Nematode assemblage structure and diversity in intertidal soft sediments at Bandar Abbas (Persian Gulf)

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Introduction

- The Persian Gulf is one of the most important waterways in the world in view of its role in oil and gas transport and of its geostrategic position.
- Marine nematodes are the most abundant and species-rich metazoans in a variety of marine sediments.
- Hitherto, there are however **no published studies on marine nematofauna** from the Persian Gulf area.
- Anthropogenic activities such as oil pollution, solid and liquid waste disposal, coastal development can affect the biodiversity and abundance of marine benthos.
- As the first goal of this study, the **abundance, genus composition and biodiversity of nematodes of intertidal sandy beaches** at four locations at Bandar Abbas on the northern part of the Persian Gulf, was investigated.
- The second goal of our study was to assess **impacts of anthropogenic sewage disposal** on sandy beach communities.

Fig. 1. Map of study area

Materials and Methods

- ✓ **Four intertidal locations** (Haghani, Suro, Terminal and Dolat (Fig. 1)), varying in degree of anthropogenic impacts, were selected.
- ✓ 3.5 cm diameter PVC cores were used to take 5 cm deep sediment samples. Samples were fixed in 4% formalin, decanted over a 38 µm sieve and meiofauna then extracted via centrifugation with LUDOX (1.18 density). Nematodes were counted, and 100 nematodes were picked up randomly from each sample, mounted on Cobb slides and identified to genus.
- ✓ Haghani is situated next to the largest sewage drainage of the city and is thus the most impacted location.
- ✓ Suro, is an isolated site receiving untreated sanitary sewage of a residential complex through a small estuary.
- ✓ Terminal, is located next to a canal of urban sewage effluents constituting mainly of urban run offs.
- ✓ Dolat Park, is considered as a comparatively pristine site and is relatively unimpacted.
- ✓ In each location, we selected **three stations along a distance gradient (50-m intervals) from the local pollution source**.
- ✓ The univariate descriptors (abundance and several diversity indices) of nematode abundance and genus diversity were analysed using ANOVA with the factor station nested in the factor location.
- ✓ Community composition was analysed using multivariate statistics in Primer software.

Results

▪ Nematode abundance and dominant genera:

A total of only 39 genera of marine nematodes, belonging to 17 families and five orders were identified.

In the whole study area, five genera (*Daptonema*, *Ptycholaimellus*, *Paramonhystera*, *Terschellingia* and *Theristus*) occurred in more than 50% of the samples and together comprised ≥75% of the nematode communities (Fig. 2). *Daptonema* and *Ptycholaimellus* increased in relative abundance towards the pollution source, whereas *Promonhystera* and *Terschellingia* showed an opposite pattern (Fig. 3).

▪ Nematode diversity:

- Genus diversity (i.e. number of genera per 10 cm²) differed significantly between locations (Kruskal-Wallis test: H (3, N= 36) =9.63, p<0.05) as well as between stations (Kruskal-Wallis test: H (2, N= 36) =6.79, p<0.05). It was highest at Suro with 28 genera and lowest at Haghani with only 13 genera.
- There were significant differences in diversity between locations when looking at Shannon-Weaver's diversity (df=3, F= 5.35, P<0.005), Simpson's diversity (dF=3, F= 3.76, P=0.020), Margalef's index (Kruskal-Wallis test: H (3, N= 36) =8.62, p <0.05) but not for Pielou's evenness (df=3, F= 2.01, P=0.13) (Fig. 4).
- Differences in diversity between stations were not significant for Shannon-Weaver's diversity (df=2, F= 2.77, P=0.078), Simpson's diversity (df=2, F= 1.53, P=0.231), Pielou's evenness (df=3, F= 2.01, P=0.13), but Margalef's index was significantly higher at station1 than at the other stations (Kruskal-Wallis test: H (2, N= 36) =7.43, p <0.05) (fig. 5).
- Taxonomic distinctness differed significantly between locations (df=3, F= 10.61, P< 0.0001) but not between stations (df=2, F= 1.60, P= 0.2185). Terminal had significantly lower distinctness than Suro, Haghani and Dolat Park (all P≤0.005) (Fig. 6).

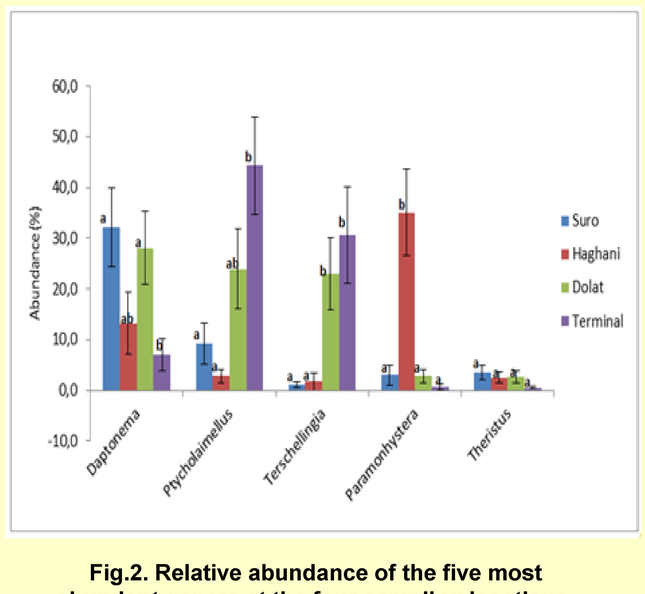

Fig.2. Relative abundance of the five most abundant genera at the four sampling locations.

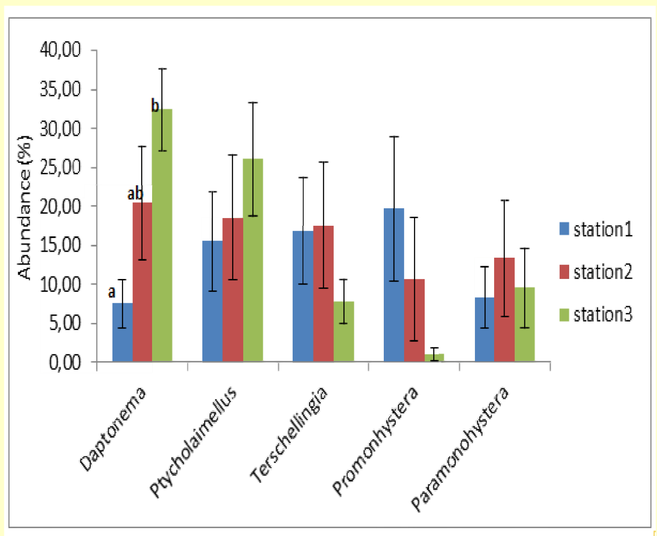

Fig. 3. Distribution of five dominant genera as a function of station distance to pollution sources (station1= most distant, station3= closest to pollution source).

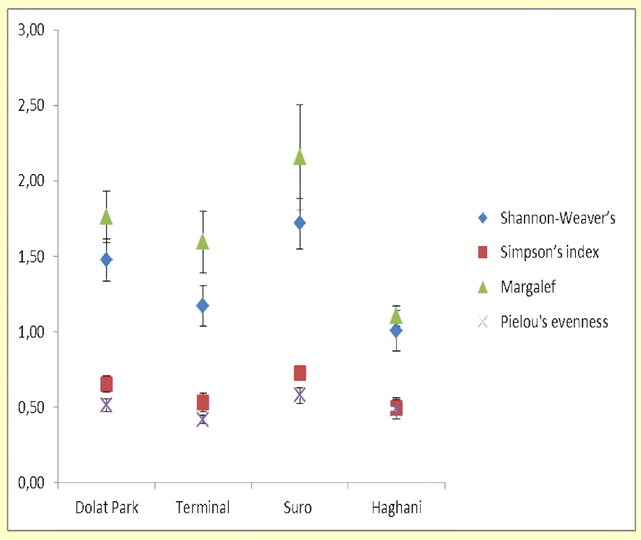

Fig. 4. Shannon-Weaver's (H'), Simpson's diversity index, Margalef index and Pielou's evenness in four sampling locations.

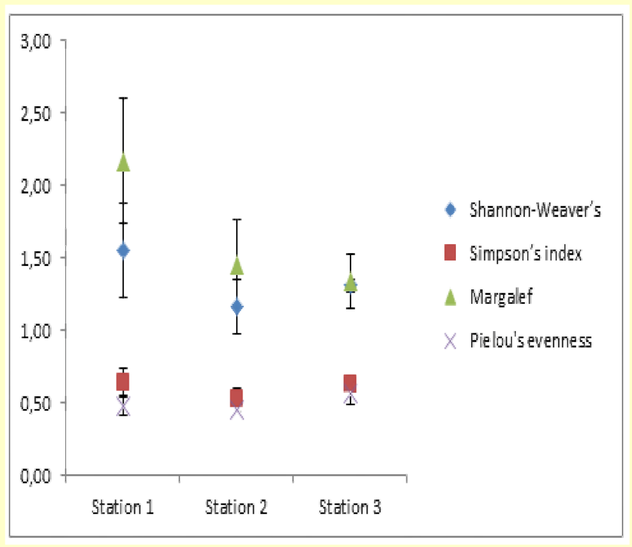

Fig.5. Shannon-Weaver's (H'), Simpson's diversity index, Margalef index and Pielou's evenness in three sampling stations .

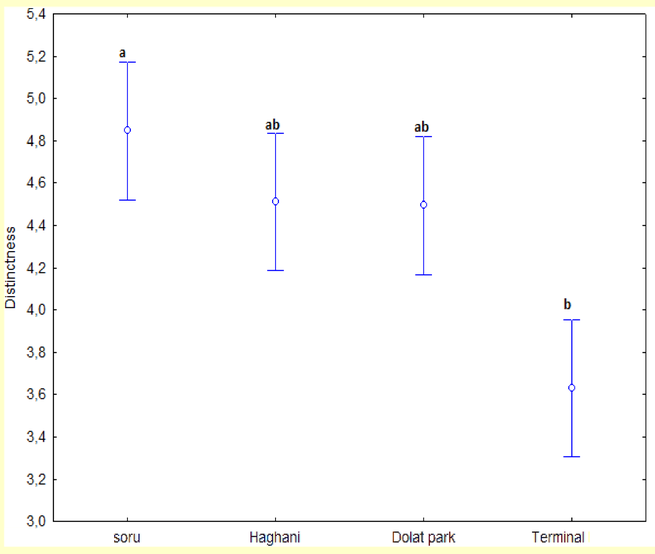

Fig. 6.Taxonomic distinctness in four sampling locations.

Conclusions

- ➢ The overall low diversity of nematodes indicates that the entire area experiences substantial anthropogenic stress. Communities had a high dominance of only few genera.
- ➢ Nematode diversity across locations correlated negatively with degree of sewage input, although different diversity indices were not all equally capable of detecting these trends.
- ➢ Within locations, nematode abundance and diversity increased with distance to a pollution source .
- ➢ Anthropogenic impacts have pronounced effects on assemblages, even in habitats which naturally experience strong environmental fluctuations.