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## A Review of Invasive Applesnails in Texas, USA.

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This paper was written by request and submitted in September 2013 for inclusion in the publication below, which is a global survey compiling multiple papers. The publication was delayed multiple times, finally being published in 2017. Our paper was overlooked for inclusion. Though the data is outdated, it is still valuable for the time period it represents.

2017 - Joshi, R.C., Cowie, R.H. & Sebastian, L.S. (eds.). *Biology and Management of Invasive Apple Snails*. Philippine Rice Research Institute, Muñoz, Nueva Ecija. xvii + 405 p.

### ABSTRACT

There are numerous papers and reports on invasive Applesnails in Texas spanning 20 years. This history has been wrought with much confusion as to the species identification. Now, with genomic cladistics analysis (Hayes et al. 2012) the species identity has been determined, and the parameters narrowed to one species of invasive Applesnail in Texas (excluding *Pomacea bridgesii*), *Pomacea maculata*, which is a species of South American origin.

This paper seeks to provide a succinct rendering of relevant data from those papers. Historical background, general educational and other extraneous data deemed relevant to the regional reporting is included herein. Major portions of this paper are transcribed directly from "Gonzales 2010".

### INTRODUCTION

#### Applesnails in Texas and Shifting of Species Names

"Initially *P. insularum* had been identified as *P. canaliculata* in Florida, Georgia, and Texas. Genetic testing confirmed that specimens collected in Florida, Georgia, and Texas were *P. insularum* (Rawlings et al. 2007). Since then, *P. insularum* has been synonymized with *P. maculata* (Hayes et al., 2012)" [Benson 2013]

The list below are the names applied to species of the Applesnail family *Pomacea*, as used in literature. Sometimes these names have been used in error, either due to misidentification, or replication. The *Pomacea sp.* citations herein are as published, not amended names. Common names used herein are derived from listings provided by the American Fisheries Society publication covering the Common Names for Mollusks [when listed]. (Turgeon et al. 1998), or are derived from cited papers.

#### Applesnails purported from Texas: the "Channeled Applesnail Group"

- |                        |                             |  |
|------------------------|-----------------------------|--|
| • Florida Applesnail   | <i>Pomacea paludosa</i>     | Origin: S.E. USA, Cuba and Hispaniola. |
| • Spiketop Applesnail  | <i>Pomacea bridgesii</i>    | Origin: South America                  |
| • Channeled Applesnail | <i>Pomacea canaliculata</i> | Origin: S.E. Asia                      |
| • Golden Applesnail    | <i>Pomacea insularum</i>    | Origin: South America                  |
| • Maculate Applesnail  | <i>Pomacea maculata</i>     | Origin: South America                  |

### Historical Referencing

- *Pomacea insularum*, historically (falsely) reported as: *Pomacea canaliculata*
- *Pomacea insularum*, now synonymized as: *Pomacea maculata* by Hayes et al., 2012

### Texas Geographic Distribution

The Florida Applesnail *P. paludosa*, is uncommon in Texas (Andrews 1977), and represents the traditional western limit for the range of this species. It is seldom found outside of coastal south Texas, and is the only member of the *Pomacea* family that is native and non-invasive. However *P. bridgesii* is the only *Pomacea* species that possession is allowable under Texas Law (TPWC 2013) (Chilton 2011). It is assumed to be oversight or that indigenous species are not listed, but rather only invasives.

In 1989, *Pomacea canaliculata* was recorded in Texas for the first time from Houston. (Neck 1992) This has since be re-identified as *P. insularum*, and later as *P. maculata* (Rawlings et al. 2007).

By 2000, Channeled Applesnail-group specimens were found established in Galveston and Brazoria counties. By 2005, Channeled Applesnail-group members had been found to be established at multiple sites in at least six counties in southeastern Texas. A population of *P. bridgesii* was known from Waco area of McLennan County, Texas, until a kill-off in winter of 2004, and have not since been reported (Howells 2005).

By 2013, specimens were also found in multiple locations in west and south west Harris County, and the Armand Bayou watershed of Southeast Harris County, Texas. (SJCC 2013)

Currently, *P. insularum* is found in the southern U.S. in eight states, including: Texas, Louisiana, Mississippi, Alabama, Florida, Georgia, South Carolina, and North Carolina (Benson 2010).

In Texas *P. insularum* is present in the Upper and Lower Galveston Bay watershed counties of: Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris and Waller (Karatayev et al. 2009).

### Generic Introduction Pathways

Escape or release from plant or animal aquaculture operations and the aquarium/pet trade (Rawlings et al. 2007).

### Health Concerns

Applesnails are an intermediate host to the Rat Lungworm - *Angiostrongylus cantonesis*, a parasitic worm of rats. Human infection by this parasite is typically from eating raw or undercooked snails or by eating raw produce contaminated by Rat Lungworm larvae. Rat Lungworm has been found in Applesnails collected from: Houston, Texas and New Orleans, Louisiana (Teem & Gutierrez 2008) (Teem 2013).

### Prohibited Lists

In the State of Texas, all species from the family Ampullariidae except for the Spiketop Applesnail, *P. bridgesii*, are legally classified as exotic, harmful, or potentially harmful. No person may import, possess, sell, or place this species into State waters except as authorized by a rule or permit issued by the TPWD. (TPWC 2013)

### Specific Primary Habitats

Applesnails are found in shallow, freshwater habitats including streams, bayous, ponds, irrigation canals and rice fields. Applesnails tolerate salinities up to 7 parts per thousand (ppt) well and can survive in salinities up to 14 ppt (Ramakrishnan 2007). Temperature tolerances of this species were determined by Ramakrishnan (2007) to be 15-36C and may limit distribution of the species in the U.S. Under conditions of hypoxia Applesnails can switch to air breathing by using their mantle cavity as an aerial lung. Texas populations have been found to maintain low population densities (<2 per m<sup>2</sup>) in permanent, stable freshwater systems (ponds and streams). Much higher population densities (>130 per m<sup>2</sup>) have been found in ephemeral agricultural environments (e.g. rice fields) in southeast Texas (Burlakova et al. 2010).

**Ecological, Economic, or Social Impact**

Negative ecological effects of this herbivorous snail species include impacts on wetlands and wetland restoration activities, competition with native snails, and the introduction of exotic parasites (Karatayev et al. 2009). Economic losses can include damage to rice crops as has been evidenced in invasions of Applesnails documented in Asia (Burlakova et al. 2009). In Texas, there is no documented agricultural damage from *P. insularum* at present. However, rice farmers experience increased maintenance costs for levees in fields with large populations of *P. insularum* due to the constant burrowing by snails (Burlakova et al. 2010).

**Physical Description**

Applesnails are typically globular or spherical in shape. They may be banded, brown, black, or yellowish-tan with color patterns being variable. Albino and gold color variations also exist (Benson 2010).

**Reproduction Characteristics**

Unlike most snails which are hermaphroditic, Applesnails have separate male and female sexes. They lay their egg clusters on solid objects (e.g. plant stems, tree trunks, rocks, storm-water outfalls, or docks) just above the water line. Each egg cluster can contain thousands of eggs that are initially bright pink or reddish in color. Over time, the eggs fade to a light pink or white color. The presence of egg masses is a good indicator of snail presence/absence in a water body. *P. insularum* not only has high fecundity, but reproduces over a long period of time (March to early November in southeast Texas), thus this species is able to take advantage of unpredictable environments, like floodplains (Burlakova et al. 2010).

**Feeding**

The Applesnail diet consists primarily of rooted aquatic vegetation. Burlakova et al. (2009) found that Applesnails will feed on native plant species such as Coon's Tail, Spider Lily, Widgeon Grass, and Lance Leaf arrowhead. Applesnails may also feed on *Spartina alterniflora*, California Bulrush, Water Cana, and common cattail, but will only do so when shoot dryness is low. Applesnails are also known to feed on invasive plants such as Elephant Ear, Alligator Weed, and Common Water Hyacinth.

**Closing and Control**

Since early detection is key to preventing the spread and establishment of this species, regional/local monitoring or surveillance is essential. Nonnative species should not be released. If found in Texas, note the capture location, kill and freeze the Applesnail, and notify the TPWD. Op. Ed. - This "Control" is in contradiction to the TPWC Rules, however, dead specimens are the goal of TPWC and if you are in the commission of helping to eradicate this invasive species the Game Warden typically would not issue a citation to the collector.

## CITATIONS

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