Evaluation of bucket traps baited with selected foods for attracting giant African snails, *Lissachatina fulica* (Bowdich) in Trinidad

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Evaluation of bucket traps baited with selected foods for attracting giant African snails, *Lissachatina fulica* (Bowdich) in Trinidad

Annika T. Minott1*, Videsh S. Jagroo1 and Marcus Ramdwar2

Abstract: The giant African snail, *Lissachatina fulica*, is a known agricultural pest with some public health concern; it was introduced in Trinidad in 2008. The purpose of this study is to highlight results obtained from the evaluation of the attractiveness of *L. fulica* to selected food baits in a bucket trap set up. Selected food baits (banana, breadfruit, cabbage and papaya) were evaluated for their use as a potential attractant for *L. fulica* in two different locations in Orange Grove, Trinidad. All food baits used in the traps showed some level of attraction. Data suggests that small and medium sized snails appeared to be associated with a more significant contribution to total snail counts than large snails for the food baited traps used in the study. Being an agricultural and public health pest, the management of giant African snail is a serious concern at the farm and national levels. Thus it is important that various management strategies are explored whether intended to complement current baiting strategies or to assist in the monitoring of populations in infested areas over time.

Subjects: Agriculture and Food; Agriculture; Agriculture & Related Industries

Keywords: giant African snail; bucket trap; food bait; invasive species

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PUBLIC INTEREST STATEMENT

The giant African snail was introduced in Trinidad in 2008. It has a voracious appetite and has a strong liking for most agricultural crops. Additionally, the giant African snail is of significant public health concern since it is known to be a vector of the rat lungworm which is linked to meningitis. In this study, an attempt was made to assess options using locally sourced crop material and buckets to capture and kill the giant African snail. The results obtained show promise for use as a complementary activity to the application of snail baits in the field and also for the purpose of in-field monitoring for the presence of the snail. Additionally, the trap can be easily adopted by the average small farmer and homeowner in an attempt to manage and monitor the giant African snail.
1. Introduction
Over the last 20 years, *Lissachatina fulica* (Bowdich) (also known as *Achatina fulica*) has become well established in the new world (Ciomperlik et al., 2013). The earliest record of the giant African snail in the Caribbean region is 1984 in Guadeloupe (Pollard, Fields, & Taylor, 2008). Since then, *L. fulica* has been reported in Anguilla (Connor, 2006), Antigua, Dominica, Martinique, St Martin (Pollard et al., 2008), St. Lucia, Barbados (Ciomperlik et al., 2013) and, Trinidad (IPPC, 2009). *L. fulica* has not been reported in Tobago. Ciomperlik et al. (2013) suggests that the spread of *L. fulica* in many areas globally are primarily as result of intentional introductions and accidental hitch hiking.

*L. fulica* is polyphagous and has been recorded on numerous different plant species; it seems to have a preference for papaya, cassava, breadfruit, cocoa, papaya, peanut, rubber and most species of legumes and cucurbits (Mead, 1961). According to Tomiyama and Nakane (1993), *L. fulica* is primarily active during the night time; however, under wet conditions, some activity may be observed during the day. Not only is *L. fulica* an agricultural pest in areas where it is found, but it is also a pest of public health concern due to it being a known intermediate host for rat lungworm, *Agiostrongylus cantonensis*, a parasitic nematode linked to eosinophilic meningitis in humans in the Pacific Basin (Kliks & Palumbo, 1992) and Brazil (Thiengo et al., 2010). The purpose of this paper is to highlight results obtained from evaluation of the attractiveness of *L. fulica* to selected food baits in a bucket trap set up.

2. Methodology
The experiment was conducted in Orange Grove, Trinidad. Bucket traps were arranged in a complete random design in two different locations where the *L. fulica* population was previously observed. The two locations (Location A and B) were 150 metres apart. Bucket traps were placed on the ground in shaded areas within each location and arranged in a “W” pattern with each bucket trap at 5 metres apart. The predominant crop in both locations was coconut; however, location B was next to a small tributary. In location B, the furthest line of traps was located 6 metres away while the nearest line of traps was located 5 metres from the small tributary. Each treatment was replicated 4 times and randomly placed within each of the 2 locations.

Forty (40) bucket traps were constructed using dark green, covered plastic buckets with the following dimensions: 10 inches (25.4 cm) cm diameter and 11.5 inches (27.94 cm) cm height. Windows 6 inches (15.24 cm) wide by 3 inches (7.62 cm) high were cut out on either sides of the bucket at a height of 1.5 inches (3.81 cm) from the top of the bucket.

Each trap consisted of 1 litre total amount of liquid solution mixed in a ratio of 10 grams copper sulphate (99%) (CuSO₄) to 1 litre of water. Food baits were added to treatments 1–4 while treatment 5 was the negative control which consisted only of a 1 litre total solution of 10 grams copper sulphate (99%) (CuSO₄): 1 litre of water. In a pre-test done to observe the effects on snails immersed in 10 g/L copper sulphate solution, snails collected from the field and placed in the copper sulphate solution remained inactive and were tightly retracted in the shells while in submersion for the 24 h period under observation. Therefore, in this study, the copper sulphate and water solution was selected for the bucket traps in an attempt to immobilize snails after they entered the traps.

Bait treatments in each bucket trap consisted of one of the following:

- Treatment 1: 150 grams fruit portion of ripe banana, *Musa acuminate*
- Treatment 2: 150 grams fruit portion of breadfruit, *Artocarpus altilis*
- Treatment 3: 150 grams of cabbage, *Brassica oleracea*
- Treatment 4: 150 grams fruit portion of papaya, *Carica papaya*
- Treatment 5 (negative control): water and copper sulphate solution only
The traps were placed in the field on 14 February 2017 and the monitoring period extended from February 17 to 3 April 2017 where the number of snails in each trap was recorded as the weather permitted. For counts, snails were categorized as small, medium and large based on the following categories: shell length of <20 mm = small (neonates); shell length of 20–45 mm = medium (juveniles); shell length of >45 mm = large (adults) (Ciomerlik et al., 2013). The number of snails in each trap was recorded 18 times across the monitoring period between the hours of 5:30 and 7:00 am (See supplement table of means for the dates that data was collected). Treatment baits were changed twice on 23 February 2017 and 20 March 2017 during the monitoring period.

Data were analyzed using Genstat through the use of Analysis of Variance (ANOVA) for a repeated measurement. Significance in the main effects of treatment and location as well as the interaction of treatment and location was determined at the 5% level of significance. The effect of time was investigated for significance at the 5% level as well as the interaction of time with the above main and interaction effects.

3. Results and discussion

During the study period, minimum temperature was 19.6°C and maximum temperature was 34.9°C. Minimum daily rainfall rate over the period was 0 mm/mm which occurred 30 out of the 49 day study period while the maximum rainfall rate was 7.5 mm/mm (See Figure 1).

All food baits used in the experiment showed some level of attraction to L. fulica except for the negative control (treatment 5). During the study period, L. fulica were not observed to be attracted to treatment 5 (negative control) which suggests that L. fulica found in food baited traps were attracted to the bucket traps due to the presence of one of the food bait evaluated during the monitoring period. Snails collected from the baited bucket traps were dead in all instances and exuded yellow mucus. This mucus secretion associated with CuSO₄ was also reported by Vanitha, Karuppuchamy, and Sivasubramanian (2013) who evaluated CuSO₄ as one of the substance tested as a barrier to the movement of L. fulica onto vanilla plants.

Generally, the treatment effect was found to be significant at the 5% level (p-value 0.001) for small, medium, large and total number of snails (See Appendix A). Data also suggests that the number of L. fulica found in the bucket traps varied based on the food bait found in the traps (See Figure 2). Overall, traps baited with breadfruit were associated with higher snail counts followed by traps baited with banana, papaya and cabbage respectively. Mean number of total snails caught per trap count over the duration of the experiment from highest to lowest were as follows: breadfruit (8.63 ± 0.693); banana (6.88 ± 0.693); papaya (2.44 ± 0.693) and cabbage (1.95 ± 0.693) (See Table 1 and Appendix A). By comparing the differences in means to the Least Significant Difference at 5% level (See Table 1), it
can be assumed that both the banana and breadfruit baits performed similarly in terms of their high level of attraction to small, medium and large *L. fulica* when compared to the other food baits used in the study.

Overall, a total of 2,865 snails were captured (See Appendix B) across all the traps over the duration of the experiment (49 days). Results from the study also suggests that over time, with the exception of the large (adult) snails, there was some significance shown in the number of small (neonates) (\(p\)-value 0.003), medium (juveniles) (\(p\)-value 0.001), and total number of snails (\(p\)-value 0.001), caught in the bucket traps (See Table 2 and Appendix A). It was assumed that the snail population would always come towards the bait therefore a decrease in the snail population was not investigated.

Overtime, there also appeared to be significant interaction between treatment and time for small (\(p\)-value 0.036), medium (\(p\)-value 0.002) and total (\(p\)-value 0.001) number of snails caught but not for the number of large (\(p\)-value 0.065) snails caught (See Appendix A).

Location was significant at the 5% level for large snails (\(p\)-value 0.028) only (See Appendix A and Table 3). Mean trap counts associated with adult snails over the duration of the study were as follows: Location B, located next to a small tributary (0.489 ± 0.0597) and location A (0.294 ± 0.0597).

| Size of Snail | Banana | Breadfruit | Cabbage | Papaya | Water | Stand error of means | Least significant difference (5% level) |
|---------------|--------|------------|---------|--------|-------|----------------------|----------------------------------------|
| Small**       | 2.88   | 3.60       | 0.91    | 1.27   | 0.00  | 0.309                | 0.894                                  |
| Medium**      | 3.37   | 4.28       | 0.79    | 0.84   | 0.00  | 0.408                | 1.179                                  |
| Large**       | 0.632  | 0.743      | 0.250   | 0.333  | 0.00  | 0.0943               | 0.2725                                 |
| Total**       | 6.88   | 8.63       | 1.95    | 2.44   | 0.00  | 0.693                | 2.001                                  |

**Indicates significance at 5% level.
| Size of snail | Date of data collection | Banana | Breadfruit | Cabbage | Papaya | Water | Standard error of means | Least significant difference (5% level) |
|--------------|-------------------------|--------|------------|---------|--------|-------|------------------------|------------------------------------------|
| Small**      | 17 February             | 2.5    | 5.25       | 0.5     | 0      | 0     | 1.075                  | 3.461                                    |
|              | 20 February             | 3.75   | 0.25       | 0.62    | 0.5    | 0     |                        |                                          |
|              | 22 February             | 0.62   | 0.37       | 0.25    | 0.12   | 0     |                        |                                          |
|              | 24 February             | 0      | 0.62       | 0.87    | 0.75   | 0     |                        |                                          |
|              | 1 March                 | 0.87   | 3.12       | 0.75    | 1.5    | 0     |                        |                                          |
|              | 3 March                 | 1.12   | 5          | 1.12    | 1.75   | 0     |                        |                                          |
|              | 6 March                 | 3.75   | 6.87       | 0       | 0.12   | 0     |                        |                                          |
|              | 8 March                 | 2.12   | 1.12       | 1.12    | 1.25   | 0     |                        |                                          |
|              | 13 March                | 3.62   | 9.88       | 2.75    | 2.25   | 0     |                        |                                          |
|              | 15 March                | 3.75   | 3.75       | 1.5     | 2.62   | 0     |                        |                                          |
|              | 17 March                | 2.12   | 0.5        | 1.25    | 0.37   | 0     |                        |                                          |
|              | 20 March                | 3.5    | 2          | 1.25    | 4.62   | 0     |                        |                                          |
|              | 22 March                | 4.5    | 4.87       | 1       | 1.37   | 0     |                        |                                          |
|              | 24 March                | 3.5    | 3.62       | 0.75    | 1.87   | 0     |                        |                                          |
|              | 27 March                | 2.62   | 2.87       | 0.87    | 1      | 0     |                        |                                          |
|              | 29 March                | 6.75   | 5.37       | 0.62    | 2      | 0     |                        |                                          |
|              | 31 March                | 3      | 4.37       | 0.5     | 0      | 0     |                        |                                          |
|              | 3 April                 | 3.75   | 4.87       | 0.62    | 0.75   | 0     |                        |                                          |
| Medium**     | 17 February             | 0.63   | 0.63       | 0       | 0      | 0     | 1.193                  | 4.062                                    |
|              | 20 February             | 1.13   | 2.25       | 1.75    | 0.5    | 0     |                        |                                          |
|              | 22 February             | 0.63   | 0.63       | 0       | 0.25   | 0     |                        |                                          |
|              | 24 February             | 0.5    | 0.25       | 0.38    | 0.37   | 0     |                        |                                          |
|              | 1 March                 | 1      | 1.25       | 0.12    | 1.75   | 0     |                        |                                          |
|              | 3 March                 | 2.88   | 3.5        | 0       | 2      | 0     |                        |                                          |
|              | 6 March                 | 0.25   | 2.38       | 0       | 0      | 0     |                        |                                          |
|              | 8 March                 | 4.63   | 0.5        | 0       | 0      | 0     |                        |                                          |
|              | 13 March                | 8.75   | 11         | 4.75    | 3.25   | 0     |                        |                                          |
|              | 15 March                | 4.5    | 4.63       | 1.12    | 1.37   | 0     |                        |                                          |
|              | 17 March                | 1.63   | 1.88       | 1.37    | 1.87   | 0     |                        |                                          |
|              | 20 March                | 2.88   | 2.88       | 0.62    | 1.5    | 0     |                        |                                          |
|              | 22 March                | 9.38   | 13.88      | 2.75    | 0      | 0     |                        |                                          |
|              | 24 March                | 4.25   | 7.13       | 0.5     | 0.5    | 0     |                        |                                          |
|              | 27 March                | 7.5    | 8.88       | 0.5     | 0      | 0     |                        |                                          |
|              | 29 March                | 5.38   | 4.38       | 0.25    | 0      | 0     |                        |                                          |
|              | 31 March                | 1.13   | 5.38       | 0.12    | 1.62   | 0     |                        |                                          |
|              | 3 April                 | 3.63   | 5.63       | 0       | 0.12   | 0     |                        |                                          |

(Continued)
This observation suggests that the start of *L. fulica* infestation in location B may have been at an earlier time than the start of infestation in location A.

Generally, food baited bucket traps appeared to attract more neonates (small) and juvenile snails (medium) than adults (large) in both locations (See Table 3). Mean trap counts over the duration of the study, associated with small and medium snails respectively were as follows: location B (1.59 ± 0.196; 1.97 ± 0.258) and location A (1.88 ± 0.196; 1.74 ± 0.258) respectively. No significant
differences were observed for trap counts of small (neonates) (p-value 0.300) and medium (juvenile) (p-value 0.528) snails based on amount caught per location thus implying that these snails were generally equally distributed across both locations (See Appendix A).

Additionally, there appeared to be no significant interaction between treatment and location for small (p-value 0.257), medium (p-value 0.458), large (p-value 0.758) and total (p-value 0.798) number of snails caught (See Appendix A). However, the means of the interaction of treatment and location for total number of snails caught was found to be significant at the 5% level for each level of time (p-value 0.004) (See Appendix A). This implies that collectively, the total snail population was changing across time at each location for each individual treatment. Further analysis done to determine whether small (p-value 0.068), medium (p-value 0.082) and large (p-value 0.334) snails contributed to the change observed in the total number of snails caught showed that the means for each were similar. Therefore, the sizes of the snail did not seem to influence the change in means of the total number of snails caught over time.

4. Conclusion

Being an agricultural and public health pest, the management of giant African snail is a serious concern at the farm and national levels. Thus it is important that various management strategies are explored whether intended to complement current baiting strategies or to assist in the monitoring of populations in infested areas over time. The bucket trap setup evaluated in this experiment showed potential for use on a wider scale by small farmers and homeowners who may use the system to complement active baiting programs for the snail. The system may also be used to monitor for the presence of *L. fulica* in new areas. The food baits used are readily available locally and can be adopted by the average small farmer and or homeowner.

Further studies will be needed to evaluate suitable placement of the bucket traps regarding distance range for attraction to *L. fulica*. This study did not evaluate the distances travelled by *L. fulica* caught in the baited traps.

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Appendix A

Table A1. Average small and medium sized snails caught in each trap at two locations in Orange Grove, Trinidad

| Date of data collection | Trap/treatment | Mean number of small snails (<20 mm length) | Mean number of medium snails (20–45 mm shell length) |
|-------------------------|----------------|-------------------------------------------|--------------------------------------------------|
|                         |                | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Location                |                | 1-banana; 2-breadfruit; 3-cabbage; 4-papaya; 5-water |
| 17 February 2017        | A              | 4 | 1.25 | 1 | 0 | 0 | 0.75 | 0 | 0 | 0 | 0 |
|                         | B              | 1 | 9.25 | 0 | 0 | 0 | 0.5 | 1.25 | 0 | 0 | 0 |
| 20 February 2017        | A              | 4.5 | 0.5 | 0.25 | 0 | 0 | 0.5 | 2 | 3.5 | 1 | 0 |
|                         | B              | 3 | 0 | 1 | 1 | 0 | 1.75 | 2.5 | 0 | 0 | 0 |
| 22 February 2017        | A              | 0 | 0.75 | 0.25 | 0.25 | 0 | 0.5 | 0.75 | 0 | 0 | 0 |
|                         | B              | 1.25 | 0 | 0.25 | 0 | 0 | 0.5 | 0.75 | 0 | 0 | 0 |
| 24 February 2017        | A              | 0 | 0.75 | 0.25 | 0.75 | 0 | 0 | 0.25 | 0 | 0 | 0 |
|                         | B              | 0 | 0.25 | 1.5 | 0.75 | 0 | 0 | 0.25 | 0.75 | 0 | 0.75 |
| 1 March 2017            | A              | 1.25 | 4 | 1 | 0.25 | 0 | 1.25 | 0.5 | 0 | 1.5 | 0 |
|                         | B              | 0.5 | 2.25 | 0.5 | 2.75 | 0 | 0.75 | 2 | 0.25 | 0 | 2 |
| 3 March 2017            | A              | 0 | 7.5 | 1 | 1.75 | 0 | 2.5 | 0.75 | 0 | 0.75 | 0 |
|                         | B              | 2.25 | 2.5 | 1.25 | 1.75 | 0 | 3.25 | 6.25 | 0 | 3.25 | 0 |
| 6 March 2017            | A              | 5.25 | 10.5 | 0 | 0 | 0 | 0.5 | 3.25 | 0 | 0 | 0 |
|                         | B              | 2.25 | 3.25 | 0 | 0.25 | 0 | 0 | 1.5 | 0 | 0 | 0 |
| 8 March 2017            | A              | 1.25 | 1 | 0.25 | 1 | 0 | 1.25 | 0 | 0 | 0 | 0 |
|                         | B              | 3 | 1.25 | 2 | 1.5 | 0 | 8 | 1 | 0 | 0 | 0 |
| 13 March 2017           | A              | 4.75 | 15.25 | 3 | 4 | 0 | 10.5 | 12.75 | 1.25 | 4.25 | 0 |
|                         | B              | 2.5 | 4.5 | 2.5 | 0.5 | 0 | 7 | 9.25 | 8.25 | 2.25 | 0 |
| 15 March 2017           | A              | 3.75 | 3.75 | 1.25 | 1.25 | 0 | 3.5 | 4.75 | 1.5 | 0.75 | 0 |
|                         | B              | 3.75 | 3.75 | 1.75 | 4 | 0 | 5.5 | 4.5 | 0.75 | 2 | 0 |
| Date of data collection | Trap/treatment | Mean number of small snails (< 20 mm length) | Mean number of medium snails (20–45 mm shell length) |
|-------------------------|---------------|---------------------------------------------|--------------------------------------------------|
|                         | Location      | 1  | 2   | 3   | 4   | 5   | 1  | 2   | 3   | 4   | 5   |
| 17 March 2017           | A             | 1.5| 0.25| 1.25| 0.5 | 0   | 1.75| 1.5 | 0.25| 1.75| 0   |
|                         | B             | 2.75| 0.75| 1.25| 0.25| 0   | 1.5 | 2.25| 2.5 | 2   | 0   |
| 20 March 2017           | A             | 0.5| 2.75| 0.75| 3.5 | 0   | 2.75| 2   | 0.25| 0.25| 0   |
|                         | B             | 6.5 | 1.25| 1.75| 5.75| 0   | 3   | 3.75| 1   | 2.75| 0   |
| 22 March 2017           | A             | 6.75| 7.75| 1   | 1.75| 0   | 16  | 9.75| 5.25| 0   | 0   |
|                         | B             | 2.25| 7.75| 1   | 1.75| 0   | 2.75| 18  | 0.25| 0   | 0   |
| 24 March 2017           | A             | 3.75| 0.5 | 0.5 | 1.25| 0   | 7.75| 1.5 | 1   | 0.5 | 0   |
|                         | B             | 3.25| 6.75| 1   | 2.5 | 0   | 0.75| 12.75| 0 | 0.5 | 0   |
| 27 March 2017           | A             | 3.75| 3   | 0.75| 1   | 0   | 8.25| 8.5 | 0.5 | 0   | 0   |
|                         | B             | 1.5 | 2.75| 1   | 1   | 0   | 6.75| 9.25| 0.5 | 0   | 0   |
| 29 March 2017           | A             | 7.5 | 5   | 0   | 3   | 0   | 4   | 5   | 0.5 | 0   | 0   |
|                         | B             | 6   | 5.75| 1.25| 1   | 0   | 6.75| 3.75| 0   | 0   | 0   |
| 31 March 2017           | A             | 5.5 | 8.75| 0.5 | 0   | 0   | 2.25| 5.5 | 0   | 0.25| 0   |
|                         | B             | 0.5 | 0   | 0.5 | 0   | 0   | 0   | 5.25| 0.25| 3   | 0   |
| 3 April 2017            | A             | 5.5 | 8.75| 0.5 | 0.25| 0   | 2.25| 5.5 | 0   | 0   | 0   |
|                         | B             | 2   | 1   | 0.75| 1.25| 0   | 5   | 5.75| 0   | 0.25| 0   |

| Sources of Variation    | Degrees of Freedom | P - values | Standard errors of means | Standard errors of differences of means | Least significant differences of means (5% level) | P - values | Standard errors of means | Standard errors of differences of means | Least significant differences of means (5% level) |
|-------------------------|--------------------|------------|--------------------------|------------------------------------------|-----------------------------------------------|------------|--------------------------|------------------------------------------|-----------------------------------------------|
| Treatment               | 4                  | <0.001**   | 0.309                    | 0.438                                    | 0.894                                         | <0.001**   | 0.408                    | 0.577                                    | 1.179                                         |
| Location                | 1                  | 0.300      | 0.196                    | 0.277                                    | 0.565                                         | 0.528      | 0.258                    | 0.365                                    | 0.746                                         |
| Treatment* location     | 4                  | 0.257      | 0.438                    | 0.619                                    | 1.264                                         | 0.458      | 0.577                    | 0.816                                    | 1.667                                         |
| Time                    | 1                  | 0.003**    | 0.474                    | 0.670                                    | 1.526                                         | <0.001**   | 0.516                    | 0.730                                    | 1.758                                         |
| Time*treatment          | 68                 | 0.036**    | 1.075                    | 1.520                                    | 3.461                                         | 0.002**    | 1.193                    | 1.688                                    | 4.062                                         |
| Time*location           | 17                 | 0.041**    | 0.680                    | 0.619                                    | 2.189                                         | 0.620      | 0.755                    | 1.067                                    | 2.569                                         |
| Time*treatment* location| 68                 | 0.068      | 1.520                    | 2.150                                    | 4.895                                         | 0.082      | 1.688                    | 2.386                                    | 5.745                                         |

**Significance at 5% level
Table A2. Average large sized and overall total number of snails caught in each trap at two locations in Orange Grove, Trinidad

| Date of data collection | Trap/treatment | Mean number of large snails (>45 mm shell length) | Overall mean of all snails caught (small, medium and large snail) |
|-------------------------|----------------|-----------------------------------------------|---------------------------------------------------------------|
|                         |                | 1 2 3 4 5                                     | 1 2 3 4 5                                                     |
| Location                | 1-banana; 2-breadfruit; 3-cabbage; 4-papaya; 5-water |                                |                                                               |
| 17 February 2017        | A              | 0 0 0 1.5 0                                  | 4.25 1.25 1.5 1.5 0                                           |
|                         | B              | 0.25 0 2.25 1.25 0                            | 1.75 10.5 2.25 1.25 0                                         |
| 20 February 2017        | A              | 0.25 0 0 0.5 0                              | 5.25 2.5 3.75 1.5 0                                           |
|                         | B              | 0 1 0.25 0 0                              | 6.75 3.5 1.25 1 0                                            |
| 22 February 2017        | A              | 0 0 0 0 0                                  | 0.5 1.5 0.25 0.25 0                                           |
|                         | B              | 0 0 0 0 0                                  | 2 0.5 0.25 0.5 0                                             |
| 24 February 2017        | A              | 0.75 0.5 0.25 0 0                          | 1.75 1.5 0.5 0.75 0                                          |
|                         | B              | 0 0.25 0 0.25 0                            | 0 1 2.25 1.75 0                                              |
| 1 March 2017            | A              | 0 0 0.5 0.25 0                             | 2.5 4.5 1.5 2 0                                             |
|                         | B              | 0 0.5 0.25 0 0                              | 1.25 4.75 1 4.75 0                                           |
| 3 March 2017            | A              | 0.5 0 0 0.25 0                             | 3 8.25 1 2.75 0                                            |
|                         | B              | 4.25 1.5 0 0 0                             | 9.75 10.25 1.25 5 0                                          |
| 6 March 2017            | A              | 0.25 0.75 0 0.25 0                        | 6 14.5 0 0.25 0                                             |
|                         | B              | 0 0.5 0 0.25 0                            | 2.25 5.25 0 0.25 0                                           |
| 8 March 2017            | A              | 0 0.25 0 0 0                              | 2.5 1.25 0.25 1 0                                           |
|                         | B              | 1.5 2 0 0.5 0                              | 12.5 4.25 2 2 0                                               |
| 13 March 2017           | A              | 0 2 0.5 0 0                              | 15.25 30 4.75 8.25 0                                         |
|                         | B              | 0.75 1.75 1 2.75 0                        | 10.25 15.5 11.75 5.5 0                                       |
| 15 March 2017           | A              | 1.25 1 0.25 0.5 0                        | 8.5 9.5 3 2.5 0                                              |
|                         | B              | 0 0.5 0.75 0 0                            | 9.25 8.75 3.25 6 0                                           |
| 17 March 2017           | A              | 1 0.25 0 0 0                             | 4.25 2 1.5 2.25 0                                           |
|                         | B              | 0.25 0.25 0.25 0 0                        | 4.5 3.25 4 2.25 0                                           |
| 20 March 2017           | A              | 0 0 0 0 0                               | 3.25 4.75 1 3.75 0                                          |
|                         | B              | 2 3 0.75 0 0                                | 11.5 8 3.5 8.5 0                                             |
| 22 March 2017           | A              | 2 1.75 1.5 0 0                             | 24.75 13.5 7.75 1 0                                         |
|                         | B              | 0.75 1 0 0.5 0                             | 5.75 26.75 1.25 2.25 0                                        |
| 24 March 2017           | A              | 0 2.25 0 0 0                             | 11.5 4.25 1.5 1.75 0                                         |
|                         | B              | 0 2.75 0 0.25 0                           | 4 22.25 1 3.25 0                                             |
| 27 March 2017           | A              | 0 0 0 0 0                               | 12 11.5 1.25 1 0                                            |
|                         | B              | 2.25 0.5 0 0 0                             | 10.5 13 1.5 1 0                                              |
| 29 March 2017           | A              | 0.5 0 0 0 0                             | 12 10 0.5 3 0                                               |
|                         | B              | 1.5 0.75 0 0 0                            | 14.25 9.5 1.75 1 0                                           |
| 31 March 2017           | A              | 1.25 0.75 0 0.5 0                        | 9 15 0.5 0.75 0                                             |
|                         | B              | 0 1 2.25 0 0                             | 0.5 6.25 0.75 5.25 0                                         |
| 3 April 2017            | A              | 1.25 0.75 0 0.5 0                        | 9 15 0.5 0.75 0                                             |
|                         | B              | 0.25 0 0 0 0                             | 7.25 6.75 0.75 1.5 0                                         |
### Appendix B

**Total number of small, medium and large snails caught over the experimental period**

| Date             | Total number of small snails | Total number of medium snails | Total number of large snails | Total number of snails caught |
|------------------|------------------------------|-------------------------------|-----------------------------|------------------------------|
| 17 February 2017 | 66                           | 10                            | 21                          | 97                           |
| 20 February 2017 | 41                           | 45                            | 8                           | 94                           |
| 22 February 2017 | 11                           | 12                            | 0                           | 23                           |
| 24 February 2017 | 18                           | 12                            | 8                           | 38                           |
| 1 March 2017    | 50                           | 33                            | 6                           | 89                           |
| 3 March 2017    | 72                           | 67                            | 26                          | 165                          |
| 6 March 2017    | 86                           | 54                            | 7                           | 144                          |
| 8 March 2017    | 45                           | 41                            | 17                          | 103                          |
| 13 March 2017   | 148                          | 222                           | 35                          | 405                          |
| 15 March 2017   | 93                           | 93                            | 17                          | 203                          |
| 17 March 2017   | 34                           | 54                            | 8                           | 96                           |
| 20 March 2017   | 91                           | 63                            | 23                          | 177                          |
| 22 March 2017   | 94                           | 208                           | 30                          | 332                          |
| 24 March 2017   | 78                           | 99                            | 21                          | 198                          |
| 27 March 2017   | 59                           | 135                           | 11                          | 205                          |
| 29 March 2017   | 118                          | 80                            | 10                          | 208                          |
| 31 March 2017   | 63                           | 66                            | 23                          | 152                          |
| 3 April 2017    | 80                           | 75                            | 11                          | 166                          |
| **Totals**      | **1,247**                    | **1,336**                     | **282**                     | **2,865**                    |
