

**A Preliminary Study of *Sicydium* and Prawn Population Density of Pools in the Spring
Field River Above and Below Road Construction.**

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Abstract

This study was conducted to show effects of construction sites where materials were poorly contained and exposed to habitats of freshwater fish. In this case, on Dominica a road was expanded (Imperial Road) in the summer of 2010 on the southeast end of the Archbold Tropical Research and Education Center (ATREC) where road materials and chemicals were exposed to the Springfield River. This river is habitat to many species of gobies and many species of prawns. To determine if the construction last summer had an impact on the species a survey was done in 5 pools downstream from the bridge and 5 pools upstream from the bridge. With the survey and an estimation of pool volumes, a population density can be established and then compared between upstream pools and downstream pools. This study will reveal whether the construction had effect on the fauna in the Springfield River.

Introduction

Dominica has a huge road restoration project underway on many major roads around the island. The impact that construction has on wildlife habitats can be detrimental or minimal depending on the responsibility of the construction companies. At the southeast end of the Archbold Tropical Research and Education Center (ATREC) is a newly expanded road (Imperial Road) constructed in the summer of 2010 which crosses the Springfield River (formally named Checkhall River). Clear signs of a poorly managed job can be seen underneath at the bed of the stream including: piles of asphalt spilled from the road, yellow paint spills on rocks, paint can lids downstream, concrete piles near the bridge and old steel road railings half submerged in the stream. Springfield River is habitat for many

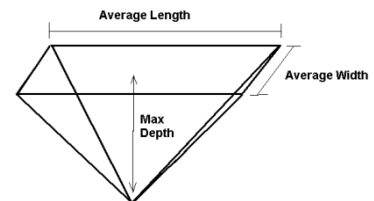
species of fish and prawns including the most noticeable gobies (*Sicydium punctatum*, *Sicydium antillarum* and *Sicydium plumieri*) and five different species of prawns (*Atya innocuous*, *Xiphocaris elongata*, *Macrobrachium carcinus*, *Macrobrachium crenulatum* and *Macrobrachium heterochirus*). Presently, ~212 genera and 1,875 species from the family Gobiidae have been reported, making Gobiidae the largest marine fish family. On average gobies are some of the smallest vertebrates, never exceeding 10 cm in length (Murdy and Hoese 2004). Prawns are decapods which inhabit bodies of freshwater, morphologically similar to the saltwater shrimp. The most noticeable difference is that prawns have two pinchers. This trait allows prawns to reach in rock crevices in streams and lake bottoms in search of food (Elovaara, 2002). It is critical to take all wildlife into consideration when construction is required especially in such sensitive areas as a river. A group of Texas A&M students did a research project over habitat study of *Sicydium* species within the Springfield River in June of 2010 just before the bridge construction. Their project was motivated to construct a pool population density comparison between five pools upstream from the bridge/ construction disturbance and five pools downstream. Results should indicate whether the construction had an impact on the fauna that inhabit the Springfield River. The hypothesis is that the construction site had an effect on all species downstream and surveying should show reduced population density in pools below the site versus pools above. If the hypothesis is proved correct, this study will bring light to the importance of maintaining good



construction planning and containing all materials for better disposal.

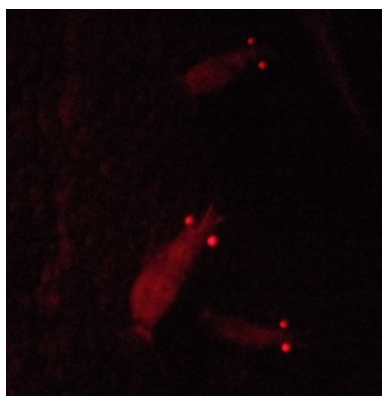
Materials

- Head lamp
- Red filtered light
- Snorkel
- Water mask
- Underwater writing tablet
- 50 meter tape measure



Methods

First pools must be measured in length, width, and depth in units of meters. An average length and width for each pool are taken along with the maximum depth. We then get a rough estimate of volume in the pool by calculating the volume of an inverted pyramid ($(\text{length} \times \text{width} \times \text{depth})/3$). Next a mask, snorkel, and underwater tablet are required for getting into the pool and identifying and surveying the different species of *Sicydium*. Surveys are done two different days around noon when the sun is directly overhead and



the brightest. Surveys started at pool 10 which is the farthest pool downstream and worked up to pool 1 which is the farthest upstream. This was done to avoid stirring up debris and clouding up the water in pools not yet surveyed. Later at around 9:00 pm a red filtered light is used to shine in the pools and count prawn eyes. The red filter makes prawn eyes

glow bright. Same plan of action used for surveying Gobies is followed for prawns, start

from pool 10 and work up to pool 1. All data is then put into an excel worksheet where correlation between fauna accounted for and volume of pools are made. Then a comparison between pools upstream and downstream from construction site is made.

Results

Table 1: Shows the measurements of pools 1-10 in meters and the volume in meters cubed

Table 1	Length (meters)	Width (meters)	Depth (meters)	Volume (m ³)
pool 1	8.8	3.89	0.6	6.846
pool 2	13.34	5.93	0.7	18.458
pool3	14.6	9.41	0.84	38.468
pool 4	15.89	4.46	0.86	20.316
pool 5	14.5	6.8	1.73	56.859
pool 6	10.7	5.6	1.36	27.164
pool 7	12.8	4.23	0.82	14.799
pool 8	13.72	4.59	0.82	17.213
pool 9	10.3	6.3	0.71	15.357
pool 10	12.67	8.78	1.44	53.396

Note: Lengths and widths are averages, depth is maximum depth of pool.

Table 2: Shows the results from the first survey. Pools 10-6 were surveyed on 1/6/11 at 2:00pm. Pools 5-1 were surveyed on 2/6/11 at 12:00pm. Prawns were surveyed 2/6/11 at 9:00pm.

Table 2	<i>Sicydium punctatum</i>	<i>Sicydium antillarum</i>	<i>Sicydium plumieri</i>	prawns
Pool 1	14	0	1	33
pool 2	41	3	0	57
pool 3	46	2	3	128
pool 4	34	4	0	33
pool 5	19	1	0	20
pool 6	25	2	2	20
pool 7	20	2	1	10
pool 8	32	3	2	33
pool 9	32	3	4	13
pool 10	23	6	4	73

Table 3: Shows the results from the second survey. Pools 10-1 were surveyed 5/6/11 at 12:00pm. Prawns were surveyed 5/6/11 at 9:00pm.

Table 3	<i>Sicydium punctatum</i>	<i>Sicydium antillarum</i>	<i>Sicydium plumieri</i>	prawns
pool 1	12	1	0	26
pool 2	15	1	0	35
pool 3	24	3	0	125
pool 4	19	4	1	16
pool 5	16	1	0	30
pool 6	11	2	0	16
pool 7	10	0	0	15
pool 8	29	3	1	53
pool 9	16	2	1	24
pool 10	19	1	1	162

The results from these surveys were averaged up for each pool and a ratio was then conducted for species per meter cubed in each pool to calculate population density. Once population density was established, a comparison of overall population density above bridge and overall density below bridge was made.

Table 4: Shows averages of *Sicydium* species and prawns from surveys 1 and 2 along with the volume of each pool. This data will be used to calculate the population density.

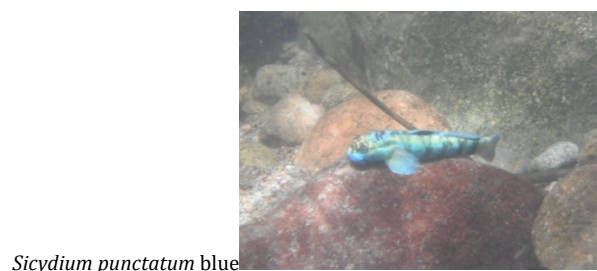
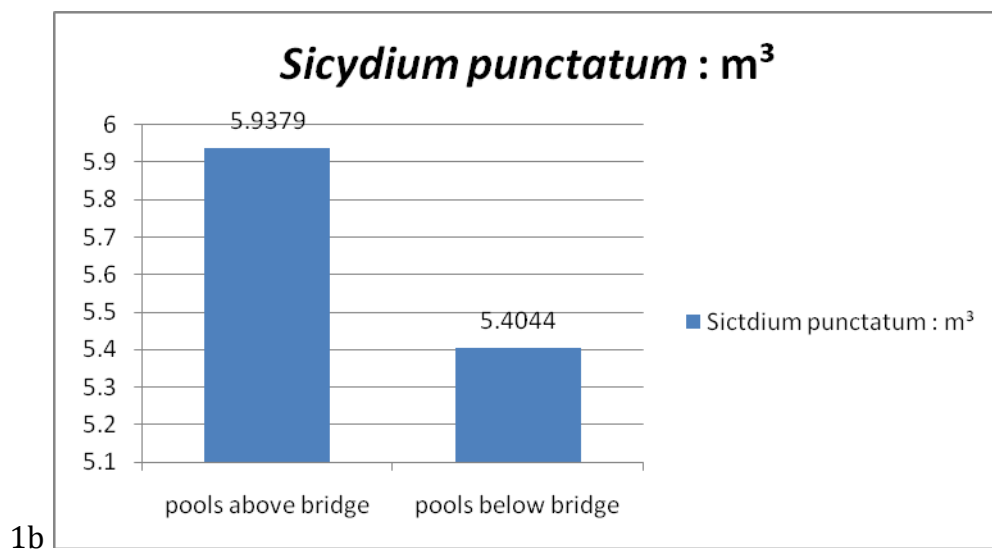
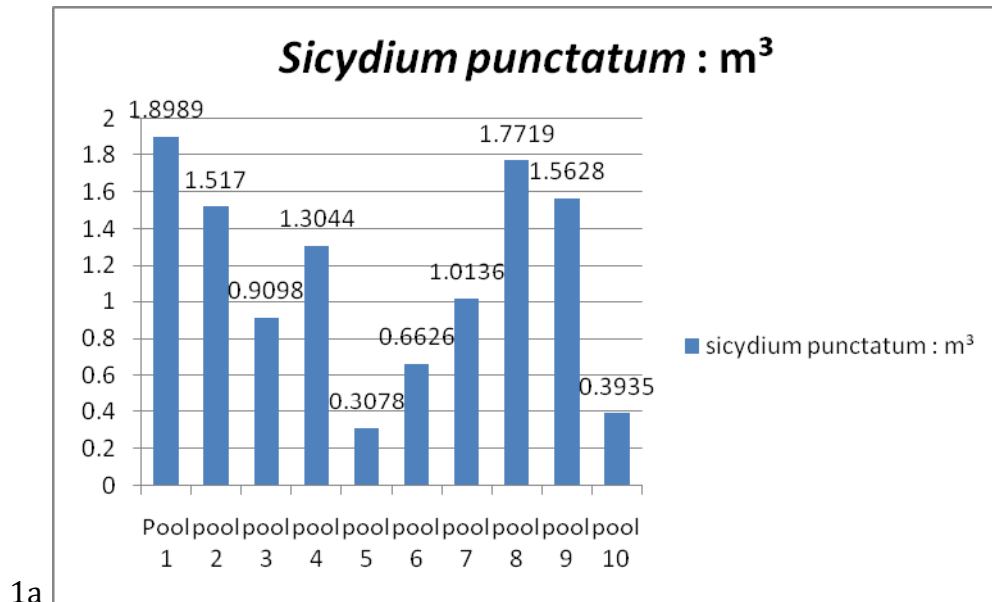
Table 4	Avg. <i>Sicydium punctatum</i>	Avg. <i>Sicydium antillarum</i>	Avg. <i>Sicydium plumieri</i>	Avg. prawns	Volume (m ³)
pool 1	13	0.5	0.5	29.5	6.846
pool 2	28	2	0	46	18.458
pool3	35	2.5	1.5	126.5	38.468
pool 4	26.5	4	0.5	24.5	20.316
pool 5	17.5	1	0	25	56.859
pool 6	18	2	1	18	27.164
pool 7	15	1	0.5	12.5	14.799
pool 8	30.5	3	1.5	43	17.213
pool 9	24	2.5	2.5	18.5	15.357
pool 10	21	3.5	2.5	117.5	53.396

Table 5: Shows population density for each pool. Density was calculated by averaging surveys and dividing result by volume to establish how many species inhabit 1 meter cubed.

	<i>Sicydium punctatum</i> : m ³	<i>Sicydium antillarum</i> : m ³	<i>Sicydium plumieri</i> : m ³	prawns : m ³	<i>Sicydium</i> : m ³
pool 1	1.8989 : 1	.0730 : 1	.0730 : 1	4.3091 : 1	2.0450 : 1
pool 2	1.5170 : 1	.1084 : 1	n/a	2.4921 : 1	1.625 : 1
pool3	.9098 : 1	.0650 : 1	.0390 : 1	3.2884 : 1	1.0138 : 1
pool 4	1.3044 : 1	.1969 : 1	.0246 : 1	1.2059 : 1	1.5259 : 1
pool 5	.3078 : 1	.0176 : 1	n/a	.4397 : 1	.3254 : 1
pool 6	.6626 : 1	.0736 : 1	.0368 : 1	.6626 : 1	.7730 : 1
pool 7	1.0136 : 1	.0676 : 1	.0338 : 1	.8447 : 1	1.1150 : 1
pool 8	1.7719 : 1	.1743 : 1	.0871 : 1	2.4981 : 1	2.0333 : 1
pool 9	1.5628 : 1	.1628 : 1	.1628 : 1	1.2047 : 1	1.8884 : 1
pool 10	.3935 : 1	.0655 : 1	.0468 : 1	2.2005 : 1	.5058 : 1

Note: *S. antillarum* and *S. plumieri* are very similar morphologically to *S. punctatum*, *S. antillarum* has vertical black stripes that do not cross the back where as the black stripes of *S. punctatum* do cross the back with shapes similar to the letters V, X, Y, or I (Bell et. al., 1995). *S. plumieri* is a lighter brown almost tan.

Graph 1: 1a shows population density of *Sicydium punctatum* in pools 1 – 10, 1b shows population density in pools above bridge and pools below bridge.

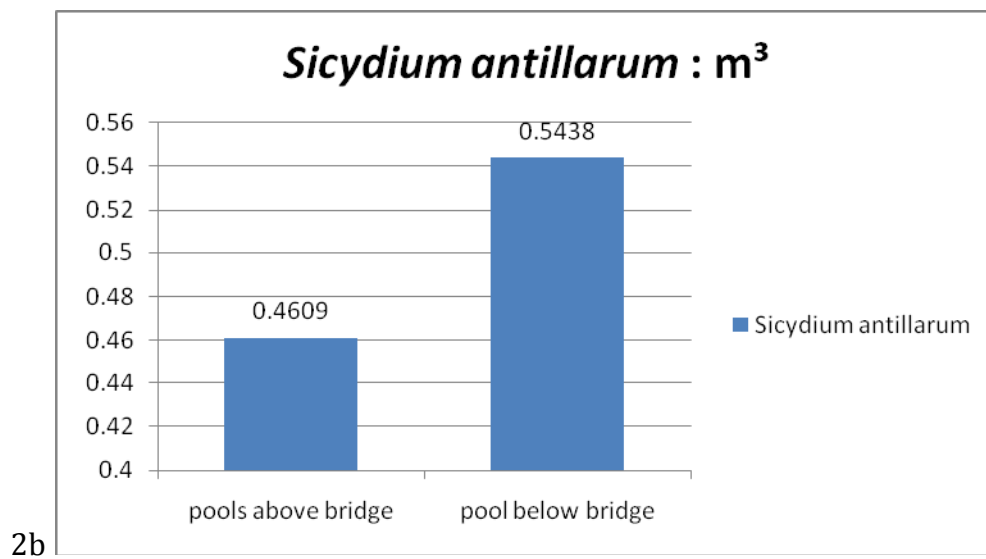
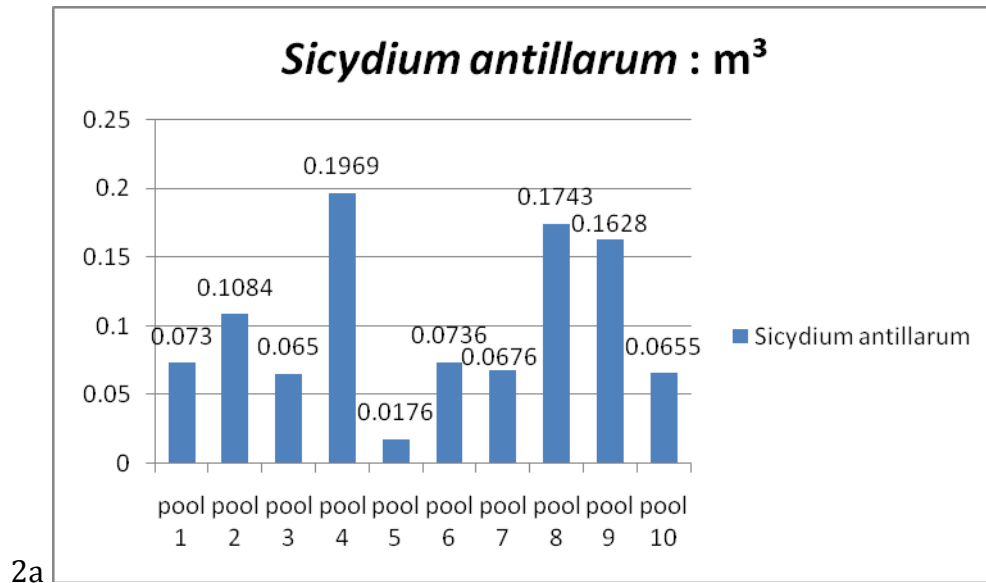


Sicydium punctatum blue

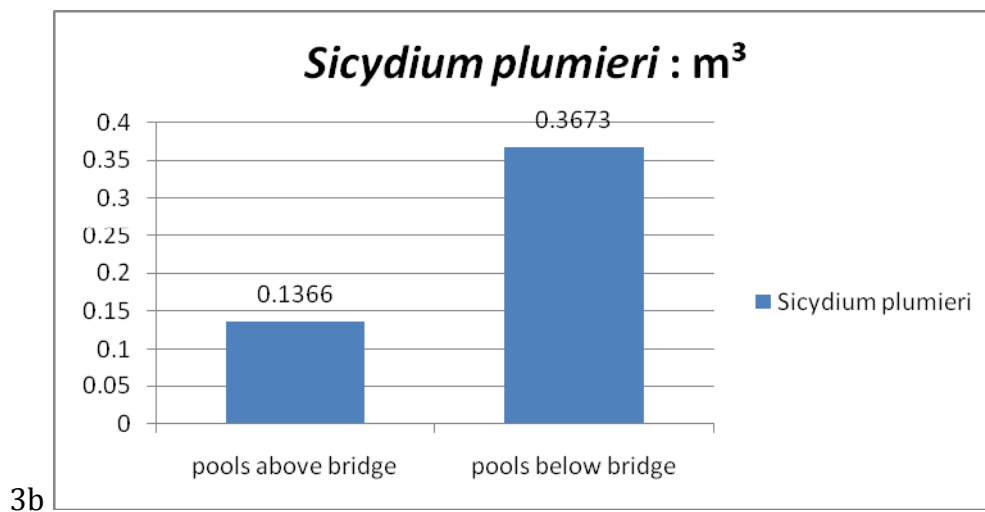
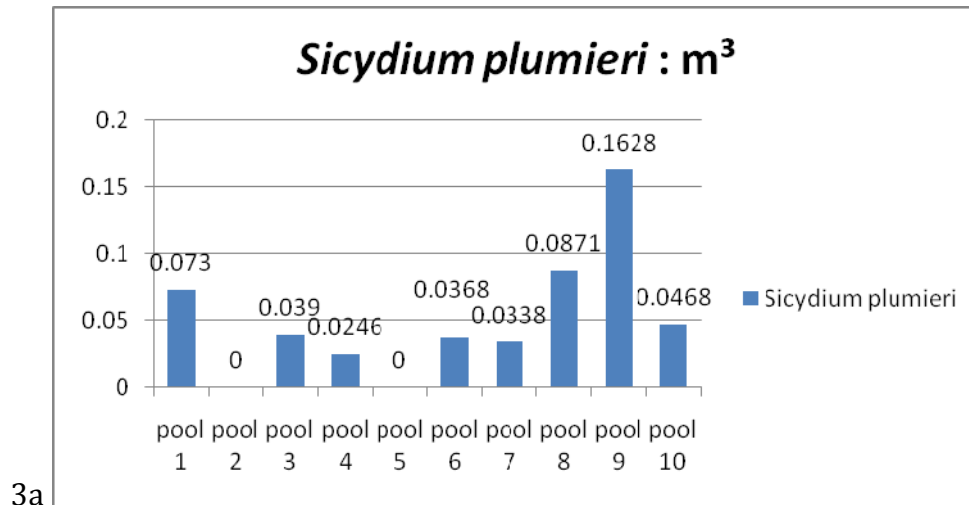


Sicydium punctatum brown

Graph 2: 2a shows population density of *Sicydium antillarum* in pools 1 -10, 2b shows population density of pools above bridge and pools below bridge.

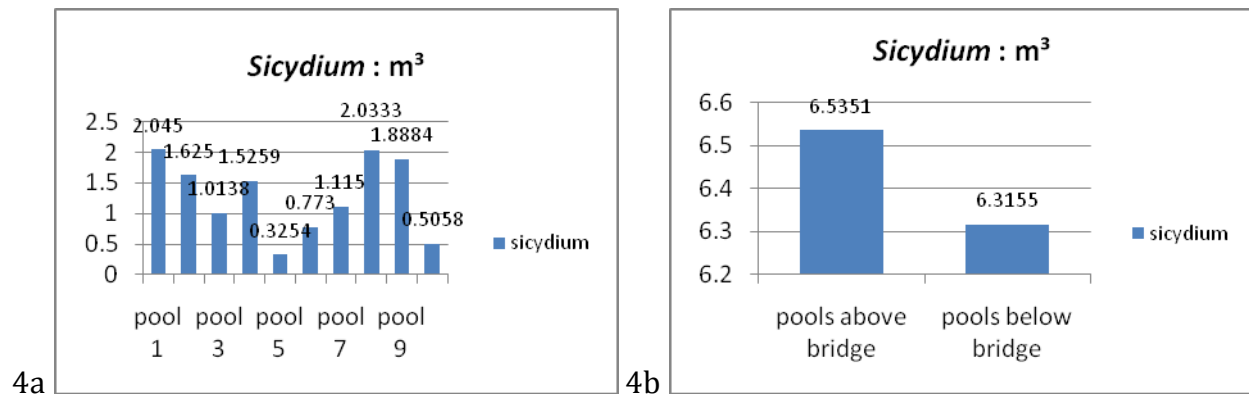


Graph 3: 3a shows *Sicydium plumieri* population density in pools 1 – 10, 3b shows population density of pools above bridge and pools below bridge.

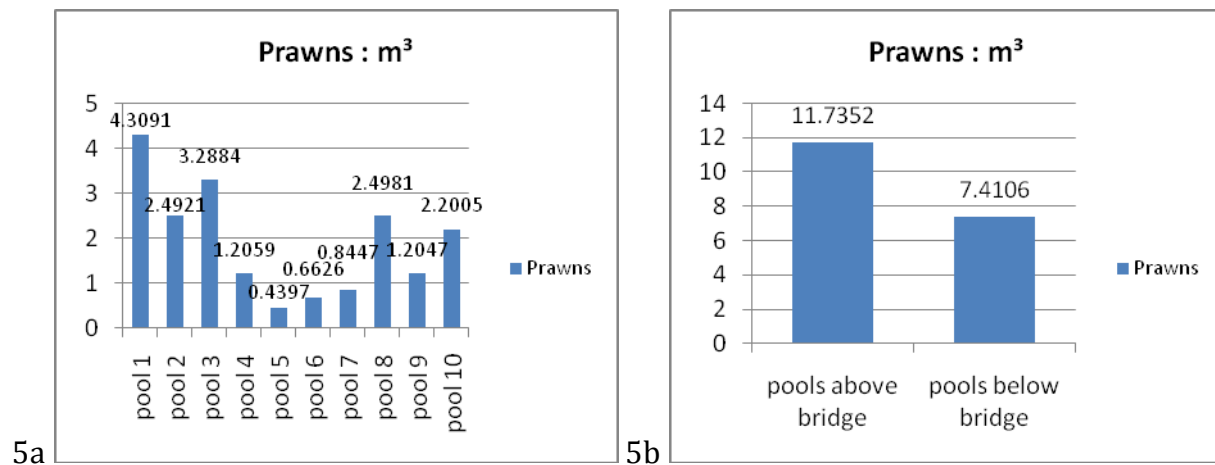


After population density was calculated for each *Sicydium* species surveyed and then calculated for the genus *Sicydium* (graph 4).

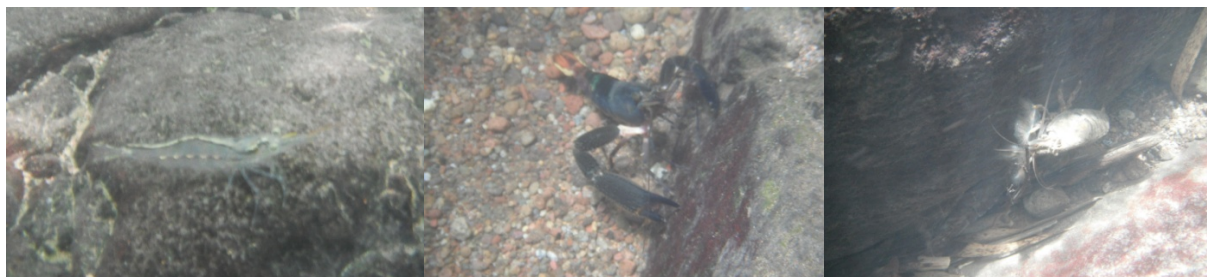
Graph 4: 4a shows the population density of all *Sicydium* species surveyed to get an estimation of gobies found in each pool. 4b shows the difference of *Sicydium* density in pools above bridge and pools below bridge.



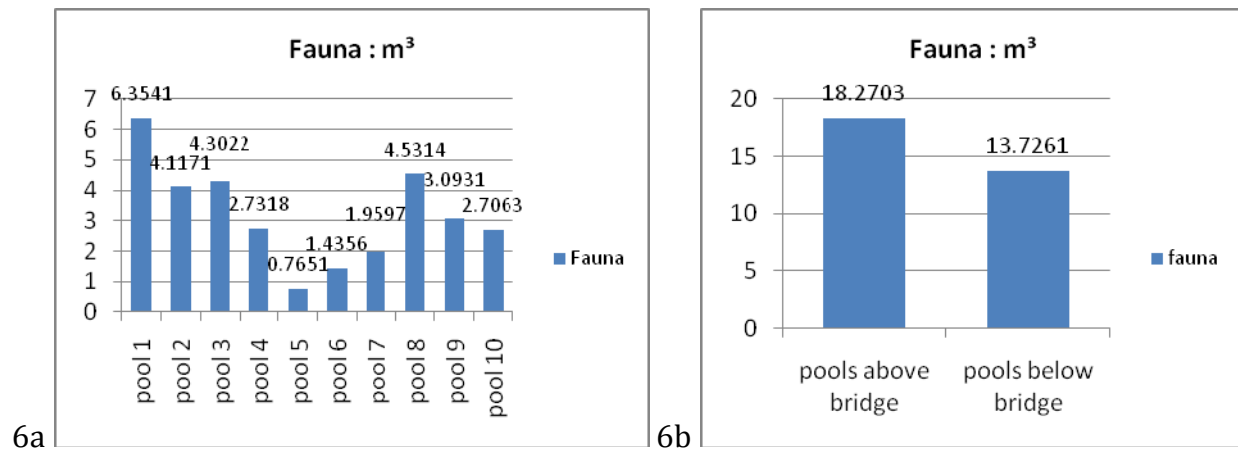
Graph 5: 5a shows the population density of prawns in pools 1 – 10, 5b shows prawn population density in pools above bridge and pools below bridge.



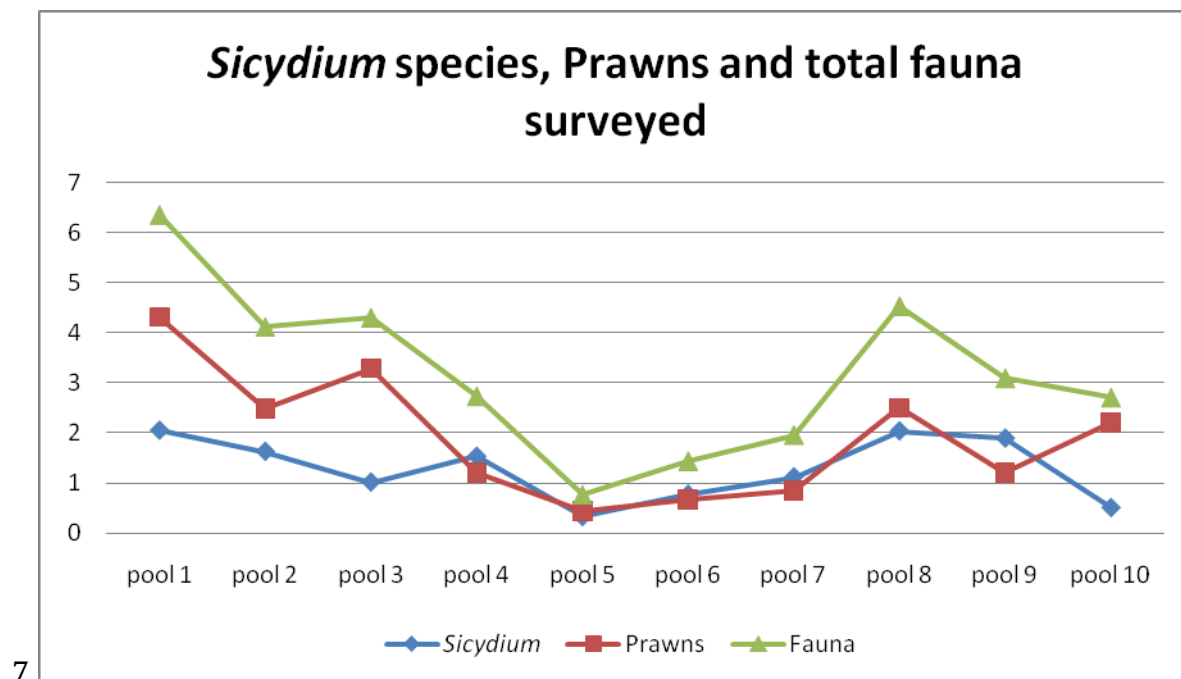
Three of the five prawn species observed at Springfield River.



Graph 6: 6a shows the population density of all fauna (*Sicydium* and prawns) surveyed in pools 1 – 10, 6b shows fauna population density in pools above bridge and pools below bridge.



Graph 7: A line graph with the genus *Sicydium*, prawns and total fauna recorded in all 10 pools.



Discussion

Pools above bridge only had a 2% difference than the pools below bridge (construction site) when looking at total *Sicydium* species recorded. 51% of all *Sicydium* species surveyed were above the construction site and 49% were recorded below the construction site. *Sicydium antillarum* and *Sicydium plumieri* did not support the hypothesis, there were more recorded below the construction site than above as suspected. However, the results from these two species could be because of difficulty in identifying *S. plumieri* and *S. antillarum* from *S. punctatum*. Prawns showed results that supported the hypothesis with a 22% difference, 61% of prawns recorded were found above construction site as suspected and 39% were recorded below construction site. A relevant observation that was made at pool 7 included ~20 dead prawns at the bottom of the pool. This was by far the most dead prawns found during the surveys. When including all fauna recorded there is a 14% difference, with 57% recorded above construction site and 43% recorded below. In conclusion, the overall fauna recorded was greater in population density in pools above the construction site, however not all species showed greater numbers per meter cubed in pools above the site. *Sicydium plumieri* and *Sicydium antillarum* showed greater density in pools below the site. The hypothesis that all species would be lower in population density in pools below the construction site is not supported for *Sicydium* but it is supported for prawns. Prawns seemed to be the most affected by the construction work, and *Sicydium punctatum* second most affected.

Acknowledgements

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Paint spill below the bridge on Imperial Road and a pile of asphalt dumped in river bed.



Paint can lid found downstream from construction site and old discarded guard rails.

Works Cited

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