Effect of habitat fragmentation and protection status on seagrass-associated meiofauna along the Kenyan coast

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Introduction

Habitat fragmentation threatens seagrass ecosystems worldwide. So far there has been disagreement on the consequences for the associated epiphytic meiofauna (38µm – 1mm).

As Harpacticoida (Crustacea, Copepoda) are the main food source for juvenile fish, any fragmentation of the seagrass beds might impact the energy flow to higher trophic levels. Therefore it is crucial to evaluate the effectiveness of marine protected areas (MPAs) as conservation tool for the biodiversity of seagrass-associated fauna.

Research questions:

Are the abundance and diversity of epiphytic meiofauna (Harpacticoida) affected by:

1) Habitat fragmentation: continuous versus fragmented meadows (potential edge effect)?

2) Different protection levels: parks (no-take zone) versus reserves (controlled fishing allowed)?

Methods

Meiofauna samples were collected while snorkeling in four *Thalassodendron ciliatum* meadows along the Kenyan coastline (January, 2012).

4 sites were sampled:

- Mombasa Marine Park: continuous + park
- Blue Bay Reserve: continuous + reserve
- Watamu Marine Park: fragmented + park
- Ras Iwatine Reserve: fragmented + reserve

Meiofauna was counted and identified at higher taxonomic levels.

Subsamples of 100 Harpacticoida were identified to species level.

Results

1) EFFECT ON ABUNDANCE

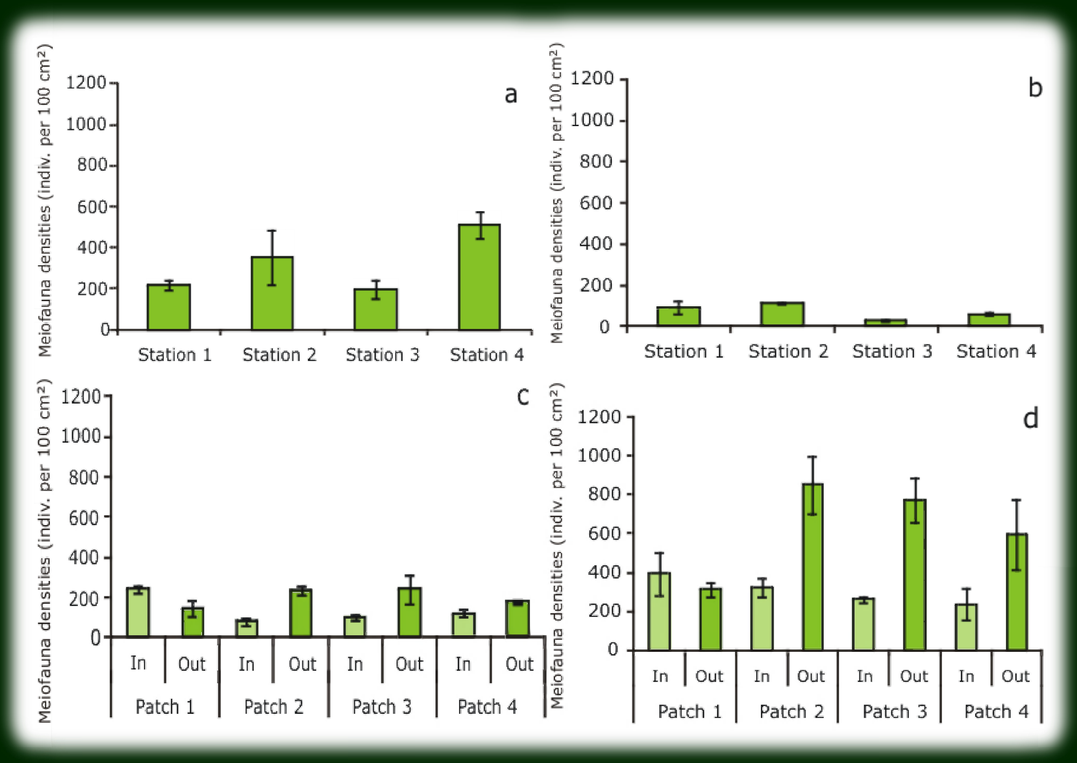


Fig. 1: Standardized meiofauna densities for (a) Mombasa Marine Park, (b) Blue Bay Reserve, (c) Watamu Marine Park and (d) Ras Iwatine Reserve.

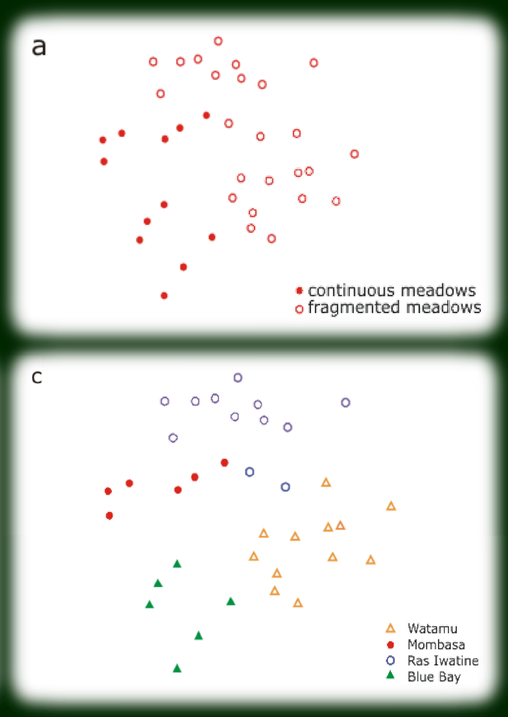
- Significant higher meiofauna densities in fragmented meadows (c – d)($p < 0.01$), likely due to a positive edge effect ($p < 0.05$).
- Same patterns and significance levels for the harpacticoid species.
- Significant higher meiofauna densities in reserves (b-d) compared with parks (a-c) ($p < 0.01$).

2) EFFECT ON DIVERSITY

- Continuous meadows yielded meiofauna communities with a significant higher evenness (N_2, N_∞) than fragmented ones ($p<0.05$).
- No significant effect of protection level was found.

3) HARPACTICOIDA COMMUNITY COMPOSITION

Fig. 2: nMDS plot (Bray Curtis dissimilarity coefficient) for harpacticoid species composition with categorized plot based on (a) fragmentation status, (b) protection status and (c) sampling site (2D Stress: 0.23).



- Grouping according to (a) fragmentation status but less obvious for (b) protection status (two-way crossed ANOSIM, $R=0.803$, $p=0.001$; $R=0.755$, $p=0.001$ respectively).
- Moreover: also significant grouping according to the sampling site (c) (one-way ANOSIM, $R=0.739$, $p= 0.001$).

Conclusions

1) FRAGMENTATION: STRONGER EFFECT ON ABUNDANCE THAN ON DIVERSITY
   Fragmented meadows yielded higher faunal densities (positive edge effect).
   Continuous meadows yielded meiofauna communities with higher evenness.

2) PROTECTION LEVEL HAD A LIMITED EFFECT:
   Reserves yielded higher meiofauna densities than parks.

3) HARPACTICOIDA COMMUNITIES DIFFER LOCALLY (effect of site).

IMPLICATIONS FOR CONSERVATION:

(1) nearby habitats (e.g. sediment matrix) should be part of an integrated conservation approach of coastal ecosystems and (2) fragmented seagrass meadows in a protective network can yield a higher diversity.

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