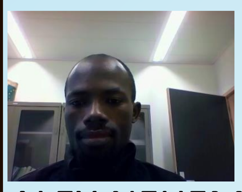
Influence of mangrove deforestation on nutrition ecology and genetic diversity of *Uca annulipes* along the Tanzania mainland and Zanzibar coast



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INTRODUCTION & OVERVIEW

Mangrove forest serves as spawning, breeding and nursery grounds for many marine species. Fiddler crabs (Ocypodidae) are well known to influence mangrove ecosystem function through their biologically potential of accelerating organic matter decomposition (Kristensen, 2007, Bartolini *et al.*, 2011).

High population pressure in coastal areas has led to the conversion of many mangrove areas to other uses, including salt production, sewage discharge, aquaculture and rice production in mangrove environments.

Photo 1: *Uca annulipes* in sediments

Photo 2: pristine mangrove

Photo 3: salt ponds

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The study intend to investigate how deforestation of mangroves due to salt pond development has impact on the diet and genetic diversity of *Uca annulipes.* This study is taking place along the Tanzania coast, where about 75% of the salt is by solar production and the salt ponds are located in mangrove areas (TCMP, 2001).

AIMS

1) Use $\delta^{13}C$ and $\delta^{15}N$ stable isotopic composition of tissues and sediments to asses the effects of salt pond constructions in mangroves on the feeding o ecology of *U. annulipes* and their habitat

2) Identify the origin of various source of the organic matter around salt ponds areas

3) Use of conservative protein-coding genes (COI sequences) to determine whether there is shift in genetic diversity due to mangrove deforestation for salt ponds construction

METHODS

- Sediments, crabs *(U. annulipes)* and their diet source are being collected in mangrove around the salt ponds for stable isotopes and genetic analysis
- For each salt pond area, samples are also collected in non salt pond-mangroves area separated from salt ponds at least by 10km to act as control (non continuous forest)
- Thee forms of controls were selected: 1. Relatively undisturbed mangrove forest; 2. Mangrove forest with other forms of human disturbances other than salt ponds construction.(contaminated with animal and human fecal materials); 3. Restored area of salt ponds with mangrove.
- $\delta^{13}C$, $\delta^{15}N$ and organic matter in sediments and crabs were analyed by Thermo Flash1112 elemental analyzer coupled to a Thermo Delta + XL via a Conflo III interface. The analysis for $\delta^{13}C$ and $\delta^{15}N$ in food source and genetic diversity *of Uca annulipes* is in progress.

CONCLUSION

Crab tissue and sediment organic matter from most salt pond areas had higher $\delta^{13}C$ and $\delta^{15}N$ values compared to relatively undisturbed areas, indicating that salt pond development in mangroves has an impact on the habitat and the diet of *Uca annulipes*. Other forms of human disturbances showed to have similar influences. *Uca annulipes* from restored salt ponds with mangrove had almost the same isotopic values as those of salt pond areas which indicates that the effect of salt ponds development takes long time for a restored mangrove to function as natural mangrove. Unpublished data (Nehemia *et al*........), indicates that this species have high condition factors around salt ponds than in mangrove areas without salt ponds.

Changes in tidal flow, organic matter content, sunlight, and hence higher production of benthic microalgae in salt ponds area, might have been the factors that caused the differences observed. Differences in $\delta^{13}C$ value of crab tissues and sediments in this study indicates that, organic matter imported from other areas might contribute significantly as a food source component for this species. These results brings useful information for decision makers in planning the management strategies and conservation of both marine flora and fauna in tropical and subtropical areas where mangroves and fauna are threatened by human activities

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RESULTS

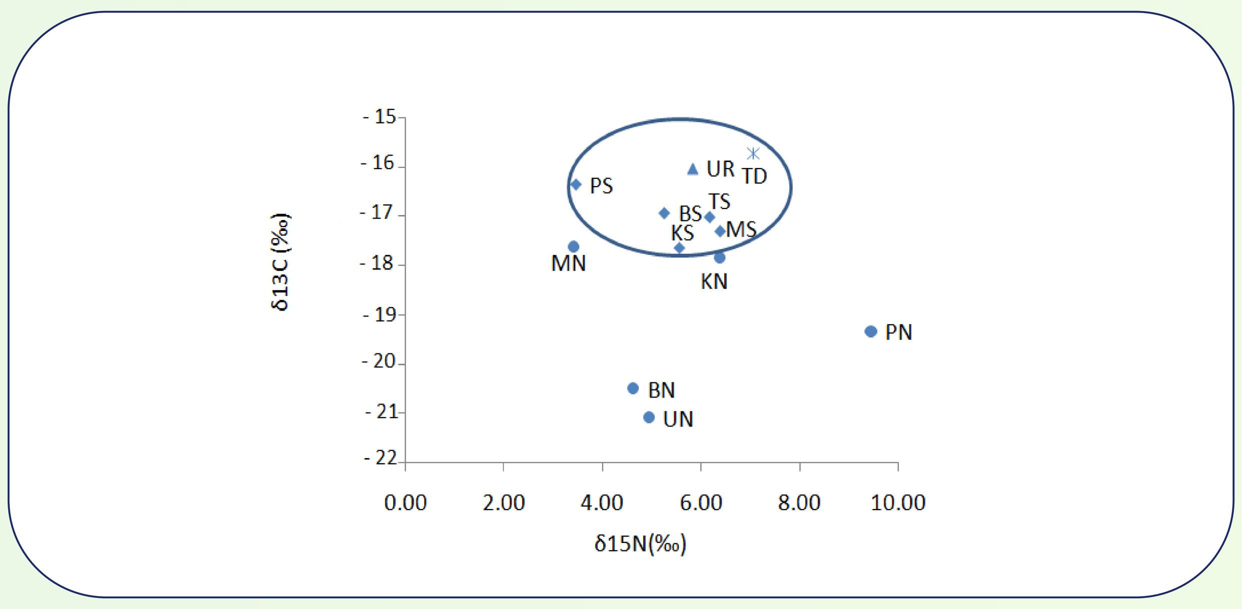

Fig. 1: Distributions of sampling sites based on $\delta^{13}C$ and $\delta^{15}N$ in *Uca annulipes* tissues

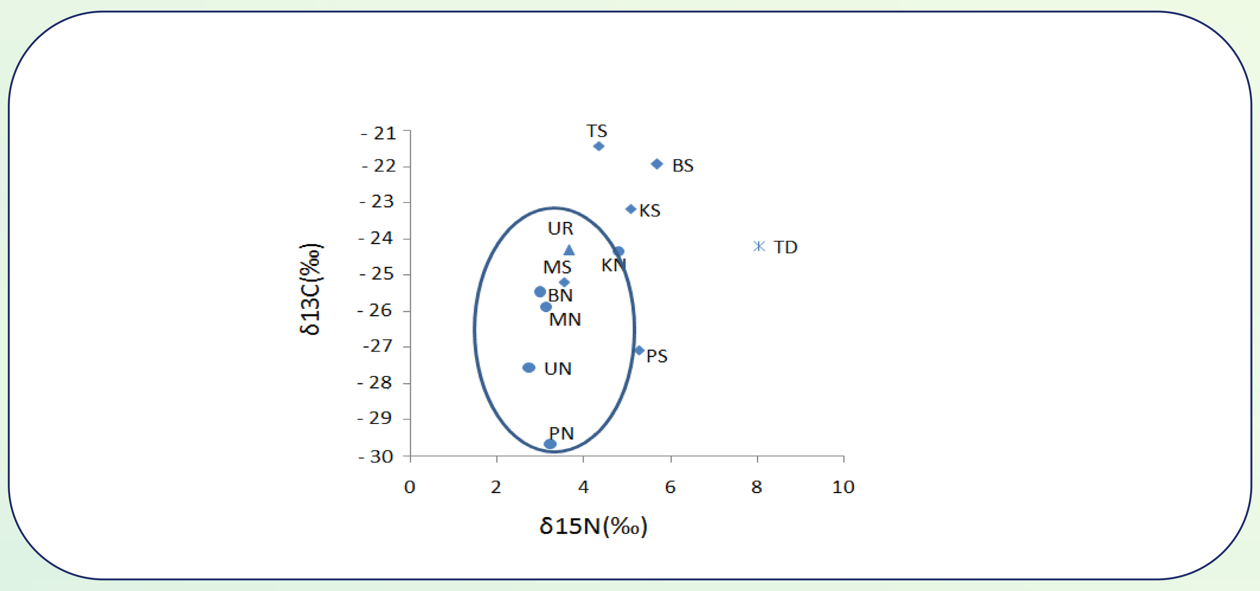

Fig. 2: Distributions of sampling sites based on $\delta^{13}C$ and $\delta^{15}N$ in sediments

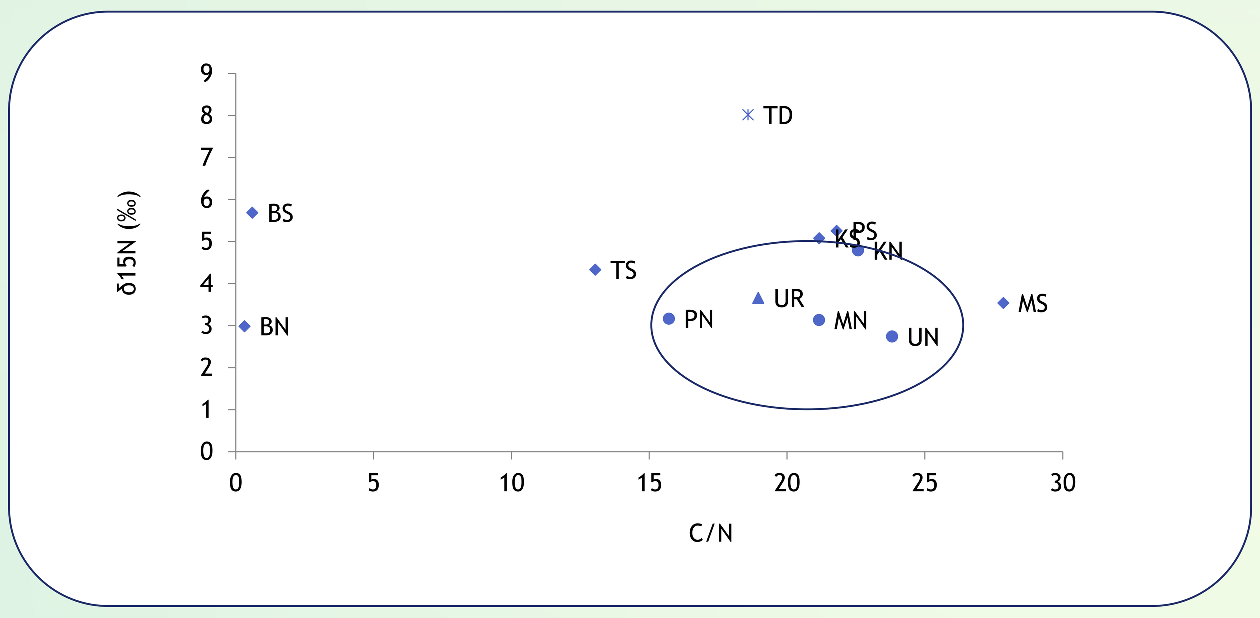

Fig. 3: Distributions of sampling sites based on $\delta^{15}N$ and C/N ratio in sediments

(TD =Tanga disturbed mangrove by other human activities than salt ponds ,TS = Tanga salt ponds, BN = Bagamoyo no salt ponds, BS = Bagamoyo salt ponds, KN = Kilwa no salt ponds, KS = Kilwa salt ponds, MN = Mtwara no salt ponds, MS = Mtwara salt ponds, UN = Unguja no salt ponds, UR = Unguja restored salt ponds with mangrove, PN = Pemba no salt ponds, PS = Pemba salt ponds)

Table 1: Mean $\delta^{15}N$ and $\delta^{13}C$ signature in *U. annulipes* tissues from salt pond and non salt pond areas

Salt ponds	Sites	$\delta^{15}N$, ‰ (mean±SD)	$\delta^{13}C$, ‰ (mean±SD)	n
Yes	TS	6.17±0.43	-17.03±0.75	5
No	TD	7.06±0.08	-15.75±1.01	5
Yes	BS	5.24±0.49	-16.94±2.84	5
No	BN	4.62±0.20	-20.51±0.65	5
Yes	KS	5.55±0.14	-17.65±1.34	5
No	KN	6.38±0.94	-17.85±1.17	5
Yes	MS	6.38±0.36	-17.31±1.21	5
No	MN	3.41±0.13	-17.62±0.78	5
Yes	UR	5.82±0.53	-16.02±0.74	5
No	UN	4.94±0.53	-21.09±1.3 0	5
Yes	PS	3.46±0.5 0	-16.36±1.38	5
No	PN	9.45±0.30	-19.35±0.79	5

Table 2: Mean $\delta^{15}N$ and $\delta^{13}C$ signature in sediments from salt pond and non salt pond areas

Salt ponds	Sites	$\delta^{15}N$ (mean±SD)	$\delta^{13}C$ (mean±SD)	n
Yes	TS	4.33±0.62	-21.44±0.44	3
No	TD	8.02±2.77	-24.22±0.15	3
Yes	BS	5.69±0.29	-21.95±0.37	3
No	BN	2.99±0.16	-25.47±0.15	3
Yes	KS	5.08±0.94	-23.17±0.16	3
No	KN	4.79±0.10	-24.36±0.35	3
Yes	MS	3.54±1.49	-25.19±0.24	3
No	MN	3.13±0.39	-25.88±0.09	3
Yes	UR	3.66±0.16	-24.31±0.03	3
No	UN	2.74±0.25	-27.57±0.08	3
Yes	PS	5.26±0.25	-27.08±0.07	3
No	PN	3.24±0.15	-29.67±0.81	3

Table 3: P values from t-test, comparison of mean : $\delta^{15}N$ and $\delta^{13}C$ signature between salt ponds and non salt ponds areas ("*" High mean isotopic value; ".S" salt ponds, ".N" no salt ponds and ".R" restored salt ponds)

SITES	$\delta^{15}N$ (*U.annulipes*)	$\delta^{13}C$ (*Uca annulipes*)	$\delta^{15}N$ (Sediments)	$\delta^{13}C$ (Sediments)
Tanga	(TS & TD*) 0.40	(TS & TD*) 0.06	(TS & TD*) 0.15	(TS* & TD) < 0.01
Bagamoyo	(BS* &BN) 0.046	(BS* &BN) 0.05	(BS* &BN) < 0.01	(BS* & BN) < 0.01
Kilwa	(KS & KN*) 0.12	(KS* & KN) 0.80	(KS* & KN) 0.64	(KS* & KN) 0.01
Mtwara	(MS* & MN) < 0.01	(MS* &MN) 0.64	(MS* & MN) 0.69	(MS* & MN) < 0.05
Unguja	(UR* & UN) 0.61	(UR* & UN) <0.01	(UR* & UN) 0.01	(UR* & UN) < 0.01
Pemba	(PS &PN*) < 0.01	(PS* & PN) < 0.01	(PS* & PN) 0.01	(PS* & PN) < 0.01

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