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Short Communication
Effect of Sediment on the Population of *Macrobrachium nipponense* (De Haan, 1849) in Anzali Lagoon

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Abstract

Background and Objective: The role of sediment in water bodies is significant because sediment can affect water quality and benthic organisms. This study investigated sediment's effect on the *Macrobrachium nipponense* population in the Anzali Lagoon. **Materials and Methods:** The samples were taken at three different sites of Anzali Lagoon in 2015. All the prawns cached by traps and sediment samples were taken exactly next to the traps. All samples were transported to the laboratory for analysis. Canonical correspondence analysis (CCA) was used to analyze the total catch for prawns across the sediment gradients measured. **Results:** It showed clear separation in all sites. Site 2 is more affected by clay; in Site 2, the number and the weight of *M. nipponense* were lower than in the other sites. In Sites 1 and 3, fine sand and medium sand were more affected, respectively. The results showed a relationship between the prawn population and sediment in the Anzali Lagoon. **Conclusion:** In some parts of the Anzali Lagoon, the quality and quantity of sediments were different, which directly affected the population of *M. nipponense*. Furthermore, because some parts of the lagoon are in good condition according to sediments and water quality, the Anzali Lagoon has a good potential for growing and living *M. nipponense*.

Key words: Sediment, *Macrobrachium nipponense*, population, multivariate analysis, Anzali Lagoon

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Competing Interest: The author has declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The Anzali Lagoon is situated on the Southern Coast of the Caspian Sea in the Gilan Province. Nineteen rivers flow into the Anzali Lagoon, connecting it to the Caspian Sea[1]. These rivers pass through forests, urban and rural areas, carrying various organic, mineral and sedimentary materials, as well as domestic, industrial and agricultural effluents[2]. The constant disposal of industrial, agricultural and domestic waste has led to a significant deterioration in water quality, impacting the ecosystems of the Anzali Lagoon[3]. The lagoon is crucial for the spawning and nurturing of fish and aquatic species. The oriental river prawn (*Macrobrachium nipponense*) is naturally found in the West of Asia and its population in the Anzali Lagoon was first recorded in 2006[4]. Later, it spread to the water basins in northern Iran. This species belongs to the phylum Arthropoda (order: Decapoda; family: Palaemonidae).

The River Delta forms from the sediment deposition carried by a river as the flow leaves its mouth and enters stagnant water. The Anzali Lagoon has several river mouths and the area has deposited sedimentations[5]. The sedimentations can affect several items of water, such as DO, TSS and phosphorus and all these factors can affect all aquatic species[6]. Therefore, this study aimed to survey the effect of sediment on the population of *M. nipponense* in the Anzali Lagoon.

MATERIALS AND METHODS

Study area: In this study, three localities were used, namely Site 1 (GPS coordinates 37°47'026.42" N and 49°34'307.12" E) and Site 2 (GPS coordinates 37°41'2998.45" N and 49°41'6902.1" E) Site 3 (GPS coordinates 37°44'2998.45" N and 49°44'6902.1" E). During 2015, prawn samples were collected for 12 months. Additionally, nine sediment samples were taken from three different sites of Anzali Lagoon in 2015 and transported to the laboratory for analysis.

Specimen and sediment sampling: In the Anzali Lagoon, 18 traps were randomly chosen across three sites for sampling prawns. All traps were deployed simultaneously and checked every 24 hrs. Samples were collected in the morning over 20 nights per month.

Studied parameters: All collected samples were immediately placed in iceboxes and transported to the fish biology laboratory for further analyses. The samples were sorted into males and females and were counted. The total length (the distance from the rostrum tip to the end of the telson) was measured for each sample with a vernier caliper to the nearest 0.1 mm. The prawns were then weighed with a balance to the nearest 0.1 g. Samples taken in each month were measured and preserved separately.

Statistical methods: Canonical correspondence analysis (CCA) was used to analyze the total catch for prawns across the sediment gradients measured. These multivariate ordination analyses were carried out with XLSTAT2020 software.

RESULTS AND DISCUSSION

The CCA results indicated that the current set of variables explained 100.00% of the variability with the first two axes (Fig. 1). The first principal component (F1) explained 67.20% of the total variance, positively correlated fine silt, negatively correlated with and very fine sand. The F2 was positively related to clay. At the same time, F2 explains 32.80% of the variance. The CCA showed that the number of *M. nipponense* was more affected by medium sand, while the weight of *M. nipponense* was more affected by fine sand.

Canonical correspondence analysis (CCA) in this study showed a clear separation in all sites. Site 2 is more affected by clay in this site; the number and the weight of *M. nipponense* were lower than the other sites. In Sites 1 and 3, fine sand and medium sand were more affected, respectively.

In Anzali Lagoon, some areas are hot spots of sedimentation. For example, a place at Sorkankol has deposited a 20 cm sediment deposit from the Nahang Roga River[3]. This part was exactly the sampling area for Site number 2. Yancheshmeh *et al.*[7] showed that depth, turbidity and DO change more during the rainy season because of urbanization, agricultural drainage and sediment influx in the Anzali Lagoon.

Polycyclic Aromatic Hydrocarbons (PAHs) are among aquatic environments' most persistent pollutants[8]. Yancheshmeh *et al.*[7] reported that the probability of toxicity for benthic organisms is "low to medium" in the Anzali Lagoon. The toxic equivalent concentrations of carcinogenic PAHs varied between 11 and 231 ng TEQ/g[9]. In this study, the pollution factor was not tested, but this factor is one of the most important factors that can directly affect benthic organisms such as *M. nipponense* in Anzali Lagoon.

Aminisarteshnizi[1] reported length-weight relationships for *M. nipponense* in the Anzali Lagoon was an allometric growth pattern and the condition factor showed *M. nipponense* has a good condition in the Anzali Lagoon. As the results showed in this study, the number and weight of

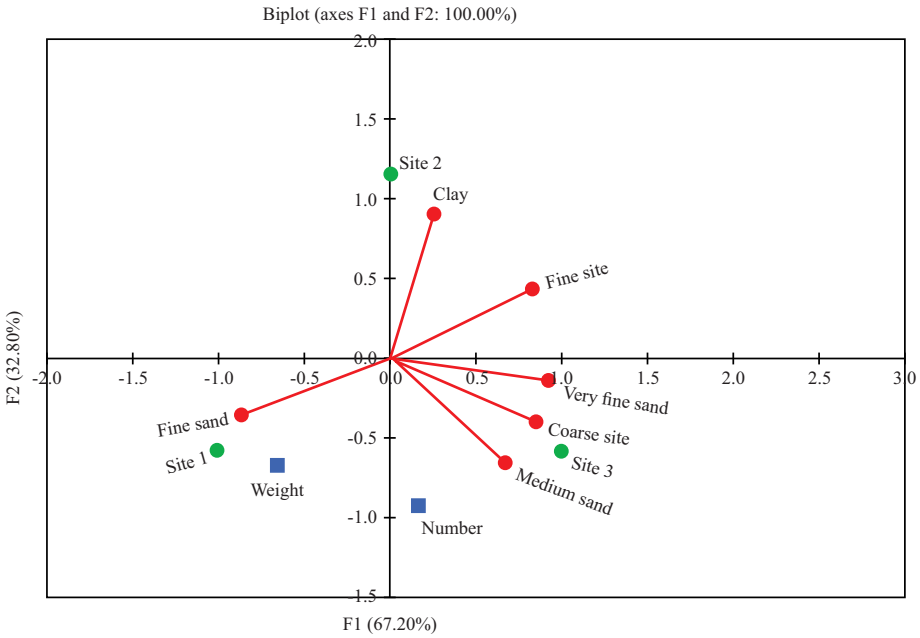

Fig. 1: Canonical correspondence analysis of *Macrobrachium nipponense* in Anzali Lagoon
Weight and number of *M. nipponense* are indicated with square symbols. The sediment structure are marked with arrows and the sites are marked with circle symbols

M. nipponense in Sites 1 and 3 was higher than in Site 2. Site 2 was more affected by the rivers and because the quality of the rivers was low, they carried a massive amount of sediment[9]. All those factors affected the number and weight of *M. nipponense* in Site 2. Schüller *et al.*[10] reported that the population of this prawn in the Anzali Lagoon was found to be in better condition compared to other parts of Iran. The total length and length-frequency data indicated that *M. nipponense* in the Anzali Lagoon were larger in size[11]. Additionally, the Anzali Lagoon was identified as having a conducive environment for the growth and habitation of *M. nipponense*[12,13].

CONCLUSION

Several factors affect *M. nipponense* in the Anzali Lagoon. One of the main factors is sediment on the bed water. The result showed that in some parts of the Anzali Lagoon, the quality and quantity of sediments are different, affecting the population of *M. nipponense*. Furthermore, because some parts of the lagoon are in good condition according to sediments and water quality, the Anzali Lagoon has great potential for the growth and sustenance of *M. nipponense*. Furthermore, managing this fishery will contribute to the conservation of the biological diversity of this ecosystem.

SIGNIFICANCE STATEMENT

This study investigated the impact of sediment on the population of *M. nipponense* in the Anzali Lagoon. This study's findings can potentially benefit aquatic ecology and management significantly. Therefore, it is crucial to understand the ecological factors, such as sediments and their effects on prawns to manage the Anzali Lagoon effectively. Furthermore, this study will assist researchers in identifying critical areas for understanding the population structure of *M. nipponense* that many researchers have not explored.

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