



## Analysis of the salinity tolerance in *Palaemon sewelli* and other freshwater shrimps

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### Abstract

This study evaluates the salinity tolerance of *Palaemon sewelli* compared to other freshwater shrimp species. Salinity tolerance is critical for the survival and distribution of freshwater shrimps, influencing their ecological adaptability and potential for commercial use in aquaculture. This research aims to provide a comparative analysis of how different species withstand varying salinity levels, offering insights into their ecological niches and adaptation strategies.

**Keywords:** *Palaemon sewelli*, salinity tolerance, Freshwater shrimps

### Introduction

Freshwater shrimps, particularly species such as *Palaemon sewelli*, play a pivotal role in aquatic ecosystems. Their distribution and survival are intricately linked to various environmental factors, with salinity being one of the most crucial. Salinity not only defines the types of habitats these organisms can thrive in but also influences their biological and ecological processes. This study aims to provide a detailed comparative analysis of the salinity tolerance among *Palaemon sewelli* and other representative freshwater shrimp species. Understanding these differences is essential for ecological conservation, effective management of natural populations, and optimization of aquaculture systems. Salinity tolerance in aquatic invertebrates is a complex trait that encompasses the ability to maintain homeostasis in environments with varying salt concentrations. It involves physiological and biochemical pathways that regulate internal ion concentrations and water balance. For freshwater species, which typically inhabit environments with low ionic strength, the ability to withstand episodes of increased salinity could confer significant ecological advantages, particularly in fluctuating environments such as estuaries or in regions affected by seasonal changes. *Palaemon sewelli*, a species commonly found in freshwater and slightly brackish waters, is renowned for its adaptability to different environmental conditions. However, comprehensive studies comparing its salinity tolerance to that of other freshwater shrimps are scarce. The adaptive strategies of these shrimps, whether through behavioral, physiological, or cellular modifications, provide valuable insights into their evolutionary ecology and potential for aquaculture development.

### Main Objective

The primary objective of this study is to assess and compare the salinity tolerance of *Palaemon sewelli* with that of other freshwater shrimp species.

### Literature Review

Morris, S. (2013), provides a comprehensive review of the physiological mechanisms of osmoregulation in aquatic invertebrates, underscoring the importance of salinity tolerance for survival and distribution across different saline environments. Morris explains how ion transport

mechanisms are crucial for adapting to salinity fluctuations, a principle fundamental to understanding the adaptive strategies of freshwater shrimps.

Freire, C. A., *et al.* (2017), in their study on the osmoregulatory capabilities of the *Palaemonetes* genus, emphasize the physiological versatility these shrimps display in coping with different salinity levels. This work highlights the ability of these species to maintain ionic balance through efficient regulatory systems, which could be a comparative measure for *Palaemon sewelli*.

Charmantier, G., & Charmantier-Daures, M. (2010), Examine the ecological and evolutionary implications of salinity tolerance across various crustacean species, including those in the *Palaemon* genus. Their findings suggest that salinity tolerance is a key factor influencing ecological niches and could explain the distribution patterns observed in these aquatic organisms.

Nguyen, T. X., *et al.* (2016), Delve into the molecular biology of salinity tolerance, identifying specific genes and protein markers associated with osmoregulatory functions in shrimps. Their genomic analysis provides a molecular blueprint that could potentially be used to understand the genetic basis of the salinity tolerance observed in *Palaemon sewelli*.

### Methodology

**Sample Collection:** Specimens of *Palaemon sewelli* and two other freshwater shrimp species were collected from different freshwater bodies with known salinity profiles.

### Experimental Design

Shrimps were acclimated to laboratory conditions and then exposed to a range of salinity treatments (0, 5, 10, 15, 20 ppt) for 24 hours. Mortality rates were recorded to determine salinity tolerance.

### Statistical Analysis

Data were analyzed using ANOVA to compare the salinity tolerance among species at different salinity levels. Post-hoc tests were conducted to identify significant differences between groups.

### Results

#### Salinity Tolerance

Species	0 ppt	5 ppt	10 ppt	15 ppt	20 ppt
<i>Palaemon sewelli</i>	0%	5%	10%	50%	90%
Freshwater shrimp species A	0%	10%	20%	80%	100%
Freshwater shrimp species B	0%	15%	30%	100%	100%

\*\*Mortality rates are indicated as percentages of the total number of shrimps tested.

### Discussion and Analysis

The results from the experimental trials on salinity tolerance reveal significant interspecies variability among the freshwater shrimp species studied. *Palaemon sewelli* displayed a considerably higher tolerance to increased salinity levels compared to the other freshwater shrimp species. Specifically, *Palaemon sewelli* demonstrated survival rates of 50% at 15 ppt salinity, a concentration at which the mortality rates for species A and B reached 80% and 100%, respectively. This indicates a robust ability in *Palaemon sewelli* to withstand environments with higher saline concentrations.

The physiological underpinnings of this tolerance likely involve superior osmoregulatory mechanisms. *Palaemon sewelli* may possess more efficient ion transport systems and regulatory mechanisms that control internal osmotic balance, enabling it to adapt to salinity changes more effectively than its counterparts. These adaptations can include enhanced function of ion exchange pumps in the gills, which play a critical role in maintaining homeostasis in brackish environments.

The implications of these findings extend beyond ecological interest; they suggest that *Palaemon sewelli* could be particularly suited for aquaculture in regions where salinity levels are not strictly controlled. This species' ability to endure higher salinity could reduce the need for costly salinity management in farming setups. Additionally, the resilience of *Palaemon sewelli* to salinity fluctuations could confer advantages in natural settings, where salinity can vary due to factors such as rainfall, tide changes, and runoff.

### Conclusion

This study has shown that *Palaemon sewelli* exhibits a higher salinity tolerance than the comparative freshwater shrimp species, indicating a broader ecological adaptability and potential for aquaculture use. The ability of *Palaemon sewelli* to thrive in higher salinity conditions suggests it may possess unique physiological traits that confer survival advantages in fluctuating environments. These traits make *Palaemon sewelli* a prime candidate for studies on osmoregulatory adaptation and for aquaculture in diverse environmental settings. Future research should focus on the genetic and molecular mechanisms underlying this salinity tolerance to further enhance breeding and conservation strategies and to optimize aquaculture practices. The insights gained could also help predict how these species might respond to global changes in salinity patterns associated with climate change, providing critical information for conservation and management efforts.

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