DOI

UNDERSTANDING THE EFFECTS OF FLOW RATE ON POPULATION DISTRIBUTION OF WATER BOATMAN *CORIXIDAE*

Haley Carrasco

ABSTRACT

Flow rate is the volume of fluid that flows past a fixed point in an stream. The flow is a function of water volume and velocity that can be effected by weather or seasonal changes. This is important because it has an impact on water quality and living organisms as well has the habitat in the stream. This study was performed to test the effect that the abiotic factor of flow rate can have on habitat and if the change increases the mortality of Water Boatman *(Corixidae)*. A transplant study was conducted on a total of sixteen Water Boatmen that were collected from a lake site with no flow. Half of the insects collected were placed back into the site where it was collected from and the other half was placed in a creek with a fast flow rate. The experiment was run for a total of a week. The data collected encompasses whether the species were living or dead in both the control and transplanted site. The results indicate that Water Boatman were unaffected by the abiotic factor of flow rate. This suggests that the abiotic factor is not what is preventing the distribution of the species. Overall the data demonstrates that flow rate had no correlation to the mortality of Water Boatman.

Key words: Water Boatman (Corixidae), flow rate, mortality, distribution, habitat

INTRODUCTION

Distribution is the geographic area where individuals of a species occur which can be directly affected by abiotic and biotic factors that are unique to every habitat. Depending on a species history and their dispersal capabilities it can determine whether they occupy large areas or are restricted to small regions. Groups of species with low dispersal ability are more native and vulnerable to disturbances like human activities or even weather. Flow rate is an abiotic factor which can impact physical habitat, the alteration or disturbance of a habitat can make species incapable of inhabiting the area. For example, low flow restricts the connectivity and diversity of habitat driving patterns of distribution affecting the composition of a biota, trophic structure, and carrying capacity (Rolls et. al., 2012). Understanding distribution is important because it can give insights to why species remain where they are and the traits that restrict them from dispersing. In this study the Water Boatman were selected because this species has an incredible dispersal ability they are able to fly and can sometimes be found in bird baths or even pools. This led me to ask the question why these aquatic insects could not be found in a creek a short distance from a lake with a high abundance of Water Boatman. Transplanting these species into an environment where they are not

DOI

found can allow us to evaluate its dispersal ability as well as the factors make survival difficult.

The water boatman can be found at the bottom of a pond or streams among underwater vegetation. The insects habits consist of a diet of algae and other small organisms, while breathing through an envelope of air stored under its wings. The study will specifically address how flow rate can make the survival of the Water Boatman difficult. Flow rate it makes it harder for freshwater algae and the necessary vegetation to grow that it uses to anchor themselves to prevent it from floating to the top of the water and eat its diet. Additionally, the differences in habitats that are caused by flow rate would make it an unsuitable habitat. The hypothesis tested is that Water Boatman are unable to inhabit environments with high flow rates as their normal habitats are still bodies of water. Studying this relationship is important because it demonstrates the distribution patterns of Water Boatman. Furthermore, this can help us understand the range of habitats the species can survive in taking abiotic factors into account.

FIELD SITE

This study took place at two different sites. The first site is a lake and the second is a creek in Cresco, Pennsylvania. The species were all collected from Ski Haven lake with lots of vegetation and no flow. The second site was Swiftwater Creek which is where the treatment group was transplanted. Swiftwater Creek is relatively fast flowing and does not have a lot of vegetation.

METHODS AND MATERIALS

The Water Boatman (Corixidae) were all retrieved from Ski Haven lake at random using a fishing net to capture the insects. The total number of species in each group used was eight allowing two animals per transplant pod, reusable K-cups were used as transplant pods which allow enough water flow in without losing the specimen. Four control groups were placed back into Ski Haven lake where the insect was found and four treatment groups were place into Swiftwater Creek. The transplant pods in areas where it would be completely submerged and anchored it on vegetation in an open area as this the habitat the Water Boatman are found in. In Ski Haven lake the transplant pods were placed near the outer banks near vegetation rather than the open water and it was anchored by industrial wire. The transplant pods in Swiftwater Creek were placed near the edge of the creek where they were completely submerged and near vegetation and substrates mimicking the environment that would be found in Ski Haven Lake. Lake. The flow rate was measured using a nerf bullet and meter stick then it was timed to detect approximately how fast the creek flowed which is called the float method.

RESULTS

After collecting data on the survival of both the control and transplanted groups, a raw data table was created to show the number of individuals that survived at both sites. The data table below represents all sixteen of the insects used for the transplant experiment. The table below shows true number of insects at the control site Ski Haven lake and Swiftwater Creek categorized as dead or alive.

	SKI HAVEN LAKE	SWIFTWATER CREEK
ALIVE	8	8
DEAD	0	0
TOTAL	8	8

Table 1. The table demonstrates results of the transplant study at Ski Haven lake and Swiftwater Creek after a week. I recorded the number of individuals found alive or dead in both sites, the data reported are the raw values of the insects transplanted.

The raw data table above shows that in both sites all of the insects survived. This indicates that there is no relationship between the abiotic factor of flow rate in the transplanted areas because all of the insects lived. The effect of flow rate was measured by the species mortality rate and the transplant study showed that there was no significance between the variables of mortality versus flow rate.

DOI

DISCUSSION

The study of the abiotic factor of flow rate shows that it can have a direct effect on habitat affecting the patterns of distribution for animals (Rolls et. al., 2012). The purpose of my study was to illustrate how flow rate can effect the mortality of Water Boatman because the different conditions present in habitats. To determine the effect flow rate had on the insect in my study I measured whether the insects lived or not in the transplanted area. I found that this was not significant because all of the transplanted individuals survived after a week of treatment. The relationship found in my study is not consistent with the literature I read that suggests flow rate can have an effect on distribution by altering a habitat. The survival of the insects can be attributed to the seasonal alteration of habitat as well as the brief week long treatment period. Observing that both Water Boatman in the control group in Ski Haven Lake and the transplant group in Swiftwater Creek survived lead me to the conclusion that the effect of flow rate had an insignificant effect. This can indicate that the Water Boatman may be able to inhabit Swiftwater Creek however there may be other factors that would limit their distribution in that habitat.

While conducting this experiment I faced the setback of heavy storm that swept away a large number of my transplant pods. This transplant study was repeated because I could not collect enough data after a large number of samples went missing. However, the repeated study had no setbacks or missing insects when returning for collection after a week. The lack of significant data indicates that abiotic factors may not be the reason that the insects are not present in Swiftwater Creek.

LITERATURE CITED

Rolls, R. J., C. Leigh, and F. Sheldon. 2012. Mechanistic effects of low-flow hydrology on riverine ecosystems: ecological principles and consequences of alteration. Freshwater Science 31:1163–1186.