A Comparison of Estuaries in Dominica

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Abstract

For this study we performed various methods of ecological sampling over a two week period in order to record variances in the characteristic traits of 3 different estuaries found throughout the Caribbean island of Dominica. Throughout the study various types of data were recorded for analyses. Some of the data was comprised of photographs to document the different species of fish inhabiting each of the estuaries. We also collected data regarding the flow rate, depth, width, dissolved oxygen levels, salinity, and temperature.

Introduction

Dominica is a pristine island located in the eastern Caribbean, also known as the nature island. Relatively unchanged since the island was discovered by Christopher Columbus on his second voyage both the forests and the waters surrounding the island host a variety of thriving ecosystems (Honeychurch, 1993). These ecosystems include the estuaries found on the island. An estuary is defined as a partially enclosed body of water along the coast where freshwater meets and mixes with saltwater from the ocean (water.epa.gov). Over the course of two weeks, we traveled to and surveyed 3 estuaries. Batalie Beach, located on the west coast, St. David's Bay on the east coast, and the Roseau River located in the capital city of Roseau. This study was designed to analyze a range of characteristics between these locations. The hypothesis used was that variations in flow rate will allow different levels of salinity to permeate up the estuary, in turn influencing which species may survive in the given environment.

Methods and Materials

To effectively study and compare the various estuaries a total of nine pieces of equipment were used. A 50-meter tape was used to measure the width and depth of each location. Flagging tape was used to mark 10 meter intervals along each transect that was run. To determine flow rate a Geopacks Flow Meter model MFP51 was used. An Extech RF20 refractometer was used to determine the level of salinity along each transect. Temperature and dissolved oxygen readings were obtained using an Oakton DO 110 meter. A mask and snorkel along with an Olympus Tough TG-610 digital camera were used to capture images for identification of the different species of fish. All data obtained was recorded on an underwater slate.

Upon our arrival at each estuary the 50 meter tape was used to assess a 30 meter transect line starting at the mouth of the estuary and moving upstream. Flagging tape was then used to mark 10 meter intervals along this transect. The reel tape was also used to measure water depth at the center point of the estuary at each of the 10 meter intervals. In addition to depth salinity readings were also taken every 10 meters. To determine salinity a few drops of water were placed onto the prism of the refractometer. The cover plate was then laid down and the refractometer was held towards the light to obtain a salinity reading. The Geopacks Flowmeter was employed at each interval for a total of 60 seconds. The Geopacks Flowmeter records the amount of signal pulses from the impeller stick. Once the number of impulses was recorded, the equation found in figure 1 was used to determine velocity in m/s. In order to acquire accurate dissolved oxygen readings the Oakton dissolved oxygen meter had to be saturated in the water for 20 minutes prior to use. Once saturated the unit was submerged at each 10 meter interval to measure the amount of dissolved oxygen (mg/L). The unit was allowed to stabilize and the reading was recorded. The temperature readings were also taken at the same time as dissolved

oxygen. Three group members then used masks and snorkels to survey the estuary for individual species of fish. The digital camera was used to capture images of the species found. Back at the station the photos were uploaded to laptops and then enhanced using Adobe Photoshop CS4. All data was later compiled into an Excel worksheet and copied into a Word document.

Figure 1

Results

Each table is titled by location. The columns represent the different types of data obtained while rows indicate the intervals at which the data was found. Following the tables are photographs of the species of fish found throughout the estuaries. Under each picture are the genus and species name of the photographed fish and where it was located.

Table 1

Batalie Beach						
	Depth (meters)	Width (meters)	Salinity (PPT)	Dissolved Oxygen (mg/L)	Temperature (°C)	Flow Rate (mph)
0 meters	0.11	2.8	0	8.26	24.8	1
10 meters	0.52	12	0	7.97	24.8	0.054
20 meters	0.71	14.3	0	7.87	24.7	0.054
30 meters	0.48	14.3	0	7.67	24.7	0.054

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St. David's Bay/Castle Bruce River						
	Depth (meters)	Width (meters)	Salinity (PPT)	Dissolved Oxygen (mg/L)	Temperature (°C)	Flow Rate (m/s)
0 meters	1.23	8.8	0	7.68	26.5	0.46
10 meters	1.28	23.16	0	7.52	26.5	0.18
20 meters	1.13	23.5	0	7.44	26.5	0.32
30 meters	0.9	23.7	0	7.62	26.5	0.30

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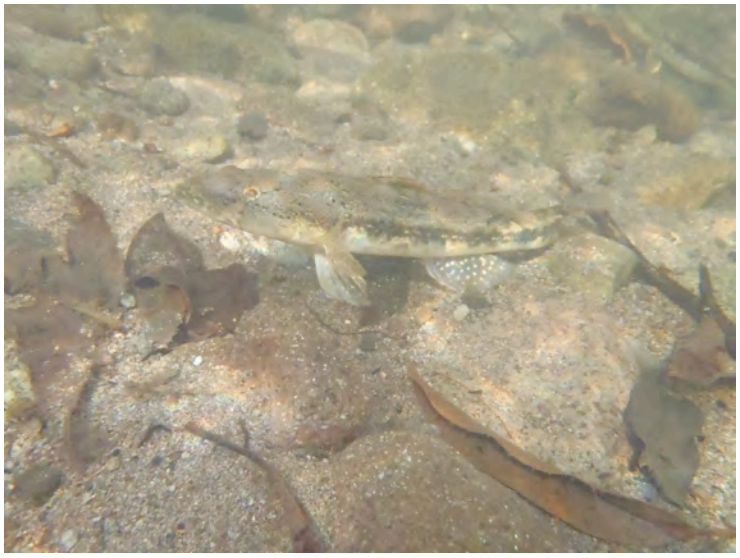
Roseau River						
	Depth (meters)	Width (meters)	Salinity (PPT)	Dissolved Oxygen (mg/L)	Temperature (°C)	Flow Rate (m/s)
0 meters	0.9	5.8	0	8.83	26.5	1.35
10 meters	0.79	18.14	0	8.82	26.6	0.34
20 meters	0.4	38	0	8.88	26.7	0.26
30 meters	0.3	40.76	0	8.88	26.7	0.49

Centropomus parallelus- Fat snook

Location: Batalie Beach, St. David's Bay, Roseau

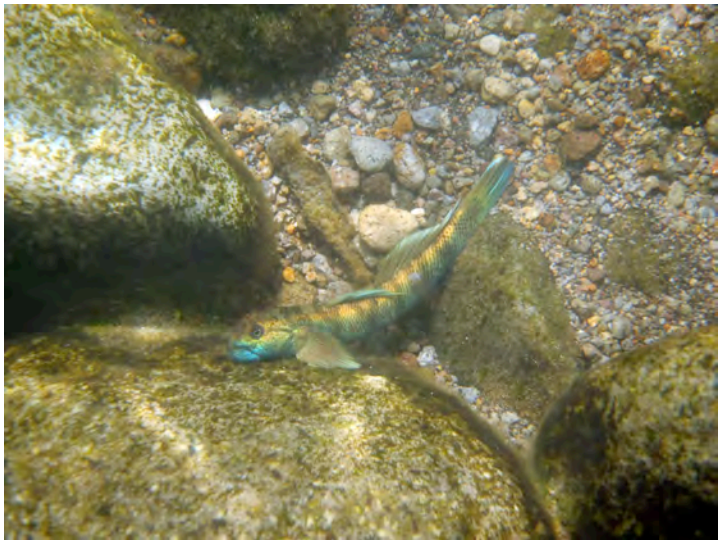
Big Mouth Sleeper- *Gobiomorus dormitory*

Location: Batalie Beach, St. David's Bay, Roseau River



Sicydium punctatum- Blue Morph

Location: Roseau River



Sicydium punctatum- Brown morph

Location: Batalie Beach, St. David's Bay, Roseau River

Sicydium punctatum- Orange morph

Location: Batalie Beach

Awaous banana—River goby

Location: Roseau River

Agonostomus monticola—Mountain Mullet

Location: Batalie Beach, St. David's Bay, Roseau River

Syacium mircrurum- Channel Flounder

Location: St. David's Bay

Discussions and Conclusions

Table 1 indicates that flow rate was highest at Batalie Beach at the 0 meter interval where salinity was measured at 0 ppt. Moving upstream along the transect line flow rates as well as dissolved oxygen levels decreased. Throughout the estuary salinity readings remained constant at 0 ppt. Temperature remained relatively steady while width and depth increased slightly.

Table 2 for Castle Bruce River shows fluctuating flow rates and depths, while dissolved oxygen generally decreased. The width increased most between the 0 and 10 meter interval and only increased slightly over the next 20 meters. Temperature held a constant 26.5 degrees Celsius while salinity was a consistent 0 ppt.

In table 3 for Roseau River, flow rate was greatest at 0 meters and decreased until the 30 meter interval where it increased once again. Dissolved oxygen decreased slightly from 0 meters to 10 meters then increased at the 20 meter interval and remained stable thereafter. Temperature was fairly steady along the transect, and salinity remained at 0 ppt. Depth and width held an inverse relationship; depth decreased while width increased.

The results of the study show that salinity and temperature data did not change significantly across the estuaries. Salinity was not detected at any point throughout the study. Temperatures hovered between 24.7°C and 26.7°C among the estuaries, but we did not find this to be a significant change. Flow rate had an increasing and direct relationship with dissolved oxygen while both generally had an inverse relationship with increasing intervals. At Batalie Beach and St. David's Bay, both width and depth usually increased as we moved upstream. However, at Roseau River width increased and depth decreased.

While many of the fish species noted were found in all three estuaries, we were particularly pleased to find *Sicydium punctatum* (orange morph) at Batalie Beach as it proved

difficult to come across. The most interesting species identified was the *Syacium mircrurum*, commonly known as the Channel Flounder.

During the course of this experiment, our hypothesis was not supported by the data. Salinity was measured at 0 ppt throughout the study while flow rate varied. Therefore, we did not observe any relationship between the two variables. Although this relationship was nonexistent, various species were found at each site. Further studies on variables such as predator density, food supply, shaded area, or water quality could be conducted to explain the species diversity.

Other factors that could be taken into account should further studies be done include stream profile, time of day, weather conditions, tide levels and characteristics of stream bottoms. Potential errors that may have occurred during our data collection include fluctuations in the dissolved oxygen meter, inaccurate measurements due to the strength of the flow, misidentification of species and species unaccounted for.

Works Cited

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