

Flow Rate and the density of *Gobiidae*, *Sicydium punctatum*, in Dominica  
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**Abstract:** During a three-week field biology study abroad in Dominica, an island in the Lesser Antilles, the flow rate of water was taken in areas where gobies were found. Data were collected from areas of high density, low density, and in which no gobies were present. The data indicate that gobies prefer a fairly constant current and were only located in areas with very similar flow rates. In these samples gobies were found in areas with flow rates of 5.37 to 7.26 cm/sec. They were not found in high flow areas (108 cm/sec and up) and were not present in low/no-flow areas (0 cm/sec as measured by the flowmeter).

**Introduction:** Dominica is home to several species of goby, including, but not limited to, *Sicydium punctatum*, *Sicydium antillarum*, *Poecilia reticulata*, and *Gobiesox punctulatus*. The species observed most frequently in this research was *Sicydium punctatum*, one of the most common gobies on the island. The Check Hall River and Middleham Falls pool were sites where data was collected for this paper. I was interested in determining if was there any relationship between goby presence and flow rate; if gobies have an optimal flow rate at which they congregate (groups of 10 and larger); and if there was any difference between day and night preferences. My hypothesis is that gobies do have an optimal range of water flow.

**Materials:**

- Flowmeter
- Dive mask
- Snorkel
- Dominica Nature Island Wildlife Checklist
- SCEPTRE Field Station
- Underwater camera
- HACH Dissolved Oxygen Test

**Methods:** Data collection was done as follows:

A river or aquatic area was located. Then the area was explored searching for gobies. Five sites were found in the Check Hall River and one in a pool near Middleham Falls (approximately 30 meters away from the falls). When finding the sites the facemask and snorkel were used to facilitate locating and counting gobies. The counting also served as a rough indicator of relative population size at that particular flow rate. Gobies were found in central regions of larger ponds. Stream flow was measured in the vicinity of the gobies, at the inlet and outlet of the ponds. The inlets and outlets were typically regions of faster stream flow. Either that day or the next day a flowmeter was taken to the site and the flow was taken. Flow was measured in counts per ten-second-time period. This number was the converted to counts per second. This number can then be converted to centimeters per second using a chart on the flowmeter or using



calculations (see results). The appearance of the gobies was used for a preliminary means of identification. An underwater camera was also used to take pictures of the gobies for a secondary identification. Flow rate data was also collected for sites near the gobies and for sites with no gobies to serve as a comparison and for additional information. The sites were visited both day and night to gather data to see if different areas were favored at different times during the day. Water samples from low/no flow, goby, and high flow sites. The water was then taken to the lab and tested with a HACH Dissolved Oxygen test as the directions indicated. All of the data collected were then analyzed.

### Results:

Formula: 
$$\frac{\# \text{ counts} \times \text{Rotor Constant}}{999999} = \text{Distance in Meters}$$

$$\frac{\text{Distance in Meters} \times 100}{\text{Time in seconds}} = \text{Speed in cm/sec}$$

Site #1 Check Hall River Approximately 20 gobies sighted  
15° 20' 44 N, 061° 22' 09 W, and Altitude 1095ft  
21 counts/10 seconds

$$\frac{21 \times 26873}{999999} = .564 \text{ meters}$$

$$\frac{.564 \times 100}{10} = 5.64 \text{ cm/sec}$$

Site #2 Check Hall River Approximately 2 gobies sighted  
15° 20' 44 N, 061° 22' 08 W, and Altitude 1103ft  
27 counts/10 seconds 7.26 cm/sec

Site #3 Check Hall River Approximately 2 gobies sighted  
15° 20' 44 N, 061° 22' 10 W, and Altitude 1080ft  
20 counts/10 seconds 5.37 cm/sec

Site #4 Check Hall River Approximately 0 gobies sighted  
15° 20' 44 N, 061° 22' 10 W, and Altitude 1080ft  
0 counts/10 seconds 0 cm/sec

Site #5 Check Hall River Approximately 12 gobies sighted  
15° 20' 44 N, 061° 22' 11 W, and Altitude 1125ft  
23 counts/10 seconds 6.18 cm/sec

Site #6 Middleham Falls Approximately 23 gobies sighted  
15° 20' 29 N, 061° 20' 20 W, and Altitude 1976ft  
21 counts/10 seconds 5.37 cm/sec



Range where gobies present 5.37 to 7.26 cm/sec Mean = 6.02 cm/sec

No-goby sites (inlets, outlets, and regions where flow seemed to be too high or low):

181.393 cm/sec, 98.0865 cm/sec, 83.3064 cm/sec, 0 cm/sec, and 106.148 cm/sec

Dissolved Oxygen levels:

Low/No Flow 9 mg/L

Flow where gobies present (5-7 cm/sec) 11 mg/L

High Flow 12 mg/L

**Discussion:** The data indicate that gobies prefer a certain range of flow rates, but there is no flow rate that is key to goby population density. They do not congregate in very high flow areas or areas with no flow at all. They were observed to be present in some high flow areas for brief moments, i.e. moving to another area or swimming away from researchers. No gobies were found in areas of low/no flow, this is because of the lower oxygen levels associated with stagnant water, 9 mg/L as compared to the 11 mg/L and 12 mg/L in the goby areas and high flow areas respectively. The gobies tended to be in the 5.37 to 7.26 cm/sec water areas that are near areas of high flow (like adjacent to a strong current). The data support the hypothesis that the gobies prefer a certain flow rate because they were only found in the regions where the flow rate was very similar. The data is of some use to future researchers, giving a narrower region to search for the gobies. It was also observed that the gobies were not very active at night in the Check Hall River, this is possibly due to the large prawn population that is active at nights. A correlation between higher population densities and altitude might be a possible follow-up experiment. Possible errors might have been because of researcher error and/or flowmeter error. Researcher error could come from not seeing some of the smaller goby populations; a solution to this could be using several researchers to look for the gobies in overlapping sweeps of the waters. Another possible researcher error is the possible agitation/oxygenation of the stagnant sample during collection and transport, possible solutions could be testing dissolved oxygen in the field using digital meters. The flowmeter error could be from the fact that the meter is meant for higher flow marine currents; a solution is to use a flowmeter designed for lower speed flows.

In conclusion, the data yielded no single flow rate that indicates a high population of gobies. There was however a narrow range of flow rate where all of the gobies were found to be congregating. It did indicate that gobies have a tendency to congregate near areas where there is a higher flow and do not congregate where there is no flow. Gobies were not found to be active at night, possibly because of



possible predation. This work can be the basis for more in depth studies on the gobies of Dominica.

**Citation:**

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