

**Dominica Tropical & Field Biology Study Abroad 2016:
Which species of *Sicydium* Gobies are present on the island of Dominica, West Indies?**

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Abstract

Various species of gobies in the genus *Sicydium* have been identified throughout the western Central Atlantic and eastern Central Pacific oceans. Specimens of three different *Sicydium* species were identified on the Caribbean island of Dominica: *Sicydium punctatum*, *Sicydium plumieri*, and *Sicydium buscki*. Each species was collected and analyzed in order to identify characters that would be useful for distinguishing between each species. Dentition was used as a form of identification, as was physical characterization and substrate scraping speed. A description of key characteristics for each species is presented. Each species exemplifies a different range of characteristics based on its life stage, which makes it difficult to identify individuals to the level of species. Because of this, a much more thorough taxonomic review of *Sicydium* is still needed.

Introduction

Dominica has relatively few freshwater fishes compared to other Caribbean islands (FishBase, 2016). All of Dominica's freshwater fishes migrate between marine water and freshwater (diadromy) at some stage in their life cycle. This includes the amphidromous gobies of the genus *Sicydium*, which are all native to Dominica (FishBase, 2016). Like other gobies, members of the genus *Sicydium* have the pelvic fins fused across the midline to form a ventral adhesive disc (Maie et al., 2007). This adhesive disc allows gobies to adhere and cling to the substrate of fast flowing rivers and streams and even enables *Sicydium* gobies to climb waterfalls (Maie et al., 2007). *Sicydium* gobies feed by scraping diatoms or algae from hard substrates and have highly modified teeth that are adapted for scraping (Patzner et al., 2012).

Three different species of *Sicydium* have been identified in Dominica by Burback et al. (2010), including: *S. plumieri*, *S. punctatum*, and *S. antillarum*. A potential fourth species, *S. buscki*, is also believed to be present on Dominica (K. W. Conway, pers. obs.). All four species are very similar in general appearance and are difficult to identify both in the field and in the laboratory. The confusion surrounding the identification of the species of *Sicydium* present in the freshwaters of Dominica could be alleviated through detailed morphological investigation of freshly collected material. The purpose of this study is to determine how many species of *Sicydium* inhabit the Caribbean island of Dominica.

Methods

This study was conducted over a period of 17 days at four different sample sites: Checkhall River, Belfast River, Castle Bruce River and Middleham Falls. Gobies were collected through the method of snorkeling and dip-netting. Once collected, they were transported alive in a five gallon bucket to the Archbold Tropical Research and Education Center (ARTEC). Once back at the facility, the gobies were humanely euthanized in clove oil and fixed in 10% formalin for preservation. For a select few, DNA samples were extracted before being added to the formalin for further future analysis. While in formalin, their fins were spread to investigate potential features that may distinguish a species. Any noteworthy specimens were photographed

(Fig. 1) laterally and ventrally. After all specimens were captured and recorded, each was scrutinized for distinguishing characteristics that could help in identifying sex, age and species.

Results

A total of 46 specimens, representing three species of *Sicydium* (*S. punctatum*, *S. plumieri*, and *S. buscki*) were collected. Four specimens were collected from the Checkhall River, twelve specimens were collected from the Belfast River, and thirty specimens were collected from Castle-Bruce. Each *Sicydium* species studied exhibits distinct characteristics that differentiates them (Table 2).

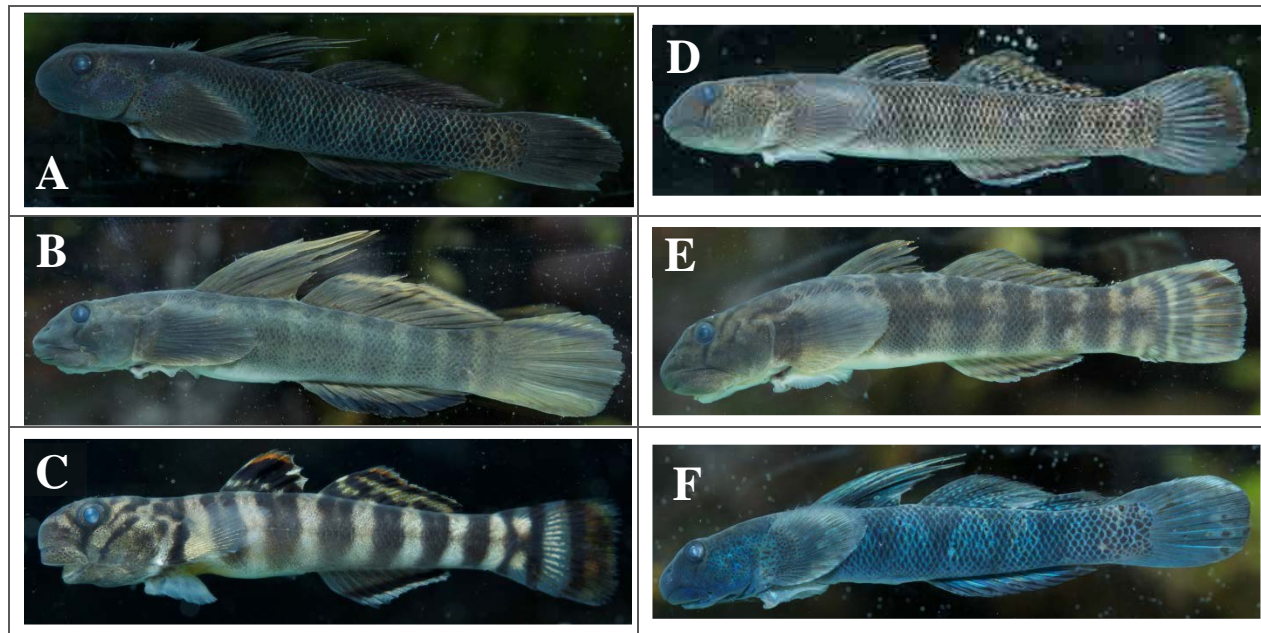


Figure 1. Specimens of *Sicydium* collected during this study. **A.** *Sicydium buscki*, male. **B.** *Sicydium plumieri*, male. **C.** *Sicydium plumieri*, juvenile. **D.** *Sicydium* sp., female, potentially *S. punctatum* or *S. buscki*. **E.** *Sicydium plumieri*, female. **F.** *Sicydium punctatum*, male.

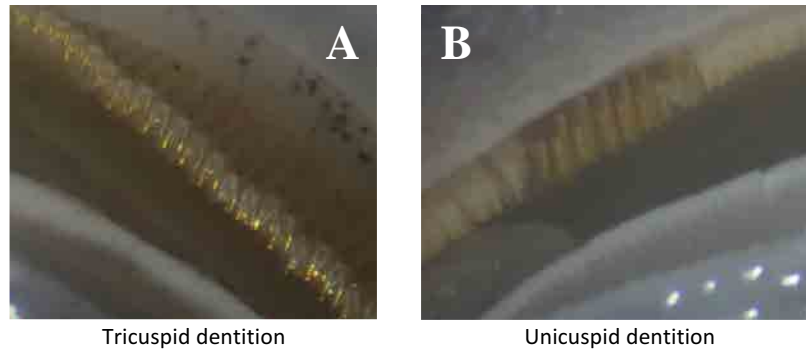


Figure 2 Dentition of *Sicydium*. **A.** Tricuspid teeth of *Sicydium punctatum* **B** Unicuspid teeth of *Sicydium plumieri*.

Both *S. punctatum* and *S. buscki* have a smaller range in head length compared to *S. plumieri* (3.9–13.5 mm, 9.8–16.2 mm, and 8.0–25.3 mm respectively). *S. plumieri* has the largest range in scraping frequency (2–6 scrapes per second) and has a decreasing scraping frequency as the head length of the individual increases. *S. punctatum* had a range of 9–11 scrapes per second and *S. buscki* had a range of 3.5–6.5 scrapes per second. (from the project “An Investigation of Substrate Scrapping behavior in three species of sicydiine gobies (genus *Sicydium*) inhabiting freshwater streams on Dominica, West Indies” by Wendy Diaz)

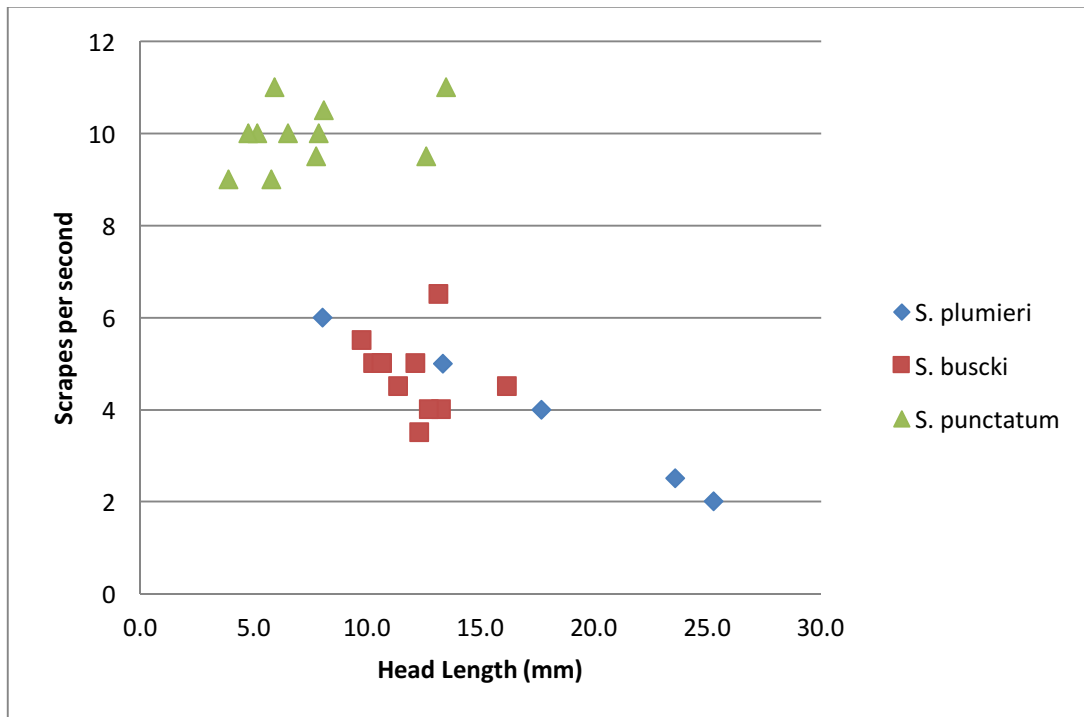


Figure 3 Frequency of scrapes plotted against head length (mm) for *S. punctatum* (n=11), *S. buscki* (n=11), *S. plumieri* (n=5), and unknown (n=2).

Table 1 Average size and average scraping frequency of *Sicydium* species.

	Average Head Length (mm)	Average Scrapes per Second
<i>S. buscki</i>	12.1	4.7
<i>S. plumieri</i>	17.6	3.9
<i>S. punctatum</i>	7.4	9.9

Table 2 Identification Table for studied species from the genus *Sicydium* on the island of Dominica.

Characteristics								
Species/ Sex	Color	Body Pattern	Dentition	Head	Dorsal Fin	Size Range	Average scrapes per second	Mouth
<i>S. punctatum</i> Male	Blue coloring.	vertical bars are "Y" / "V" shaped markings	tricuspid	Spots present on cheeks.	Filaments extend past membrane on anterior dorsal fin. Black and vibrant blue coloring on dorsal fin.	22.0 – 71.2 mm	9.9	Inferior mouth type. Posterior most point of mouth does not extend past posterior margin of eye.
<i>S. buscki</i> Male	Black spotting on scales with gold edging.	Faint vertical bars are "Y" / "V" shaped markings.	unicuspid with "heart-shaped" edge	May or may not have spots present on cheeks.	Filaments extend past membrane on anterior dorsal fin. Dark colored dorsal fin with light colored tips. May have light colored spots covering posterior dorsal fin.	42.4 – 71.0 mm	4.7	Inferior mouth type. Posterior most point of mouth does not extend past posterior margin of eye.
<i>S. plumieri</i> Male	Light brown in color.	vertical bars are "H" shaped markings.	unicuspid	Lacks spotting on the cheeks.	Filaments extend past the membrane on anterior dorsal fin.	32.3 – 117.0 mm	3.9	Inferior mouth type. Posterior most point of mouth extends past the posterior margin of the eye

Discussion/Conclusion

Based on our findings, there are at least three species of *Sicydium* present in the freshwaters of Dominica. The three species for which we have examined material include *S. buscki*, *S. plumieri*, and *S. punctatum* (Fig. 1). The fourth suspected species, *S. antillarum*, was not observed at any of the specified sample sites. According to Watson (2000) and Ryan Chabaria (pers. comm.), *S. antillarum* is a junior synonym of *S. plumieri* and is not a valid species.

Only minute differences serve to distinguish between each of the three species of *Sicydium* present on Dominica. This includes aspects of head shape, color pattern, mouth position, and teeth shape. *Sicydium plumieri* is the most easily identifiable species of *Sicydium* on Dominica. Members of this species exhibit a large mouth, the posterior most point of which extends past the posterior margin of the eye (vs. posterior most point of mouth does not extend past posterior margin of eye in *S. punctatum* and *S. buscki*). *Sicydium plumieri* also lacks spotting on the cheeks (vs. spots present on cheeks in *S. punctatum* and *S. buscki*). Additionally, both *S. plumieri* and *S. buscki* have unicuspid teeth, while *S. punctatum* has tricuspid teeth. (Fig.2). Finally, *Sicydium plumieri*'s distinct black and white, striped coloration is not as obvious in its adult form (Fig. 1B & 1E), but is very prominent in its juvenile form (Fig. 1C).

The characteristics used to differentiate *S. punctatum* and *S. buscki* are less obvious in the field, as these two species are very similar. The two differ in both morphology of upper jaw teeth and intensity of coloration (Fig. 1A & 1F). *Sicydium buscki* also exhibits a black spotting on the scales of the body, whereas spotting is less noticeable on the body of *S. punctatum*. Other than possible genetic differences, the two species can also be distinguished by the speed at which members of both species scrap the substrate during feeding. Based on Diaz (2016), there are clear differences in scraping speed between *S. punctatum* and *S. buscki* (Table 1; Figure 3). The scraping speed of *S. punctatum* is twice as fast as the scraping speed of *S. buscki* and *S. plumieri*.

The identification of *Sicydium* gobies has always been problematic. Multiple characters must be considered together in order to achieve accurate identification. The morphological characters that we have identified in Table 2 combined with new information on the substrate scraping behavior of *Sicydium* gobies (Diaz, 2016) should make it easier for future researchers to identify the *Sicydium* gobies inhabiting the freshwaters of Dominica to the level of species, whether they are working with preserved material or observing live individuals via snorkeling whilst belly crawling in the beautiful streams of Dominica.

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