

**SPACES Working Paper Series**

**No: 008 / November 2017**

**Artisanal fisheries in Cabo  
Delgado, Mozambique: rural vs  
urban fishing centers**

August 2016

By: Vera Julien, Fraser Januchowski-Hartley & Isabel da Silva



*This working paper results from the project 'Sustainable Poverty Alleviation from Coastal Ecosystem Services (SPACES) NE-K010484-1' funded with support from the Ecosystem Services for Poverty Alleviation (ESPA) programme. The ESPA programme is funded by the Department for International Development (DFID), the Economic and Social Research Council (ESRC) and the Natural Environment Research Council (NERC).*

[Type here]

**Abstract:** As part of the Sustainable Poverty Alleviation from Coastal Ecosystem Services (SPACES project, we investigated the relationship between gear, catch and income generated by the fishers in different seasons. We collected data using fish catch surveys at landing sites in Pemba town, Vamizi and Lalane. A standard questionnaire was used to collect the effort and location of the fishery. The fishery shows a wide range in both gears and profitability, and our surveys in conjunction with ecological surveys conducted by other SPACES team members revealed higher CPUE values in Vamizi and Lalane when compared to Pemba, associated with higher fish diversity and fish biomass at Vamizi and Lalane when compared to Pemba. This suggests that the near shore coral reef environment in Pemba is overexploited.

Keywords: *Fisheries, coral reef environment, CPUE, landing sites, Pemba town, Vamizi, Lalane.*

**To cite this working paper:**

Julien, V., Januchowshi-Hartley, F., and da Silva, I. 2017, 'Artisanal fisheries in Cabo Delgado, Mozambique: rural vs. urban fishing centers', SPACES Working Papers, no. 6. Available from: [www.espa-spaces.org](http://www.espa-spaces.org). (date accessed).

Vera Julien, Fraser Januchowski-Hartley & Isabel da Silva

## **1. Introduction**

Artisanal fisheries are a key subsistence activity of coastal populations of East Africa, with significant numbers of local communities dependent on artisanal fisheries for food and income.

We carried out this study in the coral coast region of northern Mozambique (Cabo Delgado). Northern Mozambique is a rapidly changing region recently boosted by the oil and gas industry and tourism. Therefore, setting a baseline for evaluation of the subsistence fishery, its sustainability and relationship with transformations in Pemba town is important to understand how these economic developments may impact people currently dependent on the coastal ecosystem. To emphasize the higher exploitation levels in Pemba, we compare Pemba's fisheries with data collected in two rural areas (Vamizi and Lalane).

This study also informs the Sustainable Poverty Alleviation from Coastal Ecosystem Services (SPACES Project, [www.espa-spaces.org](http://www.espa-spaces.org)). We investigated the fisheries roles on the

[Type here]

wellbeing of the coastal communities in order to: (1) Inform the SPACES fisheries modeling program; (2) Provide baseline information on the northern Mozambique coral reef associated fisheries.

## 2. Methods

### 2.1. Study Area

Data was collected through fish catch surveys at five landing sites in one semi-urban area: Pemba town (Paquitequete, Ruela, Marinha, Inos and Maringanha) and two rural areas: Lalane and Vamizi (Northern Mozambique) (Fig.1).

The total fishing ground area of Pemba was estimated to be approximately 25 km<sup>2</sup>. Of these, Maringanha, Ruela and Inos (which were the ones along the coast facing North) are estimated to be 16,5 km<sup>2</sup>, Marinha around 2 km<sup>2</sup> and Paquitequete around 7 km<sup>2</sup>. This was estimated from the crest of the reef outward to the approximately 30 m depth contour. Vamizi and Lalane's total fishing grounds were estimated to be around 22 and 32 km<sup>2</sup> respectively.

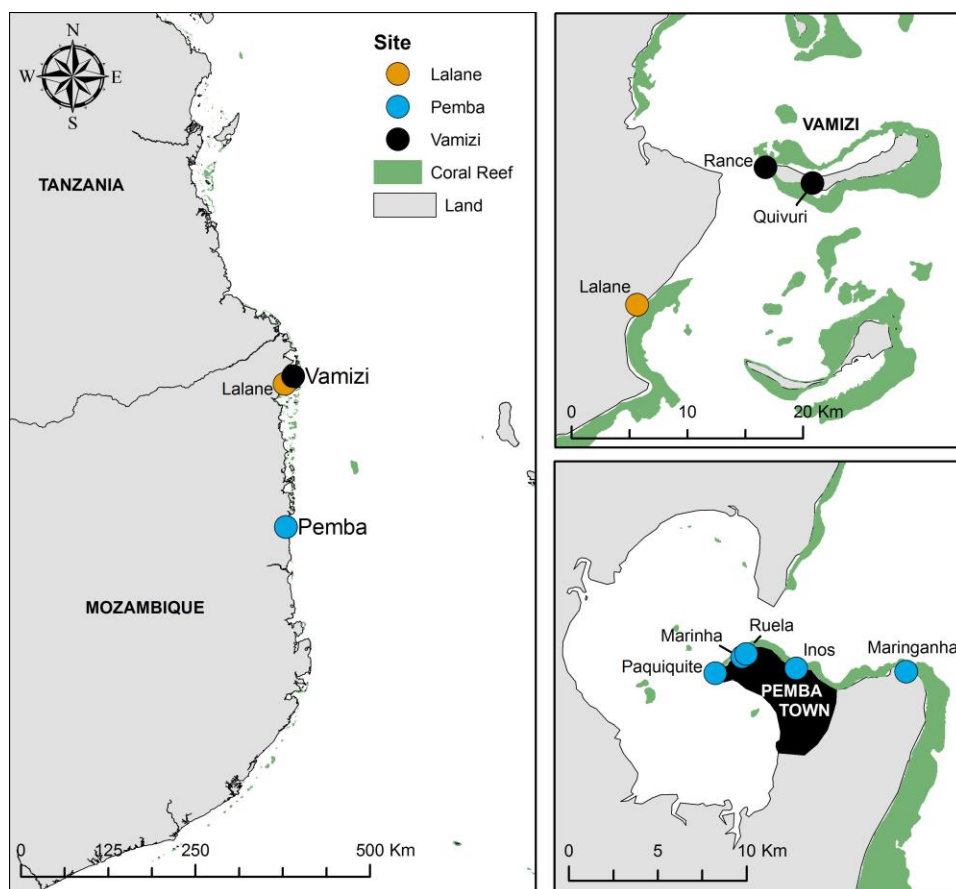


Fig. 1 - Location of the study area, Pemba, Northern Mozambique. Reef extent was taken from the UNEP-WCMC Millenium Coral Reef Mapping Project.

[Type here]

## 2.2. Data collection procedure

### ***Fish catch surveys: Pemba town***

Data were collected through fish catch surveys at five landing sites in Pemba town in two campaigns of two weeks during the dry season (15 days from October to November 2014, and 15 days in January 2015).

A standard questionnaire was conducted to the fishermen at the landing sites to collect data on: (1) fishing location and characterization, (2) gears used and fishing duration (effort), (3) total catch and price, and (4) biological data (fish species, number of fishes, fish length and weight) (Fig. 2).

Because fishermen went fishing at dawn and returned from their fishing activities during the morning (particularly on the flood tide), sampling took time from 6-7 a.m. to about 1 p.m. (about 6 hours/day).

Besides the fish catch surveys, we also conducted a survey on shellfish and crab harvesting. This survey aimed to collect data on: (1) harvesting location and methods; (2) biological data (species composition, number of individuals, weight and length/width) and (3) price (Fig. 3). Sampling took time during the mornings at low tide. However, this report only presented the fish catch surveys results.

To estimate income from fishing, we collected the price the fisher expected to receive for each species. If the fisherman did not plan to sell the fish and/or used it for personal consumption, we considered price as "0".

[Type here]

### 1. Boat details

Fishing centre:	CCP Name:	Weather conditions of the day
Boat registration:  Boat type:  No boat, dugout, canoe,	Arriving time at  Fishing centre:	Sampler:
Skipper/ Fish Master name:	Departure time at  Fishing centre:	

### 2. Effort

Date of fishing	Fishing duration		Number of fishers	Fishing gear	No of gears (hooks, spears, nets & mesh size)	Lenght of the gear
	Start time	End time				

### 3. Fishing location

Fish zone	Depth	Type of substrate (mud, sand, rubble, gravel, reef, seaweed, seagrass)
-----------	-------	--

### 4. Biological data

N <sup>0</sup>	Fish Species	Total lenght (mm)	Number of fishes	Weigth of the species	Price of the catch
----------------	--------------	-------------------	------------------	-----------------------	--------------------

**Fig. 2 - Sampling survey for Artisanal fisheries in Pemba**

[Type here]

Date	Locality	Surveyor
Name of collector	CCP	GPS coordinates
Sex	Age: adult/young/child	

Harvesting method:	cultivation	Hand picking	Hole digging
gleaning	Harpoon/ spear	net	

**Species composition**

Type (Fish, shell fish, crabs, shrimp)	Species	Number of individuals	Weight	Lenghts/ Widths (separate by commas or slash)	Price
--	---------	-----------------------	--------	---	-------

**Fig. 3 - Sampling survey for Shell fish and crabs harvestings**

***Fish catch surveys: Vamizi and Lalane***

In the rural sites, data was collected at three landing sites: Rance, Quivuri (Vamizi's landing sites) and Lalane. Fishery catch surveys at Vamizi were part of an ongoing fishery survey and cover the period November 2011 – May 2013, with surveys conducted for 4-5 days each month. Lalane data was collected between March and August 2014 using a similar sampling design.

The methodology used in these three sites was the one used by the Mozambican Fisheries Research Institute (IIP-Instituto de Investigação das Pescas). This methodology samples fishers 3 days of a random week during a month, and collects data using three forms that are in use at all the fishing centers sampled by the Mozambique government. They consist of “general data” form A: with the meteorological conditions, tides, amount of fishermen and fishing gear in the village (actives and not). The second form is about the “fishing unit” form B, and consists of : name of the fishing unit, gear type, numbers of fishermen, amount of hour fished, amount of fish (Kg) caught and species. The last form, “fish sizes” form C, consist of: measures of fishes from a random sample taken from the catch of one or several fishing units previous sample on form B.

### ***Reef fish biomass and diversity***

The biodiversity and biomass of coral reef associated fishes were surveyed by Tim McClanahan of the Wildlife Conservation Society at five sites in Pemba between Inos and Maringanha, and at 10 sites at Vamizi in both the fished area and inside an unfished protected area. Both diversity and biomass surveys were conducted along 100m x 5m belt transects. For the diversity surveys, a discrete group sampling (DGS) method was used where the observer swam twice along the transect, counting and identifying to species level all non-cryptic reef fishes, surveying larger and more mobile fish families on the first swim, and smaller and more sedentary on the second. Biomass surveys were conducted along the same transects, with the observer identifying fishes to family level and estimating their size in 10 cm bins (e.g., 0-10cm, 10-20cm, 20-30cm, 30-40cm etc.). We obtained family level length-weight ratios from Fishbase (Froese & Pauly 2014), and calculated the weight of a fish at the midpoint of each bin, and multiplied it by the total number of fish of that family in order to obtain biomass of fishes for each 500m<sup>2</sup> transect, which was then converted to biomass in kg/hectare.

## **3. Results**

### **3.1. Landing sites description**

#### ***Pemba***

Of five landing sites surveyed, Paquitequete and Ruela were the most important, in terms of number of landings. This is verified because Paquitequete neighborhood (which includes Paquitequete and Ruela landing sites) is the oldest neighborhood of Pemba and since the earliest times, it is essentially inhabited by fishermen. Additionally, at both Paquitequete and Ruela landing sites there were fish markets. Besides the fishermen and buyers, the "macarangas" (woman that cooked and sold their products to the fishermen and buyers) were also present at these markets.

Marinha landing site is located right next to Ruela and about 2,5 km ahead is Inos. At both of these landing sites there was no fish market, however, there were a few buyers in a small "tend" (*barraca*) near the main road, selling the fish products from those landing sites. These two sites were less crowded compared to Paquitequete and Ruela.

Maringanha was the most distant landing site. Maringanha is a large neighborhood and also inhabited by a large number of fishermen. However, since 2014 and early 2015, most of the

[Type here]

fishermen changed their activities from fishing and began working for construction companies, due to the infrastructure boom in Pemba. Fishermen practiced fishing activities only on days off on the construction companies.

Besides being landing sites, Marinha, Inos and Maringanha were also important gleaning sites, where especially woman and children capture invertebrate essentially for family consumption.

### ***Vamizi island***

Vamizi island is a very remote island where the population lives almost exclusively on the fishing. The island has a lodge in the east point of the island where no population leaves. In 2006, the community through the fishing council decided to close this part of the island to fishing and initiated the Vamizi community sanctuary. The island has two landing sites: Quivuri and Rance. Quivuri, the one nearest the reserve in the south side of the island, with very high number of migrant fishermen from out of province, with short visits. Rance, situated in the west point of the island, also has high numbers of migrant fishermen, but with a mix of local migrant from the mainland just across the island, and out of province migrants. All kinds of gears are used but mosquito net, that is forbidden by law and trawling that is almost impossible to do due to the high cover of coral reefs around the island are almost nonexistent. Most of the fish is dry and sold to Tanzanians and others, but migrants fishermen from Nacala with bigger boats just return to their province with their fish dried.

### ***Lalane***

In great contrast with Vamizi island, but also the surrounding villages in mainland, Lalane don't have migrant fishermen due to a strong village chief that don't allowed them around. Lalane is also has an extensive sand intertidal flats that make difficult arriving and living the village. In contrast with Vamizi where coral reefs are the main habitat near the fishing landings, Lalane nearest and more abundant habitat is sea grass. Fish is also sold dry to dealers that sell to the interior of the province or take it to Tanzania.



[Type here]

### 3.2. Observed trips

A total of 1822 fishing trips were surveyed: 229 from Pemba, 228 from Lalane and 1395 from Vamizi.

**Table 1. Number of observed trips at each landing site (Pemba)**

Landing site	Nr. of observed trips
Paquitequete	66
Ruela	55
Marinha	78
Inos	10
Maringanha	20
<b><i>Pemba (Total)</i></b>	<b><i>229</i></b>
Quivuri	691
Rance	704
<b><i>Vamizi (Total)</i></b>	<b><i>1395</i></b>
<b><i>Lalane (Total)</i></b>	<b><i>228</i></b>
Total	1 852

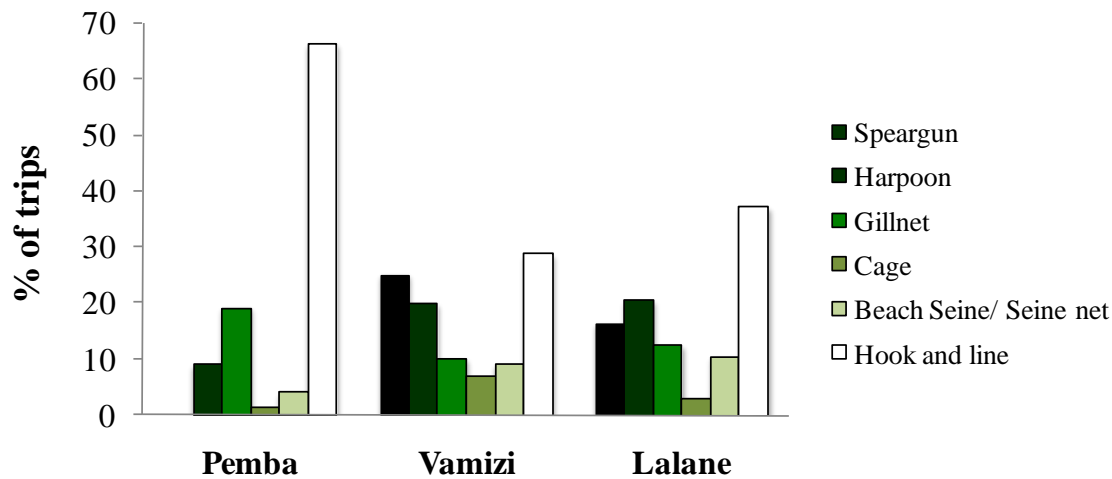
In Pemba, the most commonly used boats were canoes, but some motor boats were used as well. Canoes landed every day in each landing site, with motor vessels usually landing in Ruela and in some cases in Paquitequete.

Once the fishing boats arrived at the landing sites, they were met by the buyers who quickly negotiated the price and took the fish. Usually there was a "competition" between buyers and in some cases they did not wait at the beach for the boat to dock, and would travel out to meet incoming boats to negotiate the price of the catch and take the fish before it arrives the beach.

### 3.3. Gears used

Seven gears were used by the fishermen in the three study sites: spear-gun, hand-spear (harpoon), gillnet, cage, beach seine, seine net and . Among these, hook and line was the most commonly used gear (Fig. 3).

[Type here]



**Fig. 4 - Fishing gears used by the Pemba, Vamizi and Lalane's fishermen.**

It is likely that deeper fishing zones and rocky bottoms present in Pemba favors the use of hook and line, rather than nets. Additionally, it is also likely that Pemba fisheries had moved off the shallow reef because it has been over-fished. In contrast, Vamizi and Lalane seem to have a more even use of the different fishing gears. This could be related to heterogeneity in the substratum present at these sites, especially in Vamizi, and histories of lower exploitation pressure. Harpoon was the most important gear in Vamizi because of the large coral reef area present there. Lalane is characterized by having large sandy and seagrass covered platforms, which may favor the use of and harpoons.

The gears commonly used by the canoes were hook and line and gillnet. The motor boats only used seine nets.

### 3.4. Fish Diversity

In terms of fish diversity, Vamizi has the most diverse fishery (over 330 species), compared to Pemba with about 250 fish species and Lalane with 75 fish species (Fig.4).

[Type here]

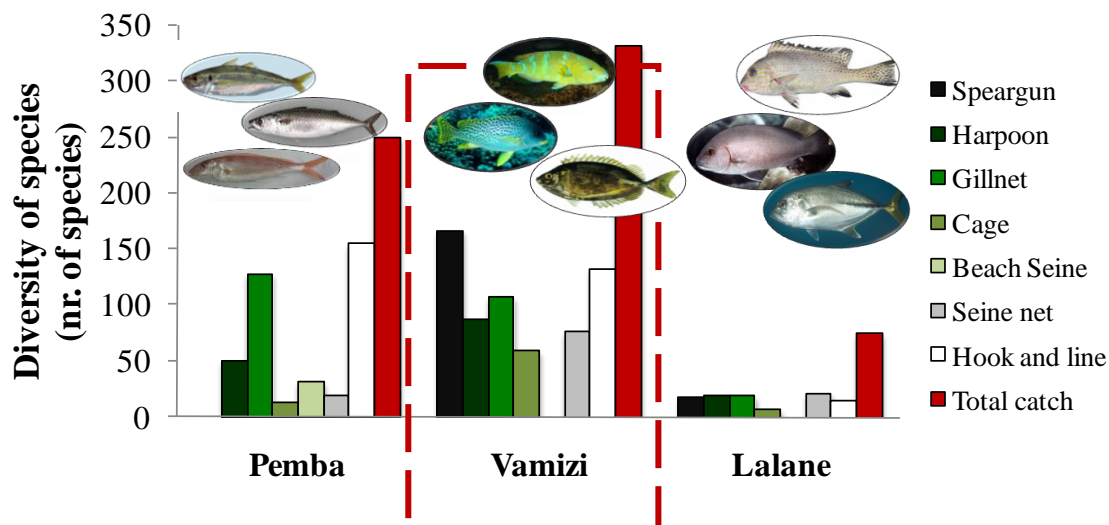


Fig. 5 - Fish diversity (number of species) caught per fish gear

Most of the fishes caught in Pemba were pelagic. Lalane had more reef and sand associated species and in Vamizi more coral reef associated species were caught. The types of species are related to the water depth and types of habitat (fish list - Appendix).

### 3.5. Fish Biomass on Reefs

Figure 6 compares the biomass of three commonly caught groups of reef fishes between Pemba and Vamizi (fished areas and no-take reserve areas).

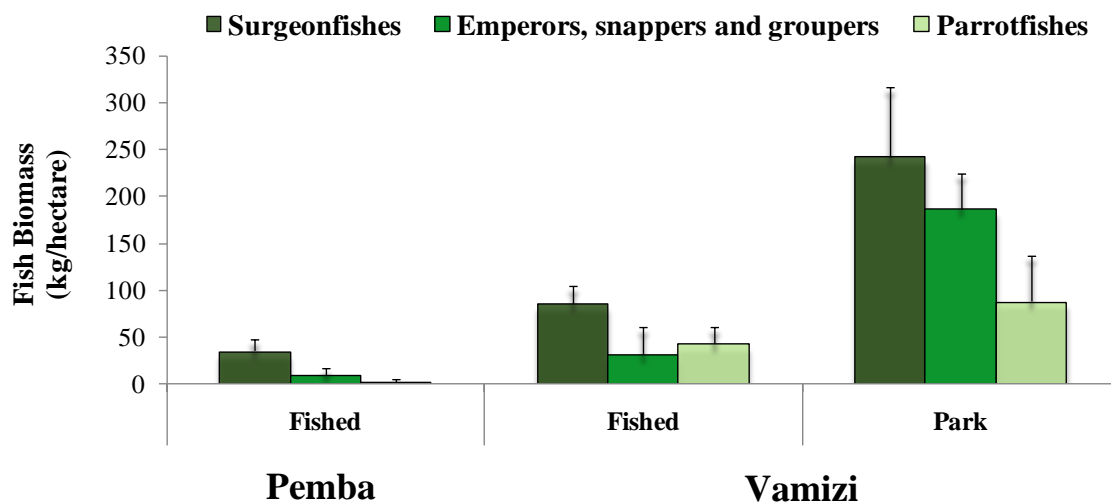


Fig. 6 - Fish Biomass as measured by underwater visual census on reefs in the vicinity of Pemba and Vamizi

[Type here]

Fish biomass is clearly higher in Vamizi. Even in the fished areas of Vamizi we found higher values of fish biomass compared to Pemba. The abundance of reef fishes reflects the level of exploitation in both areas. This suggests that the nearshore coral reef environment in Pemba is overexploited. Vamizi is recognized as one of the healthiest coral reef areas on the eastern Africa coast, it is a rural and lightly exploited area where community management of marine resources is active.

### 3.6. Catch per unit effort (CPUE)

Figure 7 compares CPUE (kg/fisher/day) in Pemba, Vamizi and Lalane. For practical reasons we removed the data from beach seine for this analysis (due to the small number of beach seines in the data).

In general, Pemba's CPUE was lower than Vamizi and Lalane. Highest CPUE in Vamizi came from seine net, while in Lalane's from cage and speargun.

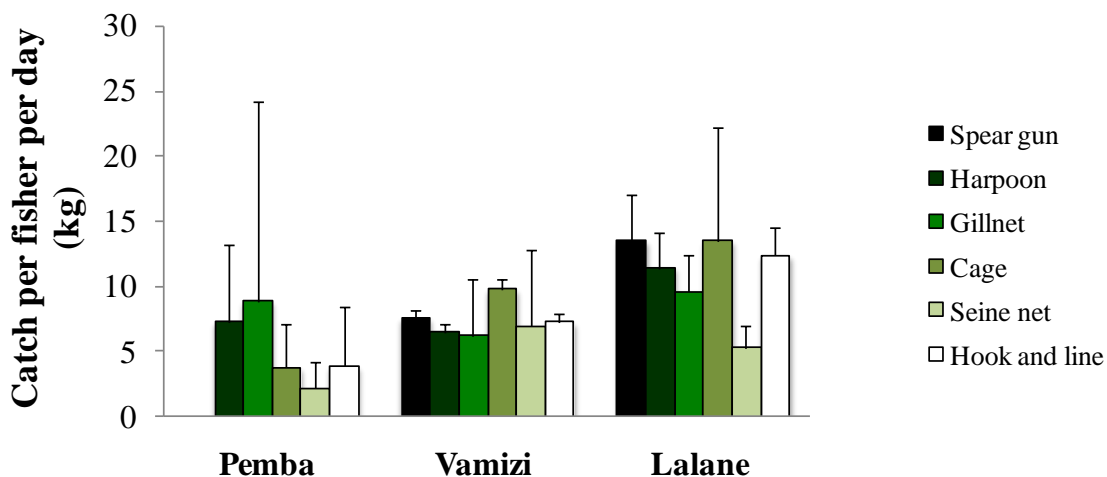


Fig. 7 - Catch per fisher per day in Pemba, Vamizi and Lalane

The higher CPUE indicate that there is higher gear efficiency in Vamizi and Lalane, which reinforce the idea that the fisheries in Pemba are over-exploited.

Even though harpoon and cage are not very heavily used in Pemba (see Figure 4), they have the second and third highest CPUEs. This relatively high efficiency could make them an alternative if the highly unselective gillnet were removed from the fishery.

The high variation in gillnet and seine CPUE in Pemba and Vamizi respectively, potentially indicates the infrequent catch of large schools of fishes.

#### **4. Conclusion and Recommendations**

Seven gears were used by the fishermen across the study sites. Hook and line was the most widely used gear in Pemba, while harpoon and line were the most used in Vamizi and Lalane respectively.

Vamizi and Lalane have higher CPUE values compared to Pemba. Fish diversity and fish biomass was also higher in Vamizi and Lalane when compared to Pemba. This suggests that the near shore coral reef environment in Pemba is overexploited. For maximum multispecies sustainable yield it is suggested that a fish biomass of  $> 300\text{kg/ha}$  is required (McClanahan *et al.*, 2011). In Pemba the average biomass is  $\sim 200\text{kg/ha}$ . The increased effort on the coral reefs of Pemba may lead to declining returns in both catch and income.

## **5. Study Limitations**

One of the main limitations of the study was the period of data collection in Pemba, which was limited. 30 days of data collection (15 in each field trip), may not reflect a significant sample. In addition to that, data were collected only in the dry season. Therefore, the results presented only reflect the fishing activities in the dry season. Moreover, the fishing activity in Pemba is very dynamic, so, it would be appropriate to do "continuous" data collection through the year.

Another pertinent issue was the fact that we may not have captured all fish landed in each of our sites during our sampling periods. For example, some fishermen in Pemba, especially in Paquitequete, do not go fishing. They go to sea and buy fish from other fishing boats. Therefore, our results should be considered a conservative and low estimate of the current exploitation level and pressure in Cabo Delgado.

## 6. Reference List

McClanahan, T. R., Graham, N. a J., MacNeil, M. A., Muthiga, N. a, Cinner, J. E., Bruggemann, J. H. & Wilson, S. K. 2011 Critical thresholds and tangible targets for ecosystem-based management of coral reef fisheries. *Proc. Natl. Acad. Sci. U. S. A.* 108, 17230–3. (doi:10.1073/pnas.1106861108)

Newton, K., Cote, I. M., Pilling, G. M., Jennings, S., & Dulvy, N. K. (2007). Current and future sustainability of island coral reef fisheries. *Current Biology*, 17(7), 655-658.

UNEP-WCMC, WorldFish Centre, WRI, TNC (2010). Global distribution of warm-water coral reefs, compiled from multiple sources including the Millennium Coral Reef Mapping Project. Version 1.3. Includes contributions from IMaRS-USF and IRD (2005), IMaRS-USF (2005) and Spalding et al. (2001). Cambridge (UK): UNEP World Conservation Monitoring Centre. URL: <http://data.unep-wcmc.org/datasets/1>

## Appendix

### Species List

#	Pemba	Vamizi	Lalane
1	Abudefduf sp.	Abalistas stellatus	Atrina pectinata
2	Abudefduf sparoides	Ablennes hians	Caesio teres
3	Abudefduf vaigiensis	Acanthurus bleekeri	Carangoides malabaricus
4	Acanthurus dussumieri	Acanthurus dussumieri	Caranx sexfasciatus
5	Acanthurus sp.	Acanthurus mata	Carpilius convexus
6	Acanthurus triostegus	Acanthurus nigricauda	Cephalopholis aurantia
7	Acanthurus xanthopterus	Acanthurus nigrofuscus	Charyadis natator
8	Aethaloperca rogaa	Acanthurus tennenti	Charybdis natator
9	Alectis indicus	Acanthurus thompsoni	Cheilinus chlorourus
10	Alepes djedaba	Acanthurus triostegus	Cheilinus trilobatus
11	Allothunnus fallai	Acanthurus xanthopterus	Cheilio inermis
12	Amanses scopas	Actinopyga echinites	Chicoreus ramosus
13	Amblygaster sirm	Actinopyga mauritiana	Chirocentrus nudus
14	Amphiprion allardi	Actinopyga miliaris	Cociella crocodilus
15	Anyperodon leucogrammicus	Aethaloperca rogaa	Cypraea erosa
16	Apogon sp.	Alectis indicus	Dasyatis Kuhlii
17	Argyrops sp.	Alepes djedaba	Decapterus macrosoma
18	Arothron hispidus	Aluterus monoceros	Diagramma pictum
19	Aulacocephalus sp.	Aluterus scripus	Elops machnata
20	Auxis rochei	Aluterus scriptus	Gerres acinares
21	Auxis thazard	Ambelygaster sirm	Gerres filamentosus
22	Balistapus undulatus	Anguilla bicolor	Hemiramphus far
23	Balistidae (FAMILY)	Anguilla marmorata	Holothuria edulis
24	Balistoides viridescens	Anyperodon leucogrammicus	Holothuria nobilis
25	Bothus pantherinus	Aphareus rutilans	Holothuria scabra
26	Caesio sp.	Aprion verescens	Kyphosus cinerascens
27	Caesio xanthonota	Aprion varescens	Leptoscarus vaigensis
28	Cantherhines dumerilii	Aprion virescens	Lethrinus harak
29	Carangidae (FAMILY)	Atrina pectina	Lethrinus lentjan
30	Carangoides armatus	Atrina pectinata	Lethrinus mahsena
31	Carangoides ferdau	Atrina pectita	Lethrinus nebulosus
32	Carangoides malabaricus	Auxis rochei	Lethrinus varigatus
33	Carangoides sp.	Auxis thazard	Lixo
34	Caranx papuensis	Balistapus undulatus	Loligo forbesi
35	Caranx sp.	Balistoides viridescens	Lutjanus bohar
36	Carcharhinus obscurus	Bodianus bilunulatus	Lutjanus ehrembergi
37	Cephalopholis argus	bodianus perditio	lutjanus fulviflamma
38	Cephalopholis boenack	Bohadschia argus	Lutjanus russelli



[Type here]

39	Cephalopholis miniata	Bohadschia marmorata	Mugil cephalus
40	Cephalopholis nigripinnis	Bolbometopon muricatum	Natica gualteriana
41	Cepharopholis sp.	Brevirostris	Octopus aegina
42	Chaetodon auriga	caesio caerulea	Panulirus versicolor
43	Chaetodon trifasciatus	Caesio lunaris	Parupeneus cinnabarinus
44	Chanos chanos	Caesio teres	Plectorinchus gaterinus
45	Cheilopogon cyanopterus	Caesio varilineata	Plectorinchus gibbosus
46	Chelio inermis	caesio varilineata	Plectorinchus schotaf
47	Chirocentrus nudus	Calotomus carolinus	Polinices tumidus
48	Chirocentrus sp.	calotomus spinidens	Pomadasy kaakan
49	Chlorurus sordidus	calotomus viridiscens	Pomadasy maculatum
50	Cirrhlabus sp.	Canthidermis maculatus	Pomadasy stridens
51	Ctenochaetus binotatus	Carangoides chrysophrys	Portunus pelagicus
52	Ctenochaetus strigosus	Carangoides dinema	Pseudobalistes flavomarginatus
53	Dactyloptena petersen	Carangoides ferdau	Saccostrea cucullata
54	Dactyloptena petersen	Carangoides fulvoguttatus	Sargocentrum rubrum
55	Dascyllus sp.	Carangoides malabaricus	Scarus ghobban
56	Dascyllus trimaculatus	Caranx heberi	Scarus tricolor
57	Dasyatidae (FAMILY)	Caranx papuensis	Scolopsis bimaculatus
58	Dasyatis kuhlii	Caranx sexfasciatus	Scolopsis ghanam
59	Decapterus tabl	Carcharhinus seatei	Scomberoides tol
60	Decapterus russelli	carcharinus leucas	Scylla serrata
61	Decapterus macrosoma	Cassis cornuta	Sepia latimanus
62	Decapterus russelli	Cephalopholis argus	Squilla serrata
63	Decapterus sp.	Cephalopholis aurantia	Siganus sutor
64	Decapterus tabl	Cephalopholis leopardus	Sphraena jello
65	Diodon hystrix	Cephalopholis miniata	Sphraena chrysotaenia
66	Echidna zebra	Cephalopholis sexmaculata	Stichopus variegatus
67	Encrasicholina punctifer	Cephalopholis sonnerati	Taeniura Lymna
68	Ephinephelus areolatus	Cephalopholis urodeta	Terapon jarbus
69	Epinephelus areolatus	Cetocarus bicolor	Terebralia palustris
70	Epinephelus argus	Charonia tritani	Terebralia palustris
71	Epinephelus fasciatus	Cheilinus chlorourus	Thalamita ornata
72	Epinephelus faveatus	Cheilinus diagrammus	Thelenota ananas
73	Epinephelus malabaricus	Cheilinus fasciatus	Tridacna maxima
74	Epinephelus melanostigma	Cheilinus trilobatus	Tylosaurus C. Crocodilus
75	Epinephelus rivalatus	Cheilinus undulatus	Variola louti
76	Epinephelus sp.	Chelio inermis	
77	Epinephelus tauvina	Chicoreus ramosus	
78	Euthynnus affinis	Chirocentrus dorab	
79	Fistularia petimba	Choromytilus inderidionalis	
80	Gerres acynaces	Coris formosa	
81	Gerres filamentosus	Ctenochaetus binotatus	

[Type here]

82	Gerres macracanthus	Ctenochaetus striatus	
83	Gnathodentex aurolineatus	Ctenochaetus strigosus	
84	Gomphosus caeruleus	Cymatium pileare	
85	Gymnothorax favagiensis	Cyphraecassis rufa	
86	Gymnothorax meleagris	dasyatis brevicaudata	
87	Hemiramphus far	Dasyatis Kuhlii	
88	Hemiramphus sp.	Decapterus kurroides	
89	Heniochus acuminatus	Decapterus longimamas	
90	Himanthura gerrardi	decapterus russelli	
91	Holothuria nobilis	Diagrama pictum	
92	Holothuria scabra	diagramma pictum	
93	Hyporhamphus affinis	Diodontidae	
94	Istiophorus platypterus	Drepane longimanus	
95	Katsuwonus pelamis	echidina micotaemia	
96	Lactoria diaphana	Echidna leucotaenia	
97	Leiognathus equula	Elagatis bipinnulata	
98	Leiognathus equulus	Epinephelus areolatus	
99	Leiognathus sp.	Epinephelus chlorostigma	
100	Leptoscarus vaigiensis	Epinephelus fasciatus	
101	Lethrinus absoletus	Epinephelus fuscogutattus	
102	Lethrinus crocineus	Epinephelus hexagonatus	
103	Lethrinus harak	Epinephelus lanceolatus	
104	Lethrinus lentjan	epinephelus magniscuttis	
105	Lethrinus mahsena	Epinephelus malabaricus	
106	Lethrinus mahsena sanguineus	Epinephelus melanostigma	
107	Lethrinus microdon	Epinephelus merra	
108	Lethrinus nebulosus	Epinephelus microdon	
109	Lethrinus rubrioperculatus	Epinephelus ongus	
110	Lethrinus sp.	Epinephelus posteli	
111	Lethrinus variegatus	Epinephelus rivulatus	
112	Lethrinus xanthochilus	Epinephelus spilotoceps	
113	Lithognatus mormyrus	Epinephelus tauvina	

[Type here]

11 4	Loligo duvauceli	Etelis carbuncus	
11 5	Loligo forbesi	Etrumeus teres	
11 6	Loligo sp.	exocoethus monocirrhous	
11 7	Lutjanus sanguineus	Fistularia petimba	
11 8	Lutjanidae (FAMILY)	Gerra oyena	
11 9	Lutjanus bengalensis	Gerres acinares	
12 0	Lutjanus bohar	Gerres filamentosus	
12 1	Lutjanus fulviflamma	Gerres oyena	
12 2	Lutjanus kasmira	gymnocranius johnsoni	
12 3	Lutjanus lentjan	Gymnocranius robinsoni	
12 4	Lutjanus lutjanus	Gymnothorax baecdeni	
12 5	Lutjanus monostigma	Gymnothorax breedeni	
12 6	Lutjanus notatus	Gymnothorax favagiensis	
12 7	Lutjanus rivulatus	Gymnothorax flavimarginatus	
12 8	Lutjanus sabae	Gymnothorax monochrous	
12 9	Lutjanus sp.	Gymnothorax permistus	
13 0	Lutjanus vitta	Gymnothorax phasmatodes	
13 1	Makaira indica	Gymnothorax undulatus	
13 2	Megalaspis cordyla	Halichoeres hortulanus	
13 3	Mene maculata	Hemigymnus melapterus	
13 4	Monotaxis grandoculis	Hemiramphus far	
13 5	Mulloidichthys vanicolensis	Hemiramphus lutkei	
13 6	Muloides sp.	Hethaloperca rogaa	
13 7	Muloidichtys vanicolensis	Hexacanthus sp.	

[Type here]

13			
8	Myripristis murdjan	Himantura uarnak	
13			
9	Naucrates ductor	Hipposcarus harid	
14			
0	Nemipteridae (FAMILY)	holothuria atra	
14			
1	Nemipterus japonicus	holothuria edulis	
14			
2	Nemipterus sp.	holothuria fuscogilva	
14			
3	Novaculichthys taeniourus	Holothuria microthede	
14			
4	Octopus vulgaris	holothuria nobilis	
14			
5	Opleognathus conwayi	Holothuria scabra	
14			
6	Ostracion cubicus	Hypoatherina barnesi	
14			
7	Panulirus ornatus	hyporhamphus affinis	
14			
8	Panulirus penicillatus	Istiophorus platypterus	
14			
9	Papilloculiceps longiceps	Kuhlia mugil	
15			
0	Paralichthodes algoensis	kyphosus cinerascens	
15			
1	Parapercis hexophthalma	Lambis lambis	
15			
2	Pardachirus marmoratus	Lector insidiator	
15			
3	Parupeneus cinnabarinus	leptoscarus bicolor	
15			
4	Parupeneus cyclostomus	Leptoscarus vaigensis	
15			
5	Parupeneus indicus	Lethrinus conchyliatus	
15			
6	Parupeneus macronema	Lethrinus crocineus	
15			
7	Parupeneus rubescens	Lethrinus crythracanthus	
15			
8	Parupeneus sp.	Lethrinus harak	
15			
9	Pempheris schwenkii	Lethrinus lentjan	
16			
0	Platycephalidae (FAMILY)	Lethrinus mahsena	
16			
1	Plectorhinchus flavomaculatus	Lethrinus microdon	

[Type here]

16			
2	Plectorhinchus gibbosus	Lethrinus nebulosus	
16			
3	Plectorhinchus leucozonus	Lethrinus obsoletus	
16			
4	Plectorhinchus schotaf	lethrinus rubrioperculatus	
16			
5	Plectorhinchus sordidus	lethrinus varigatus	
16			
6	Plectorhinchus sp.	Lethrinus xanthochilus	
16	Plectroglyphidodon		
7	leucozonus	Lithognathus lithognathus	
16			
8	Plectroglyphidodon sp.	Lobotes surinamensis	
16			
9	Plotosus lineatus	Loligo duvauceli	
17			
0	Pomacanthus imperator	Loligo forbesi	
17			
1	Pomadasys commersonnii	Loligo oualaniensis	
17			
2	Priacanthus hamrur	Lotomui spinidens	
17			
3	Pristimoides sp.	Loxodon macrorhinos	
17			
4	Pristipomoides sieboldii	Lutjanus argentimaculatus	
17			
5	Psettodes erumei	Lutjanus ehrembergi	
17			
6	Pterocaesio chrysozona	lutjanus fulviflamma	
17			
7	Pterocaesio marri	Lutjanus gibbus	
17			
8	Pterocaesio tile	Lutjanus guilcheri	
17			
9	Pterois antennata	Lutjanus kasmira	
18			
0	Pterois russelli	lutjanus lemniscatus	
18			
1	Pterois sp.	Lutjanus monostigma	
18			
2	Puerulus carinatus	lutjanus notatus	
18			
3	Rhinecanthus aculeatus	Lutjanus rivulatus	
18			
4	Sardinella albella	Lutjanus russelli	
18			
5	Sardinella sp.	Lutjanus vitta	

[Type here]

18 6	Sargocentron diadema	Macolor niger	
18 7	Sargocentron spiniferum	Megalaspis cordyla	
18 8	Scarus globiceps	Modiolus philippinaron	
18 9	Scarus japonensis	Modiolus philippinaum	
19 0	Scarus niger	Monacanthidae	
19 1	Scarus scaber	Monodactylus argenteus	
19 2	Scarus sordidus	Monotaxis grandoculis	
19 3	Scarus sp.	monotaxis grandoculis'	
19 4	Scolopsis bimaculatus	mory	
19 5	Scolopsis ghanam	Mpeneus taenioptenes	
19 6	Scolopsis sp.	Mugil cephalus	
19 7	Scolopsis vosmeri	Mulioides Flavolineatus	
19 8	Scomber japonicus	Mulloides vanicolensis	
19 9	Scomberoides lysan	Myripristis adjustus	
20 0	Scomberoides sp.	Myripristis berndt	
20 1	Scomberoides tol	Myripristis melanostictus	
20 2	Scomberomorus commerson	Myripristis Murdjan	
20 3	Scorpaenopsis diabolus	Naso brachycentron	
20 4	Secutor indicus	Naso brevirostris	
20 5	Secutor insidiator	Naso hexacanthurus	
20 6	Sepia latimanus	Naso lituratus	
20 7	Seriolina nigrifasciata	Naso tuberosos	
20 8	Serranidae (FAMILY)	Naso unicornis	
20 9	Shrimp (sp. not identified)	Naucrates ductor	

[Type here]

21 0	<i>Siganus luridus</i>	<i>Nemipterus japonicus</i>	
21 1	<i>Siganus stellatus</i>	<i>Octopus aegina</i>	
21 2	<i>Siganus sutor</i>	<i>Octopus cyaneus</i>	
21 3	<i>Sillago chondropus</i>	<i>Octopus indicus</i>	
21 4	<i>Sillago sihama</i>	<i>Octopus macropus</i>	
21 5	Sparidae (FAMILY)	<i>Oedithys ardeiepiscopus</i>	
21 6	<i>Sphyraena flavicauda</i>	<i>Ommastrephes bartrani</i>	
21 7	<i>Sphyraena forsteri</i>	Otraciidae	
21 8	<i>Sphyraena jello</i>	<i>Palinurus delagoe</i>	
21 9	<i>Sphyraena sp.</i>	<i>Panulirus longipes</i>	
22 0	<i>Sphyrna lewini</i>	<i>Panulirus versicolor</i>	
22 1	<i>Stolephorus holodon</i>	<i>Papilloculiceps longiceps</i>	
22 2	<i>Sufflamen chrysopterus</i>	<i>Parupeneus barberinus</i>	
22 3	<i>Synodus indicus</i>	<i>Parupeneus cinnabarinus</i>	
22 4	<i>Synodus variegatus</i>	<i>Parupeneus cyclostomus</i>	
22 5	<i>Taeniura lymna</i>	<i>Parupeneus indicus</i>	
22 6	<i>Terapon puta</i>	<i>Parupeneus macronema</i>	
22 7	<i>Terapon theraps</i>	<i>Parupneus pleurostigma</i>	
22 8	<i>Thalassoma hebraicum</i>	<i>Platax orbicularis</i>	
22 9	<i>Thalassoma lunare</i>	<i>Plectorinchus chubbi</i>	
23 0	<i>Thalassoma sp.</i>	<i>Plectorinchus flavomaculatus</i>	
23 1	<i>Thelenota ananas</i>	<i>Plectorinchus gaterinus</i>	
23 2	<i>Thenus orientalis</i>	<i>Plectorinchus gibbosus</i>	
23 3	<i>Thunnus albacares</i>	<i>Plectorinchus orientalis</i>	

[Type here]

23			
4	Thunnus obesus	Plectorinchus playfairi	
23			
5	Thunnus sp.	Plectorinchus schotaf	
23			
6	Trachinocephalus myops	Plectorinchus sordidus	
23			
7	Trachinotus botla	Plectropomus punctatus	
23			
8	Trichiurus lepturus	Plectorinchus schotaf	
23			
9	Tylosurus acus melanotus	Pomacanthus imperator	
24			
0	Tylosurus crocodilus	Pomacanthus striatus	
24			
1	Tylosurus sp.	Pomadasy kaakan	
24			
2	Upeneus bensasi	Pomadasy maculatum	
24			
3	Upeneus moluccensis	Priacanthidae	
24			
4	Upeneus sp.	Priacanthus hamrur	
24			
5	Upeneus sulphureus	Pristipomoides sieboldii	
24			
6	Upeneus taeniopterus	Pristipomoides typus	
24			
7	Upeneus tragula	Psettodes erumei	
24			
8	Upeneus vitattus	Pseudobalistes flavomarginatus	
24			
9	Upeneus vittatus	Pseudobalistes fuscus	
25			
0	Zanclus cornutus	Pterocaesio marri	
25			
1		Pterocaesio tile	
25			
2		Pterois miles	
25			
3		Rachycentron canadum	
25			
4		Raja alba	
25			
5		Rhabdosagus thorpei	
25			
6		Rhinecantus rectangulus	
25			
7		Rhynchobatus djeddensis	



[Type here]

25 8		Sardinella albilla	
25 9		Sargocentrum caudimaculatus	
26 0		Sargocentrum praslin	
26 1		Scarus candofascidatus	
26 2		scarus enucantus	
26 3		Scarus falcipines	
26 4		Scarus festivus	
26 5		Scarus frenatus	
26 6		scarus gaterinus	
26 7		Scarus ghobban	
26 8		Scarus gibbus	
26 9		Scarus globiceps	
27 0		Scarus harid	
27 1		Scarus japanensis	
27 2		Scarus niger	
27 3		Scarus psittacus	
27 4		Scarus rubroviolaceus	
27 5		Scarus russelli	
27 6		Scarus scaber	
27 7		Scarus sordidus	
27 8		Scarus tricolor	
27 9		Scarus viridifucatus	
28 0		Scolopsis apanam	
28 1		Scolopsis bimaculatus	

[Type here]

28 2		Scolopsis ghanam	
28 3		Scomberoides lysan	
28 4		Scomberomorus comersoni	
28 5		Scorpaenopsis venosa	
28 6		Selar crumenophthalmus	
28 7		Sepia prashadi	
28 8		Seriola dumerili	
28 9		Shasenepsetta legrebris	
29 0		Siganus luridus	
29 1		Siganus stellatus	
29 2		Siganus sutor	
29 3		Sphraena jello	
29 4		Sphyaena barracuda	
29 5		Sphyaena chrysotaenia	
29 6		Sphyaena flavicauda	
29 7		Sphyaena forsteri	
29 8		Sphyaena putnamiae	
29 9		Sphyaena qenie	
30 0		Stichopus chloronotui	
30 1		Stichopus chloronotus	
30 2		stichopus variegatus	
30 3		Stiophorus platypterus	
30 4		strombidae	
30 5		Strombus gibberulus	

[Type here]

30 6		Strongylura leira	
30 7		Strongylura leiura	
30 8		Symplectoteuthis oualaniensis	
30 9		Synanceia verrucosa	
31 0		Tacniura melanospilos	
31 1		Taeniura Lymna	
31 2		Taeniura melanospilos	
31 3		Teptoscarus vaigiensis	
31 4		Tetraodontidae sp	
31 5		Tetraptarus sugustirostris	
31 6		Tetrapturus angustirostris	
31 7		Thelenota ananas	
31 8		Thelenota anax	
31 9		Thunnus alalunga	
32 0		Thunnus obesus	
32 1		thysanoteuthis rhombus	
32 2		Trachinotus blochii	
32 3		Trachurus delagoa	
32 4		Triaenodon obesus	
32 5		Tripneustes gratilla	
32 6		Tylasaurus acus melanotus	
32 7		Tylosaurus C. Crocodilus	
32 8		unknown	
32 9		Upeneus taeniopterus	

[Type here]

33 0		urotrygon daviesi	
33 1		Variola louti	
33 2		Zebrasoma gemmatum	