Affordable Trap and Dehydrating Mechanisms for *A. fulica*

By: Anna Kalkanis-Ellis, Martin Legault & Tamara Provencher
Supervised by: Dr. Danielle Donnelly (McGill) and Dr. Mark Lefsrud (McGill)

Introduction

In the early 2000s, *Achatina fulica* (The Giant African Snail or GAS) was introduced to the island nation of Barbados (Fields et al., 2006). GAS, a land gastropod native to Eastern Africa, is a potential agricultural pest, health risk, and visual nuisance. The Global Invasive Species Database currently lists GAS as being among the top 100 of the World's Worst Invasive Alien Species due to its expansive dispersal and potential agricultural and health threats (ISSG, 2010). Throughout the world chemical, physical and biological methods have been used in attempts to control or eradicate this pest. However the majority of these methods may be detrimental to the environment or not cost-efficient (ISSG, 2010).

Illustration 1: A.fulica or GAS

As a country of only 430 sq km and 37% arable land (CIA World Factbook, 2011), Barbados faces issues of limited crop production and food insecurity. The introduction of an agricultural pest may therefore be particularly detrimental to Barbados' already fragile agricultural sector.

In addition to its threat as an herbivore, *GAS* poses a threat to the health of people of Barbados as well as to their tourism based economy (CIA World Factbook, 2011). GAS has been shown to have the potential to transmit the rat-lungworm nematode (*Angiostongylus cantonensis)* which is implicated in eosinophilic meningitis in humans (Caldiera et al., 2007). This has direct impacts on the potential disease risk to the Barbadian population as well as affecting the image of the island as a safe tourist destination.

Barbados has attempted control through chemical means with the dispersal of metaldehyde to local farmers and land-owners. However, this was not a viable method as the chemicals were not always used correctly and the costs to the government were unsustainable (pers. com. Gibbs, 2011). Two years ago, the government of Barbados instituted a bounty system which pays individuals $0.50 for every pound of GAS collected and turned into the ministry of agriculture to be destroyed (pers. com. Gibbs, 2011).

The Project

As chemical control has proven costly and biological control may be detrimental to biodiversity, the objective of our group was to develop an integrated system for trapping and processing of GAS. Our group was composed of three McGill students, Anna Kalkanis-Ellis, Martin Legault and Tamara Provencher. We worked under the supervision of Dr. Danielle Donnelly and Dr. Mark Lefsrud of McGill University, with input from Mr. Keith Laurie, Dr. Angela Fields, Mr. Ian Gibbs, Mr. Jeff Chandler, and others in Barbados.

The proposed method involves a trap for collection of snails, a crushing mechanism for initial processing of snails and a dehydrator for secondary processing of the snails in preparation for either disposal as waste or compost, or use as an animal feed component. The complete system is suggesed for local farmers and home-owners. However certain components may be omitted depending on the individual's needs.

Initially the project was focused on the design of a trap which would simply and efficiently capture GAS. However, the well known disgusting odor of rotting snails inspired the design of a trap which would simultaneously capture and dehydrate the snails, to avoid snails rotting inside the trap. A second group of McGill students was investigating the use of dried snails as an amendment to animal feed. So, the dehydration component of the trap allowed for integration of the two projects.

The initial design for the trap contained the trap and the dehydrator within a single mechanism. However, GAS have the capacity to shrink into their shells and secrete a protective closing layer that enables them to survive in hot, dry situations. For this reason, manually crushing the snails is necessary prior to a dehydration step.

A major goal in the design of the trap was to make it affordable and simple enough that it had the potential to be built and installed by farmers and home-owners around the island of Barbados. With this as an ultimate goal, the three main components (the trap, the crusher and the dehydrator) were separated into three simplified mechanisms. A trap made of 5 gallon buckets collected from a local fast-food restaurant, a hammermill or hand-powered screw crusher, and a solar dehydrator built from plywood.

The Final Design

The structure of the trap is created using a 5-gallon bucket. Using a jig-saw, two holes are cut into opposite sides of the bucket for the snails to enter, and the bottom is cut out. A gate made of straws covers each doorway to allow snails into the trap, but prevents them from leaving. The bottom is cut off the bucket and a modified planter-pail is turned upside-down and placed inside the trap to section off the

bottom from the top. An attractant is located beneath the bucket in a chamber separate from the one that the snails enter. This allows for easy replacement of attractant and does not interfere with any snails inside the trap. Ventilated areas at the bottom of the bucket promote odor dispersal from the attractant. A piece of wood may be placed vertically inside the trap to allow for more space inside the trap for other snails to enter.

Illustration 2: Trap prototype with inside chamber removed.

The crushing-mechanism used was a hammermill obtained from Mr.Keith Laurie, a well known agricultural specialist and farmer. However, in keeping with making this design accessible to the general public, a simple manual screw crusher may also be used.

The solar-dehydrator is based on plans for many food dehydrators found online (Build It Solar, 2011). Typically, shelves are made of screens to allow for air flow through the layers. However this one makes use of cookie sheets to hold the snails and uses air flow over the top of each layer to promote drying. The racks alternate in placement with a small gap between the cookie sheet and the side of the dehydrator. This pushes hot air in a zig-zag fashion over the top of each shelf drying the snail matter as air rises through the box. The source of hot air is a simple rectangular box-shaped solar collector. Five sides of the solar collector are made of plywood which has been painted matte black while the sixth side is made of transparent plastic material to allow penetration of solar radiation. Holes on each end allow for airflow into and out of the collector with a fan helping to draw air through the unit.

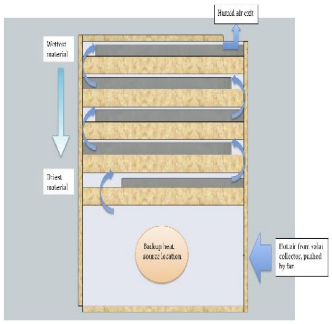

Illustration 3: Solar-dehydrator with arrows to represent airflow.

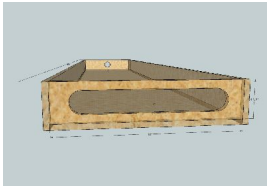

Illustration 4: Solar collector with transparent top to capture solar radiation.

A key component to the effectiveness of a trap is the bait. Ideally, bait is both highly attractive to the snails and relatively cheap and accessible for the trap-owner. An attractant test was carried out to determine which locally available products were most effective in attracting GAS, and modelled after one done at Zagazig University in Egypt (El Aal and Hamed, 2010). In these experiments the snails were placed in the center of a tarp with three potential baits placed in three separate quadrants equidistant from the snails. The movement of the snails was tracked periodically to determine which product was the most attractive to GAS.

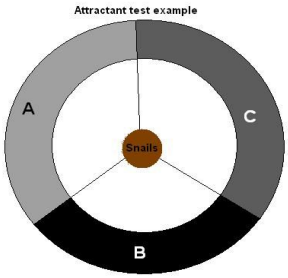

Illustration 5: Methodology of attractant test.

Results

The attractant test was conclusive, showing that *A. fulica* was most attracted to a mixture of balanced animal feed and molasses, less interested in moist oats (more expensive), and not interested in spent grain, balanced animal feed mixed with beer, or balanced animal feed mixed with yeast.

The baited traps were deployed in the backyard of Mr.Jeff Chandler and left overnight. In the morning one trap was found to be disturbed by an animal, possibly a rat. The baited traps proved to be successful in attracting and containing the snails. Alterations were made to stake the trap to the ground, and an aluminum plate was added in the bottom to help keep rodents out. In addition, a few adjustments were made to the door; this was lowered, the straw mechanism was simplified, and another door was added to improve GAS access to the trap.

The solar collector has been tested using both Saran wrap and clear polyethylene from trash bags as a “window” for solar radiation. On days of approximately 30C, the internal temperature of the collector reached 55C and 60C with the Saran wrap and polyethylene, respectively. Of the two options, the plastic from the trash bag was the simpler, cheaper, and more effective option

A major goal in this project was to design a trap and dehydrator that were low cost and accessible to the general public. The designs proposed are made partly of recycled materials and everything used can be found on the island. A ‘How To’ guide has been put together outlining how to build the proposed mechanisms at home so that farmers and homeowners can build and deploy them on their own as needed.

Acknowledgements

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