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# Habitat preference of Leptonema sp. (Trichoptera: Hydropsychidae) on tropical waterfalls

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# Habitat Preference of *Leptonema sp.* (Trichoptera: Hydropsychidae) on Tropical Waterfalls.

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## ABSTRACT

According to Wiggins & Mackay (1978), most Trichoptera live in cases that they have made; there are several species that attach their cases to rocks and feed from the current and others that live in the gravel of the stream. Still, there are others that are located in the areas behind rocks where there is not as much current; most Trichoptera are restricted to cool lotic waters (Wiggins & Mackay 1978b). With such variability in habitat choices available for Trichoptera, it is evident that wherever a habitat is chosen it needs to be the right one. In this study a species of Trichoptera called *Leptonema sp.* are surveyed to find if water speed across the three different regions of a waterfall effect their distribution. There was no relationship found between *Leptonema* abundance and height of the waterfall. When the abundance of *Leptonema* per rock was regressed with the surface area of the rock ($mm^3$) no significant difference was found. When the abundance means for each region were compared there was no significant difference between the above and below region, however both of those regions were marginally different from the crest, which had the most individuals. It was concluded that the *Leptonema* prefer the crest region because it is there that the fastest water flow occurs. This study is important because it allows an area of tropical stream ecology that has been studied little, to be investigated. The conservation implications of this study are long reaching. The ability to examine streams for the presence or absence of certain macroinvertebrates offers an opportunity to test the water quality of untrammeled lengths of stream, as certain kinds are useful as indicator species.

## RESUMEN

Según Wiggins & Mackay (1978), la mayoría de los Tricopteros viven en refugios que ellos construyen, existen varias species que adhieren sus refugios a rocas y se alimentan con las Corrientes y otros que viven en el suelo de las quebradas. Además existen otras que se encuentran en áreas detrás de rocas en las cuales no hay mucha corriente; la mayoría de los Tricopteros están restringidos a aguas frías lóticas (Wiggins & Mackay 1978b). Con esta gran variabilidad en hábitats disponibles para los Tricópteros, es evidente que cada hábitat escogido debe ser el correcto. En este estudio la especie *Leptonema sp.* fue estudiada para determinar si la velocidad del agua en tres regiones diferentes en una cascada afecta su distribución. No hay relación entre la abundancia de *Leptonema* y el tamaño de la cascada. No se encontró relación entre la abundancia de *Leptonema* y el área de la roca. Cuando se comparo la abundancia entre las regiones de arriba y debajo de la catarata no se encontró ninguna diferencia, sin embargo ambas regiones son marginalmente diferentes de la cresta, la cual posee la mayoría de los individuos. Se concluye que *Leptonema* prefiere la región de la cresta porque es donde el agua fluye más rápido. Este estudio es importante debido a que abarca un área de la ecología de quebradas poco estudiada con anterioridad. Las implicaciones conservacionistas de este estudio son de largo alcance. La capacidad de examinar la presencia o ausencia de ciertos macroinvertebrados ofrece una oportunidad de probar la calidad del agua en las quebradas, y ciertas especies son útiles com especies indicadoras.

## INTRODUCTION

In the past, numerous studies on macro-invertebrates have been conducted with an emphasis on habitat selection (Urbanic *et al.* 2005), habitat structure (Crisci-Bispo *et al.* 2007), and even food preferences (Slack 1936). However, little is known on macroinvertebrate selection of habitat along waterfalls. Along the course of a river where a waterfall might be found with macroinvertebrates in it, there may be differences in the speed of the water flow. Chen and Zhang *et al.* (2004) noted that there are abrupt hydrological changes that occur at waterfalls.

In agreement with Georgian & Thorp (1992), macroinvertebrates from the family Hydropsychidae have a reputation for preferring habitats with a firm and large substrate, and a high water flow velocity. The amount of dissolved oxygen in the water also may play a role in where a macroinvertebrate prefers their habitat. According to Hauer & Resh (1996) nearly all stream organisms are sensitive to oxygen concentration. In a study by Connolly & Crossland (2004), examining the effects of dissolved oxygen levels on macroinvertebrates in tropical streams; it was found that in taxa other than mayflies, death occurred when the dissolved oxygen levels fell below 8% saturation.

The macro-invertebrate of focus for this study was *Leptonema sp.* (Trichoptera: Hydropsychidae). *Leptonema* are a tropical species of the Caddisfly. Hydropsychidae can be found along the different surfaces of rocks in stream riffles; some of them roam across the rock while others stay in fixed shelters on the underside (Wiggins & Mackay 1978c). Overall, there is a wide range of habitats.

Despite all the information that is known about the habitat location of *Leptonema*, there has yet to be a study that I have found that examines the selection of habitat of *Leptonema* across the profile of waterfall's flow. The aim of this study was to discover if the change in the speed of water flow along a waterfall affected the distribution of *Leptonema.*

## MATERIALS AND METHODS

### STUDY SITE

This study was conducted in the San Luis Valley of Costa Rica during the end of the dry season, from the beginning of April to the beginning of May 2010. The site of the study was the Finca La Catarata at the San Luis River. The San Luis River is an ideal study site because it is composed of rocky terraces with many waterfalls along its course. The San Luis River resides in an area of Premontane wet forest. According to Nadkarni & Wheelwright (2000), the Premontane life zone of the San Luis Valley is highly seasonal. The altitude of the section of river that was studied is between 1000-1200 m above sea-level.

## TESTING AND SITE SELECTION

Waterfalls were examined for the presence or absence of *Leptonema*. Waterfalls were defined as areas along the stream where water was falling with a vertical incline. At the base there needed to be frothing water that was all or partially white.

Three regions were tested at each waterfall. The first region was below the waterfall. The second region was at the crest of the waterfall. The crest of the waterfall was the area that the water fell from into the below region. The third region was above the waterfall. Waterfalls along the river were selected based on whether or not they possessed all three regions. In addition, each region had to be large enough to allow for a one meter transect to be placed along the river bottom. Each region had to be accessible on foot and contain at least four lift-able rocks of at least 3 cm by 4 cm.

## METHODOLOGY

Upon selecting a study site, a 1m transect was placed horizontally across the river bottom. Any rock that touched the transect line, was lift-able, and larger than roughly 3 cm by 4 cm, was picked up. Each rock's length and width were measured using a 30cm ruler. Each rock was then visually inspected for the presence or absence of *Leptonema*. If the shelter of a *Leptonema* was found with nothing inside it, it was assumed that the *Leptonema* was away but would return and it was still noted.

A full measurement of waterfall height was recorded from the crest region (the uppermost point of where the water fell), to the surface of the frothing water below. Microsoft Excel and a statistics program called JUMP were used for graphing and data processing.

# RESULTS

A total of 60 *Leptonema sp* were located in 21 waterfalls over an approximate river gradient of 2.5 km. In all, 447 rocks were measured for their length and width. The smallest rock found in terms of surface area was 47.88 $cm^3$. The largest rock found in terms of surface area was 339.13 $cm^3$. There was no relationship found between the number of *Leptonema* on a rock and the surface area of a rock (figure 1).

The highest mean abundance of *Leptonema* was found in the crest (figure 2). For the above, crest, and below regions of the waterfalls, the counts of *Leptonema* found were: above 17, crest 29, below 14. The tallest waterfall tested was 1m, while the smallest waterfall tested was 22 cm. When the abundance of the below regions of the waterfalls was regressed with the height of the waterfalls, there was no significant relationship between the two variables (figure 3).

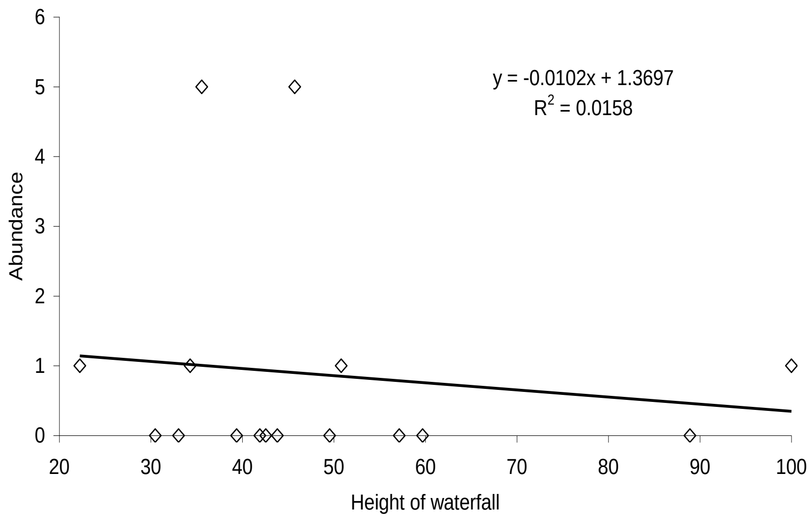


Figure 1. Total *Leptonema* found per rock to the surface area of the rock ($cm^3$) for 21 waterfalls in the San Luis River, San Luis, Costa Rica. Linear Regression, F = 0.017, p = 0.90.

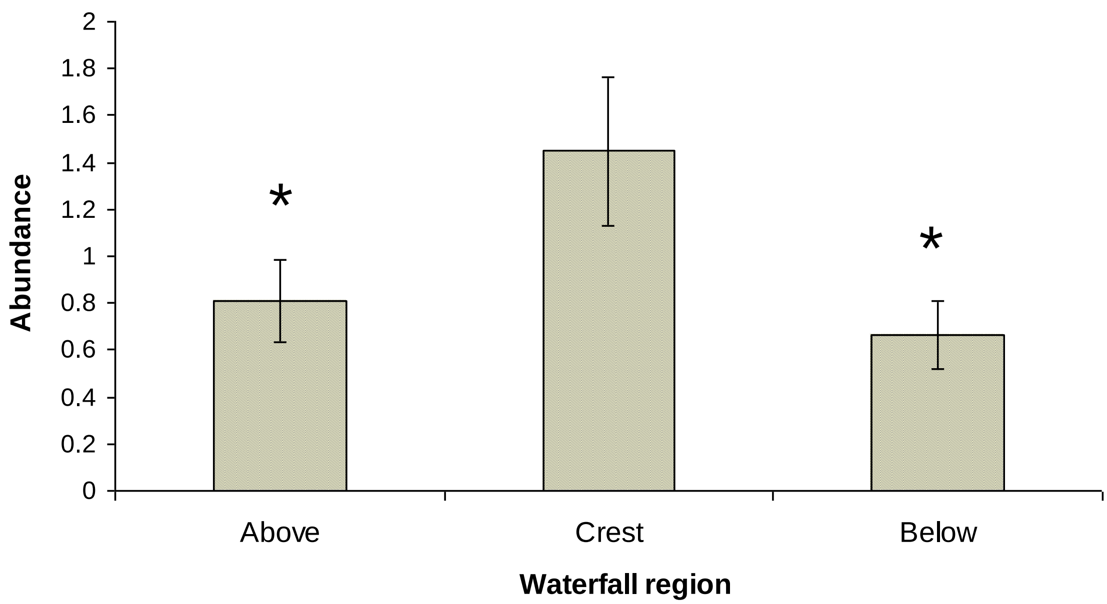


Figure 2. Mean abundance of *Leptonema* (+/- 1 SD) to waterfall zones from 21 waterfalls in the San Luis River, San Luis, Costa Rica. Asterisks above, the above and below regions indicate that these regions were not significantly different from each other, however they were marginally significant from the crest. (K-W: chi= 5.82 df = 2, p = 0.05)

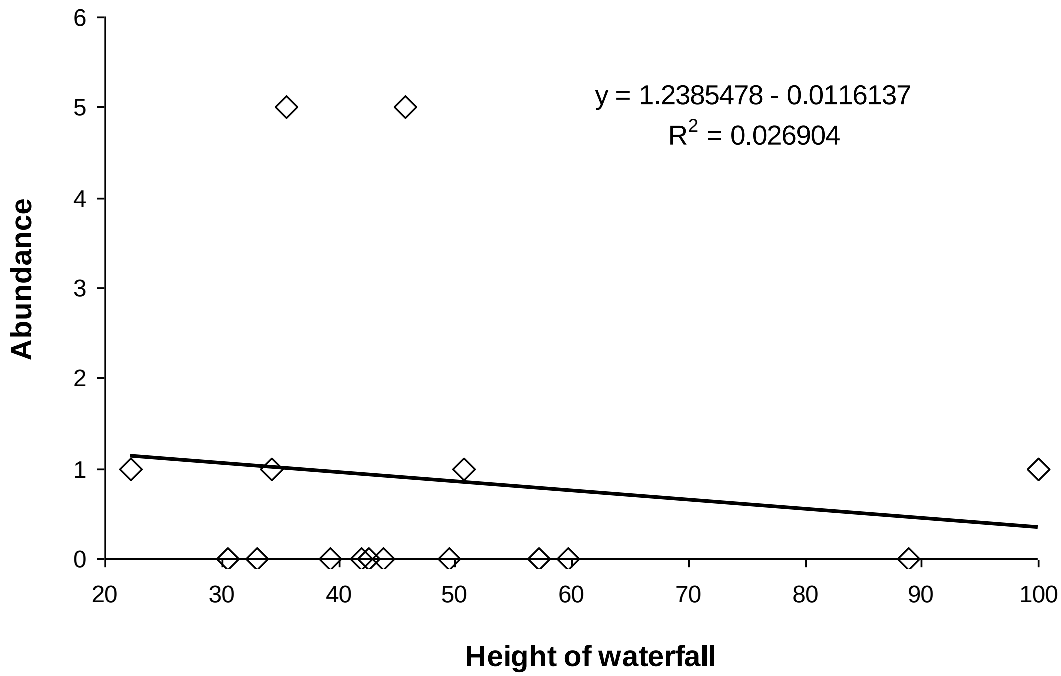


Figure 3. Abundance of *Leptonema* for region below the waterfall (N = 21), in the San Luis River, San Luis, Costa Rica. Linear Regression, F = 0.52, p = 0.48.

## DISCUSSION

There were more *Leptonema sp.* found in the crest region of all the waterfalls than any other region. Something about the crest of the waterfalls caused a larger abundance of *Leptonema*. Abundance of *Leptonema* was not related to the surface area of the rocks found in the waterfalls. The abundance of *Leptonema* in the below region was not related to the height of the waterfalls. The fact that more *Leptonema* were found in the crest region than any other region suggests that an undetermined variable such as water speed, could explain why this occurred. The observations that were made in the field suggest that the water flow's the fastest at the crest region. It is at the crest region that the water is subject to the laws of gravity as it falls downwards. According to Chen & Zhang *et al.* (2004), water velocity and the exchange between air and water increase greatly at waterfalls. This could explain why the *Leptonema* choose to procure a habitat in the crest region. Due to higher speeds of water flow they view this region as a possibility to gather more food. In a study examining the effects of microhabitat selection on feeding rates of Hydropsychidae (Georgian & Thorp 1992), it was found that areas of high water flow were chosen by 96% of Hydropsychid larvae as habitat in colonizing artificial moss substrates. Another study that examined three species of Trichoptera in a stream in Canada, found that they preferred shallow and fast moving water with large moss covered rocks (Williams & Hynes 1973).

The implications of this study can serve as a scientific endowment in a very specific area of ecology that seems to have not been studied very much. It can also serve as a primer for conservation of streams and rivers in the tropics. According to Goodnight (1973), when an aquatic organism is present it can provide indications of the condition of the stream. As deforestation continues in Central America, though it is not as much as in the Amazon, the importance of being able to monitor streams and rivers for water quality testing for human consumption will likely rise.

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