Osmotic Adaptation Mechanisms in *Idotea Resecata*

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Introduction

Idotea resecata is an arthropod crustacean that is found from Alaska to the tip of Baja California, and Mazatlan, Mexico [1]. The posterior border of the animal's telson is distinctively concave and the lateral edges are pointed towards the rear as well, making identification an easier undertaking. The body of the animal is generally green when on its preferred substrate, the eel grass *Zostera*. When removed from this vegetation and placed on kelp, however, *Idotea resecata* has a tendency to turn a more brownish color. *Idotea resecata* is commonly found from the surface of the water down to a depth of 18 meters [2].

The animal itself is incredibly resilient, and very well adapted to life in the water. In addition to the strong grasping ability shown in utilizing its legs, *I. resecata* has uropods modified to form trap-door-like "operculae" that can be forced open by the animal [3]. This forceful opening can allow the expulsion of fluid previously held within the uropods to act as a "jet or afterburner" and increase the speed of swimming over short distances in open water. There is also some thought that *I. resecata* may actually, during grazing on its substrate *Zostera*, be imparting a beneficial stimulus encouraging growth and repair signals within the plant itself [4]. While being very versatile animals, there are some things that these isopods cannot do. There is significant research that seems to show that *I. resecata* is more susceptible to salinity changes than its relative *Idotea Wosnesenskii*. *I. resecata* was able to survive in fresh water for 60-83 minutes, 79 minutes in 200 percent seawater, 445 minutes in 150 percent seawater, and 33 hours in 125 percent seawater [5]. While these results are interesting and valuable, there is still a

question to be answered, namely if these animals respond to decreases in salinities that are theoretically more likely than finding themselves in fresh water. It seems that the trend discovered in earlier experiments should continue, and all of these isopods should only be able to survive in reduced salinities for a time between 60 minutes and 33 hours as their bodies attempt, and fail, to cope/adapt by producing extremely large amounts of urine to drop their blood osmolalities to match their environment.

Methods

All 25 specimens examined were collected from Coos County, Oregon. They were collected at several locations due to the difficulty of finding an abundance at one location. The majority of the *I. resecata* utilized came from the eelgrass near Hungryman's Cove off of Coos Bay, Oregon. In addition, another significant quantity of these isopods was taken from the dock area adjacent to South Slough, on the far side of the Charleston Bridge from the Oregon Institute of Marine Biology (OIMB). Individual specimens were of variable size due to the higher level of difficulty in locating and isolating the species as a whole. The specimens were taken, along with the *Zostera* they were found inhabiting, back to the OIMB campus. The samples were divided into 4 groups, those to be put in pure seawater, an 85% salinity test group, a 70% test group, and a 60% test group. Tupperware containers were filled with seawater, and then diluted with fresh water from the hose until the salinities matched the theoretical values. The animals were then placed in these containers in equally numbered groups, or as evenly as was possible. Each Tupperware container was provided with its own air stone to impart fresher oxygen to the isopods within. The containers were left alone for 48 hours, save periodic check-ins to prevent malfunctions of the air stones. This time period should

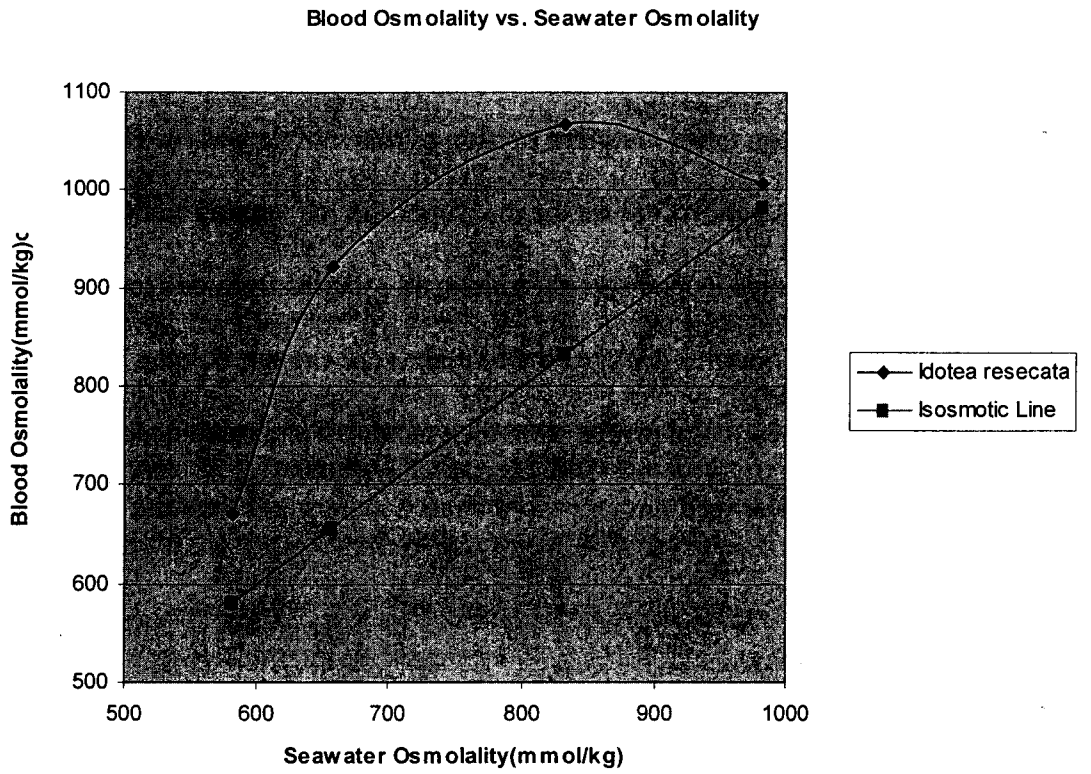
have given the isopods more than enough time to acclimate their bodies to the environment before testing. After 48 hours, isopod blood samples were drawn by syringe and placed in microcentrifuge tubes. A small portion of this sample was run through an osmometer to give blood osmolality values for the isopods in the varying salinities. As the volume obtained from each isopod was so minute, all samples from one testing salinity were pooled into a microcentrifuge tube to make sure enough volume for osmolality testing was present. The results were then tabulated and referenced against sample values of the saltwater medium they were housed in during the testing period.

Results

The results of the blood osmolality testing can be found in the table below.

	Osmolality	
%Seawater	Seawater (mmol/kg)	Sample (mmol/kg)
100%	982	1006
85%	832	1068
70%	657	922
60%	582	671

Subsequently, the blood values were then plotted with the seawater values to produce a blood osmolality versus seawater osmolality graph. The following graph contains an isosmotic line for easy reference and comparison to obtained experimental data values.



Discussion

At the conclusion of testing, all of the isopods had survived for the full 48-hour period. The only reason that there was 100% mortality was because of the nature and volume of the extremely taxing blood withdrawals from the individual animals. It was discovered that these isopods certainly did not conform to their environment by producing copious amounts of urine to drop blood osmolality values. In fact, *Idotea resecata* proved itself a strong osmoregulator, as all of the blood osmolality values were significantly higher than the environmental samples of the saltwater. In addition, the values of the saltwater osmolalities were not exactly true to the theoretical values, they were in fact lower. This means that even though the isopods were placed in water with lower salinity than planned, they still continued to osmoregulate at a strong level. It does appear from the

data that there is a limit to the ability of *I. resecata* to osmoregulate, and that that limit was almost reached with experimental testing. In any further exploration, it would be interesting to attempt to push these salinity values ever lower to determine the exact extent of the osmoregulating capacity of *Idotea resecata.* These animals provided a very interesting insight into the world they inhabit, as well as a peak at their highly adaptive physiology. While the results of the exploratory experiment did not follow the initial thinking and previous research, extremely valuable information was discovered, and will hopefully be utilized in future projects.

References

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