

**Interspecific Competition between  
Prawns in the Checkhall River**

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## ABSTRACT

On the island of Dominica, nature remains virtually untouched by humans. This makes the island an exceptional choice for biological research as well as animal habitats. With its many different ecosystems, numerous animals take refuge throughout the island. Five species of prawns coexist within the Checkhall River on the island of Dominica, two of which lack pincers. In the Checkhall River, I researched competition of prawns for available food sources in different areas of the stream, including shallow areas, deep areas, and waterfall areas. Coconut was tied to fishing line, weighted down with a rock, and used as bait. The bait line was then dropped in chosen areas of the stream and watched for interspecific interactions until a clear winner was present. Multiple trials were held in each designated spot. From the results, it is clear the *Macrobrachium* species of prawns dominate competition in the Checkhall River. I believe this is because of their larger pincers. Their pincers can be used to obtain and keep hold of a food source and intimidate other species of prawns. This research can be helpful to future biologists studying the behavioral ecology of freshwater prawns.

## INTRODUCTION

Dominica is a relatively small volcanic island located in the Lesser Antillean chain of the Caribbean. Appropriately nicknamed the Nature Island, Dominica is characterized by many different habitats including mountainous terrain, rainforests, waterfalls, lakes, and rivers (Discover Dominica Authority). These different ecosystems make Dominica an exceptional place for field biology research as they remain mostly untouched by humans and modern society. The abundant annual rainfall, ranging from 1,780 millimeters at the coast to 5,340 millimeters throughout the mountains (LukeTravels.com), leaves the rivers and streams of Dominica consistently flowing, creating a beautiful environment for underwater species.

Prawns are underwater invertebrates belonging to the Order Decapoda (BBC 2013). They are mostly nocturnal, foraging in the darkness of night to avoid predators. Prawns prefer scavenging to

obtain food sources and do not actively hunt. Although some species possess pincers on their second leg, these pincers are used to grab food and compete with other underwater animals. Males and females are easily distinguishable as males are larger than females (D'Abramo and Brunson 1996). Different species of prawns can live in the same habitat, although they compete for the same food sources. The following report discusses interspecific competition of five species of prawns located in the Checkhall River, a small stream found in the southwest area of Dominica.

Five species of prawns coexist in the Checkhall River. All five prawn species belong to two families, Atyidae and Palaemonidae (Lemmon 2004). The first family, Atyidae, consists of *Atya innocuous* and *Xiphocaris elongata*. Both species lack pincers and can be readily differentiated by their appearance. *A. innocuous* has a dark brownish color while *X. elongata* is clear in color. The second family, Palaemonidae consists of *Macrobrachium carcinus*, *Macrobrachium crenulatum*, and *Macrobrachium heterochirus*. These three species have pincers and are harder to differentiate than the aforementioned. *M. carcinus* have longitudinal dark and light stripes with equal sized pincers, *M. crenulatum* is dark brown with a light posterior and has unequal sized pincers, and *M. heterochirus* has lighter coloration with dark transverse bands and equal sized pincers (Lemmon 2004). The purpose of this experiment is to determine which species of prawn competes best for food sources in different areas of the river. I believe the Palaemonidae family will outcompete the Atyidae family due to the presence of pincers.

#### MATERIALS AND METHODS

Prawn competition data was obtained in the Checkhall River located near Springfield. Coconut was used as bait to attract the prawns throughout the trials. In order to maintain the bait in a certain area, the coconut was tied to a long strand of fishing line. A rock was tied below the coconut so the bait would sink into the area occupied by the prawns. The bait was left in a chosen area for thirty seconds. If no prawn approached the bait within the thirty seconds, it was moved to another area. With the goggles and snorkel provided, I observed the prawns approach and attack the bait until a "winner" was clear.

Winners were described as individual prawns that obtained and kept the bait for more than fifteen seconds. Once a winner was observed, the results were immediately written down using waterproof paper and a pigma pen. Five trials were held in each area in order to gain more accurate results.

## RESULTS

Prawn Competition Results			
	Waterfall	Shallow Water (<3 feet)	Deep Water (>3 feet)
Trial One	<i>M. carcinus</i>	<i>X. elongata</i>	<i>M. heterochirus</i>
Trial Two	<i>M. carcinus</i>	<i>M. carcinus</i>	<i>X. elongata</i>
Trial Three	<i>M. carcinus</i>	<i>M. carcinus</i>	<i>M.crenulatum</i>
Trial Four	<i>M. heterochirus</i>	<i>X. elongata</i>	<i>M.crenulatum</i>
Trial Five	<i>M. carcinus</i>	<i>M. crenulatum</i>	<i>M. heterochirus</i>
Overall Winner	<i>M. carcinus</i>	Tie between <i>X. elongata</i> and <i>M. carcinus</i>	Tie between <i>M. heterochirus</i> and <i>M. crenulatum</i>

Total Wins for each Prawn Species	
<i>M. carcinus</i>	6
<i>M. heterochirus</i>	3
<i>M. crenulatum</i>	3
<i>X. elongata</i>	3

In waterfall areas, *M. carcinus* was the clear winner. In the shallow area of the pool, an area with depth less than three feet, the coconut bait was equally attained by *X. elongata* and *M. carcinus*. In the deep water areas of the pool, areas three or more feet in depth, both *M. heterochirus* and *M.*

*crenulatum* acquired the coconut bait equally. Overall, the *M. carcinus* species is the most competitive when discussing food sources, followed by *M. heterochirus*, *M. crenulatum*, and *X. elongata* being equally competitive.

## DISCUSSION

Although all five species of prawns live in Checkhall River, some are more abundant than others in certain areas. The separation of the species mostly has to do with their different colorations. Darker colored prawns prefer to be near the larger, darker rocks while the translucent prawns prefer open water. Both areas of the river provide good protection from predators as the prawns are easily camouflaged to their habitat.

The prawns most abundant in the waterfall areas of the river are the *Macrobrachium* species including *M. carcinus*, *M. crenulatum*, and *M. heterochirus* (Lemmon 2004). During the waterfall competition trials, bait was placed in an area crowded with different species of prawns. It is important to mention that the waterfall trials were held near large rocks about one foot away from the waterfall. The motion and aeration from the waterfall allowed for better coverage for the prawns, which is most likely why so many different species hovered around this area. For several of the trials, *M. heterochirus* and *M. carcinus* fought over the bait for short periods of time until one prawn receded. While the prawns fought, other prawns of all species would gather around waiting for their chance at the bait. Their goal of acquiring the coconut was rarely reached. It seems that unless the prawn was the first or second to approach the bait, it had no chance of obtaining it. In the waterfall area, bait was placed in close proximity to juvenile and adult *A. innocuous* species as well as the *X. elongata* species. These prawn species did not advance toward the coconut bait throughout all five trials. I believe this is due to their lack of pincers and the large abundance of the *Macrobrachium* species. It seems the prawns without pincers have become accustomed to the *Macrobrachium* species acquiring the food first while they hold back. *M. carcinus* was the clear winner of the waterfall area trials, winning four out of five

trials. These results could have been affected by the presence of three crabs near the prawns and the waterfall area, as many prawns did not move while the crab was within several feet of them. However, the prawns that did try to obtain the coconut bait were prawns with pincers.

The shallow competition trials were held in water that was less than three feet deep. The prawns associated with shallow water include *X. elongata* and *A. innocuous* (Zapalac, Liou, Priesmeyer, Gayler 2006). Two species of prawns were able to equally access the coconut bait: *X. elongata* and *M. carcinus*. The two species are very different especially when considering the presence of pincers and the way the species approach the bait. *X. elongata* is cautious when approaching bait, and on more than one occasion, swam around the bait multiple times before making a clear move towards it. *M. carcinus* swam directly towards the bait once it was introduced. Again I believe this to correlate with the presence of pincers. *M. carcinus* is able to directly approach bait because if another prawn advanced towards it, they could fight it off with their pincers. *X. elongata* must be more cautious when approaching because it has no pincers to help defend themselves or their food. However, I believe each species were able to attain the coconut bait equally because of their different tactics. *M. carcinus* did not mind sharing the coconut bait with its own species. However, if another prawn species approached, they would be chased off and *M. carcinus* species would shortly return to the coconut. Surprisingly, *A. innocuous* did not appear once throughout my shallow water trials. I believe this is because they like to cling on the large rocks (Lemmon 2004), and my trials were held in shallow waters with little rocks and sand.

Deep competition trials were held in waters with a depth that exceeded three feet. The prawn species accustomed to the deeper waters include all three *Macrobrachium* species. *M. crenulatum* and *M. heterochirus* attained the coconut bait equally but not without some fighting. Both of these species have pincers, helping them to grab the coconut bait and fight off any other approaching prawn species. The winner of the deep competition trials usually depended on which species of prawn approached the

bait first. Fighting only occurred once within these trials, probably due to the organic matter resting on the bottom of the floor. This organic matter could provide a lot of food to the majority of prawns living in the deep areas. Although fighting occurred in this area, fighting occurred more in the waterfall areas. I believe this is because the rapid moving water causes the potential food to be flushed away faster than in the deeper areas. Thus, prawns must fight more often for the food that becomes quickly available and unavailable.

It is important to mention that these trials were conducted after almost a week of heavy rainfall. Within that time, the Checkhall River raised between one and three feet in varying areas. I believe many prawns were washed out of the experimental area and many others replaced them. The rain possibly changed the species makeup of the area I was conducting my research in, thus affecting my results. For instance, *A. innocuous* is known to be in shallower areas of the river, but I only found them in the deeper areas. Thus, it would be interesting to repeat this experiment during a dry season in Dominica, so as to confirm or reject the results.

## CONCLUSION

Dominica is a very diverse island, consisting of numerous different ecosystems. The rivers and streams of Dominica are an example of these ecosystems, and create a rich environment for the five prawn species that inhabit the island. Through my experiment and research, it was discovered that competition does exist between these five prawn species. After reviewing the results, it is clear that the Palaemonidae family, the *Macrobrachium* species, dominate prawn competition in the Checkhall River. This is largely due to the presence of pincers giving them the ability to fight off approaching prawn species when obtaining food sources. In the future, I hope this research can aid biologists understand the behavioral ecology of freshwater prawns of Dominica.

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