Effects of and Control Methods for the Invasive Apple Snail, *Pomacea canaliculata*, in Southwest Alabama

Ben Ricks
District V Fisheries Biologist
Alabama Division of Wildlife and Freshwater Fisheries
Department of Conservation and Natural Resources, Spanish Fort, Alabama

October 1, 2008

Eradication of established populations is probably not possible. Numerous measures have been tried in an attempt to control apple snails in agricultural settings. These include widespread use of pesticides, with serious environmental and human health consequences; biological control, notably the use of fish and ducks; a range of cultural and mechanical control measures. None has proven entirely effective, safe, and economically viable. None is likely to be appropriate in natural ecosystems.
(IUCN Invasive Species Specialist Group (ISSG), 2005 in Levin and Hui Kalo 2006)

Introduction

Invasive apple snails (*Pomacea sp.*) are native to Central and South America. These snails have invaded and become a pest in Southeast Asia, Sri Lanka, Guam, Hawaii, Papua New Guinea, Dominican Republic, Australia, and Mainland United States (Rawlings et. al 2007). While apple snails currently are found in Texas, Louisiana, Mississippi, Alabama, Georgia, Florida, and California, their thermal tolerances from their native ranges indicate there is potential for expansion as far north as the mid-Carolinas (Rawlings et. al 2007).

Apple snails have been in the United States since 1950; however, they were not considered problematic until they began to feed on agricultural rice in Texas and Louisiana. Once apple snails were discovered to be damaging as a crop pest, they also became a concern in wetland areas where they were observed degrading native aquatic vegetation.

Apple snails have been documented with consumption rates between 55% and 96% of a native aquatic macrophyte stand. Apple snails preferred native plant species include spider lilies, widgeon grass, arrowhead, and coontail (Burlakova et. al. 2008). Apple snails also will forage heavily on exotic macrophytes such as wild taro, alligator weed, and water hyacinth (Burlakova et. al. 2008).

In addition to damaging agricultural and wetland areas, apple snails can be disease vectors as they typically harbor nematodes and trematodes that have potential for human health risks. The primary health risk is *Eosinophilic meningoencephalitis* which is caused by a human endoparasite, the rat lungworm. The apple snail is an intermediate host of this endoparasite (Joshi 2005).

Apple snails are a species of great concern because of their invasive potential attributed to fast maturation (60 to 85 days) and to high rates of reproduction. Apple snails lay between 50 and 1000 eggs with an 80% hatchability rate at weekly intervals (Joshi 2005; Denson and Eby 2004; Purchon 1977).

Apple snails in the United States are typically introduced to a new area through the aquarium trade. Once introduced they have four general modes of transport: land travel (37 ft/day), entrainment in drifting aquatic macrophytes, floating and subsequent drifting downstream, or being flushed to new areas by flooding (Personal Communication, Larry Connor). Once introduced, apple snails are likely to become a pest within four years (Joshi 2005).

In Alabama, apple snails (*P. canaliculata*) have been observed in the Three Mile Creek (TMC) drainage in Mobile County, specifically in the lower 32-acre pond located at Langdon Municipal Park (LMP) and within 300 yards downstream of the dam. The introduction of apple snails is of concern because TMC drains directly into the Mobile River Ship Channel. Salinity in the Mobile River could be enough to limit apple snail movement, though there is no guarantee since they can tolerate salinities up to 25 ppt for 96 hours (Personal communication, William Haller). Furthermore, tides and currents can easily move newly hatched snails. If this occurs, apple snails could invade more than 20,000 acres of the Upper and Lower Mobile Delta. Once apple snails reach the mouth of TMC, they could then attach and lay eggs on ships and barges. If this were to occur, the Port of Mobile could become a source of apple snails to the Tombigbee River, Alabama River, and ports outside Alabama.

Proposed Control Methods

There are several methods that have been used for apple snail control. These methods include biological, mechanical, and chemical control. In agricultural areas of Hawaii and the South Pacific islands, ducks have been a biological control of apple snails (Ako and Tamaru 2007; Levin and Hui Kalo 2006). Many states, including Florida and Georgia, have used copper sulfate in wetlands to chemically eliminate apple snails (Personal communication, William Haller). This has been done with varying success primarily due to lack of funding for follow-up treatments and improper application. All of these methods have been considered, and the best possible measures are listed below with special consideration to the site and the resources available to the Alabama Department of Conservation and Natural Resources.

The following control plan is performed in phases and the work is labor intensive. Though this is a large endeavor initially, money and resources will be saved in the long run if initial control and isolation of this pest is given due consideration. This is true when considering the problems associated with such invasive species as zebra mussels, cogon grass, hydrilla, cuban bullrush, salvinia, and water hyacinth. These invasives at one point, could have been eliminated permanently. A proactive approach will yield the most positive result. The primary goal of this plan is to eliminate or greatly diminish the population of apple snails in the TMC drainage and restrict further expansion of their range in Alabama.

<u>Phase 1: Elimination of Emergent Aquatic Plants</u>

The pond at LMP has about 5 acres of emergent aquatic vegetation. While eliminating the vegetation will not affect the snails, it will make the next phases of the

plan more feasible. Without removing the emergent plants, control of the apple snails becomes much less efficient. This action will decrease the available egg-laying substrate and make control and monitoring for eggs less labor intensive. Two imazapyr treatments at 6 pints per acre will be conducted to achieve the goal of phase 1.

Phase 2: Initial Removal of Egg Masses

An initial sweep of the pond at LMP and the affected area will be conducted. During this time eggs and any visible adult snails will be removed by hand. Eggs will be removed by either scraping egg masses off permanent structures or by clipping off vegetation with eggs attached. Eggs will be frozen so they are no longer viable and then disposed of appropriately.

Phase 3: Elimination of Adults

Within a week or in conjunction with Phase 2, a 5 ppm copper sulfate application with a granular herbicide blower will be conducted on the entire 32-acre lake and the affected area below the spillway at LMP to eliminate adult apple snails. This treatment must be done while the water temperature is above 60°F. Once the water temperature falls below 60°F, the snails will burrow in the mud and go dormant. During the application of copper sulfate, a sweep for egg masses will also be done as in Phase 2.

Phase 4: Monitoring

Once a month for the next six months the lake will be swept for adult apple snails and egg masses. Any that are found will be removed. If snails or egg masses are observed, a second copper sulfate treatment will be necessary and monitoring will have to continue for another six months. If they are not observed, then the apple snails will be

assumed under control and visits to the lake on a biannual basis will continue to monitor success.

Notes

- Currently an apple snail trap is being developed. This trap could be a useful tool during the monitoring process. As this product is being developed, the control plan may be revised to include snail traps (Personal Communication, Jesse VanDyke).
- A second application will be almost a certainty, since an invasive species is rarely eliminated with a single attempt. Furthermore, this plan is for one year of control. LMP will need to be monitored periodically in the years to come. If elimination or control of the apple snail is not achieved, then the plan must be repeated or revised in order to reach our goal.
- Estimates of the apple snails' range in Alabama are likely to expand if no method of control is employed. As apple snails expand their range in Alabama they will become even more difficult to control.
- This project is too large for the District V fisheries staff to conduct alone. In order for success, assistance in the form of manpower and funding will be needed from other districts, state agencies, city groups, environmental groups, and federal agencies.

Budget

Costs are estimates. Changes in fuel cost, time to complete tasks, requirement for additional materials or effectiveness of treatments could change overall costs

Phase I: Elimination of Emergent Aquatic Plants

Items	Amount	Cost
Airboat	2 days	400
Truck	80 miles	40
Salary	6 man days	1712
Perdiem	6 day trips	68
Habitat (Imazapyr)	8 gallons (6 pints/acre)	2400
Dyne-Amic (Surfactant)	4 gallons (5 pints/100 gallons solution)	156
SUBTOTAL		4776

Phase 2: Initial Removal of Egg Masses

Truck	3 trucks 600 miles	300
Boat	2 boats 10 boat days	1600
Salary	6 men 30 man days	8560
Perdiem	30 day trips	1294
Tools	Buckets, shears, scraper etc	500
SUBTOTAL		12254

Phase 3: Elimination of Adults

Airboat	2 days	400
Boat	2 days	400
Truck	2 trucks (160 miles)	80
Salary	12 man days	3424
Perdiem	12 day trips	518
Copper sulfate	2000 pounds (13.3 pound/acre ft)	3280
Vortex TR Aquatic Blower	1 blower	4100
SUBTOTAL		12202

Phase 4: Monitoring

Boat	6 days	1000
Truck	240 miles	120
Salary	2 men (12 man days)	3789
Per diem	12 day trips	135
Tools	Buckets, shears, scraper etc	100
SUBTOTAL		5144

Second Copper Sulfate Application

Airboat	2 days	400
Boat	2 days	400
Truck	2 trucks (160 miles)	80
Salary	12 man days	3424
Perdiem	12 day trips	518
Copper sulfate	2000 pounds (13.3 pound/acre ft)	3280
SUBTOTAL		8102

Second Monitoring Phase

Boat	6 days	1000
Truck	240 miles	120
Salary	2 men (12 man days)	3789
Per diem	12 day trips	135
Tools	Buckets, shears, scraper etc	100
SUBTOTAL		5144

Administrative Cost

Salary	8 hours	200

TOTAL (Phase 1-4)	**$33,892**
TOTAL (Phase 1-4 with repetition of phase 3 and 4)	**$47,822**
Cost of chemicals and new equipment	**$14,116**

* This is the total cost of materials and supplies excluding the cost of equipment and labor supplied by the Alabama Division of Wildlife and Freshwater Fisheries.

Possible Funding Sources

Alabama State Docks

City of Mobile

Mississippi-Alabama Sea Grant Consortium

Mobile Bay National Estuarine Program

National Aquatic Nuisance Species Task Force

National Fish and Wildlife Foundation

Southeastern Wildlife Conservation Group

United States Department of Agriculture

US Fish and Wildlife Service

References

Ako, H. and C. Tamaru. Efforts at golden apple snail control in Hawaii. Department of Molecular Biosciences and Bioengineering and Sea Grant Extension Service, University of Hawaii. 2007.

Burlakova, L. E., A. Y. Karatayev, D. K. Padilla, L. D. Cartwright, and D. N. Hollas. Wetland restoration and invasive species: Apple snail (*Pomacea insularum*) feeding on native and invasive aquativ plants. Restoration Ecology. 2008. 1-8.

Connor, L. Personal Communication, Exotic Species Coordination Section, Division of Habitat and Species Conservation, Florida Fish and Wildlife Conservation Commission. Eustis, Florida. September 2008.

Denson, D. and G. Eby. Lake Brantley infested with invasive snails. Florida Department of Environmental Protection. 2004.

Haller, W. Personal Communication. Center for Aquatic and Invasive Plants. University of Florida. Gainesville, Florida. September, 2008.

Joshi, R. C. The golden apple snail: Raiders of the rice fields. Outlooks on Pest Management. 2005. 23-26.

Levin, P, and O. N. Hui Kalo. Statewide Strategic Control plan for Apple Snail in Hawaii. The Hawaii Land Restoration Institute. 2006.

Purchon, R. The Biology of the Mollusca. Pergamon Press, New York. 1977.

Rawlings, T. A., K. A. Hayes, R. H. Cowie, and T. M. Collins. The identity, distribution and impacts of Non-native apple snails in the continental United States. BMC Evolutionary Biology. 2007; 7:97.

VanDyke, J. Personal Communication. VanDyke Environmental Services. Tallassee, Florida. September, 2008.