore fishing developed at Shanga after the 12th century. This trend is visible in samples that were included in a regional analysis: all the sites with offshore taxa – Shanga, Chwaka, Mduuni, Mtambwe Mkuu, Ras Mkumbuu, Tumbatu, and Songo Mnara – have evidence of occupation beyond the 12th century (Quintana Morales 2013a). Furthermore, samples dated to before the 12th century, Fukuchani and Unguja Ukuu, do not include offshore species. However, not all samples dated after the 12th century have open-sea fish species (i.e. Vumba Kuu, Kaliwa, and Kizimkazi). The later settlements without offshore fishing have smaller numbers of domesticated animal remains than those with offshore specimens (Quintana Morales 2013a). Furthermore, in two samples that were compared chronologically (Shanga and Chwaka), the number of domesticates increases at the same time that offshore fishing becomes more prevalent on the coast (Quintana Morales 2013a; 2013b).

One possible explanation is that there is a link between having the capital/position needed to manage or obtain livestock and having the ability to invest in more expensive equipment to engage in offshore fishing. Historical accounts describe the use of livestock as important ritual food used in feasting (e.g. Hollis 1900) and as gifts to visitors (e.g. Freeman-Grenville 1962, 57), showing that these were not just markers of high status but cultural tools through which status was created and reinforced (Fleisher 2010). Ethnographic and ethno-archaeological research on the coast indicates that higher socioeconomic classes have more access to domesticated animals and invest in the larger boats required for offshore fishing (Quintana Morales 2013a; Nakamura 2011). Thus, the conditions associated with high consumption of domesticated animals (people with higher prestige and socioeconomic power) also favour the investment in offshore fishing. The faunal sample from Vumba Kuu presents an interesting case because it has a high number of cattle remains (>50% of identified mammal remains) and no evidence of

offshore fishing (Quintana Morales 2013a). However, excavations at Vumba Kuu have yielded relatively small quantities of imported ceramics and there is little evidence of coral-stone architecture (Wynne-Jones 2010). These material characteristics are often associated with high levels of socio-economic status. Thus, the link between evidence of high socio-economic power and offshore fishing holds.

A growing coastal population may have provided an alternative or additional pressure to expand the range of exploited aquatic habitats by going farther from the shoreline and targeting larger-bodied fish. At Shanga, for example, the size of the settlement grew from 5 to 15 ha during its occupation (Horton 1996), which indicates a growing population. While both an increasing population and a developing socio-economic hierarchy provide plausible explanations, the timing of these shifting subsistence strategies around the beginning of the second millennium could be associated with a wider set of changes evident across the region, including changes in the location and structure of settlements and technological and architectural developments, that point to an increasingly maritime outlook (Fleisher *et al*. forthcoming).

6. Conclusion

Fish were consumed as part of a varied diet that included meat (both hunted and domesticated) as well as shell-fish, with sorghum, millet and rice providing the carbohydrates. The fish element, as with other food, is closely linked to both natural and cultural processes; for example, fishers make decisions about how and when to fish by considering environmental factors (e.g. monsoon currents, tides, and fish habitats) as well as cultural factors (e.g. age, skill, and socioeconomic status, perceived status of fish). Because the archaeological record of fish remains is a result of the effects of these factors, ichthyo-archaeological analysis allows us to reconstruct both social and environmental aspects of life on the Swahili coast. A systematic analysis of exploited fish habitats at various Swahili settlements shows the variability of fishing practices along the coast. Five main habitats are found along the Swahili coastline although in different proportions around each settlement: coral, estuary, sandy-muddy, mangrove, and open sea. Overall, the exploitation of

marine habitats reflects the proximity of these habitats to the settlements. For example, around offshore islands, where coral reefs are more abundant and accessible, fishers exploited more coral species. However, the types of exploited fish taxa within habitat groups varied among settlements; this could reflect a combination of variability in fish taxonomic distributions and the use of different fishing strategies or tools to exploit similar environments. Furthermore, open-sea fishing occurred in the second millennium CE only in settlements with more capital, attested by higher numbers of coral-stone architecture, imported ceramics, and higher proportions of domesticated animal meat. This regional analysis demonstrates that although Swahili settlements shared a reliance on marine resources, variability in fishing practices resulted from a combination of their particular cultural and environmental contexts.

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