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NOTES

RECENT INTRODUCTION AND POTENTIAL BOTANICAL IMPACT OF THE GIANT RAMS-HORN SNAIL, *MARISA CORNUARIETIS* (PILIDAE), IN THE COMAL SPRINGS ECOSYSTEM OF CENTRAL TEXAS

FRANCIS R. HORNE, THOMAS L. ARSUFFI, AND RAYMOND W. NECK

Department of Biology, Southwest Texas State University, San Marcos, TX 78666
Texas Parks and Wildlife Department, 4200 Smith School Road, Austin, TX 78744

The giant rams-horn snail, *Marisa cornuarietis* (Linnaeus, 1758), family Pilidae (=Ampullariidae), is a large discoidal prosobranch gastropod that is native to northern South America and southern Central America (Baker, 1930). The first occurrence of North America was in Florida (Hunt, 1958). Neck (1984) reported a population of *Marisa* in June 1983 in the San Marcos River, Hays Co., Texas. F. R. Horne had observed them in the river since April 1981. The purpose of this note is to document the establishment of ramshorn snails in a neighboring aquatic ecosystem located within the city of New Braunfels, Comal Co., Texas, and to speculate from preliminary observations on the potential ecological impact of this voracious herbivore on macrophytes in Landa Lake.

Marisa was first detected in the Comal River in June 1984 when four empty shells were collected from the lake in Landa Park. Extensive sampling did not yield living specimens. Snails were introduced prior to 1981 into the San Marcos River and about 1983 into the Comal River. *Marisa* was not reported from the San Marcos River during a gastropod survey in 1977 and 1978 (Lindholm and Huffman, 1979). The method of introduction is unknown. However, since *Marisa* is a common aquarium snail that is sold by pet dealers in both San Marcos and new Braunfels, it is possible that unwanted ramshorns were released by aquarists.

Neck (1984) suggested that *Marisa* might have a substantial impact on the San Marcos River. Species in the tropical gastropod family Pilidae (e.g., *Marisa, Pomacea*) tend to show a preference for macrophytes as food resources (Andrews, 1965), and *Marisa* has been investigated as a biological control agent for aquatic weeds (Seaman and Porterfield, 1964; Blackburn et al., 1971). The radular morphology of *Marisa* is of the taenioglossate pattern with long canine-like lateral teeth which can effectively pierce and tear both macrophyte leaf and stem tissue (Fig. 1). The powerful jaws clip, grasp and hold stems and leaves while the radula shreds them. Plants in many areas of Landa Lake have been denuded of leaves or even grazed to the bottom. Feeding snails clip the petiole or basal stem of plants before feeding on the cuttings and frequently lose their grip, allowing the aerenchymous cuttings to float away in the current to form large floating masses. Mowing of the plants in Landa Lake by park employees to allow swimming and recreational use of the lake has stopped since the snails have so effectively grazed the macrophyte communities. Herbivory on flourishing macrophytes by macroinvertebrates is uncommon in freshwater ecosystems (Otto and Svensson, 1981; Wetzel, 1983, but see Sheldon, 1987). Most snails feed on epiphyton by radular scraping rather than grazing the entire macrophyte (Bronmark, 1989).

No quantitative studies have been made to de-

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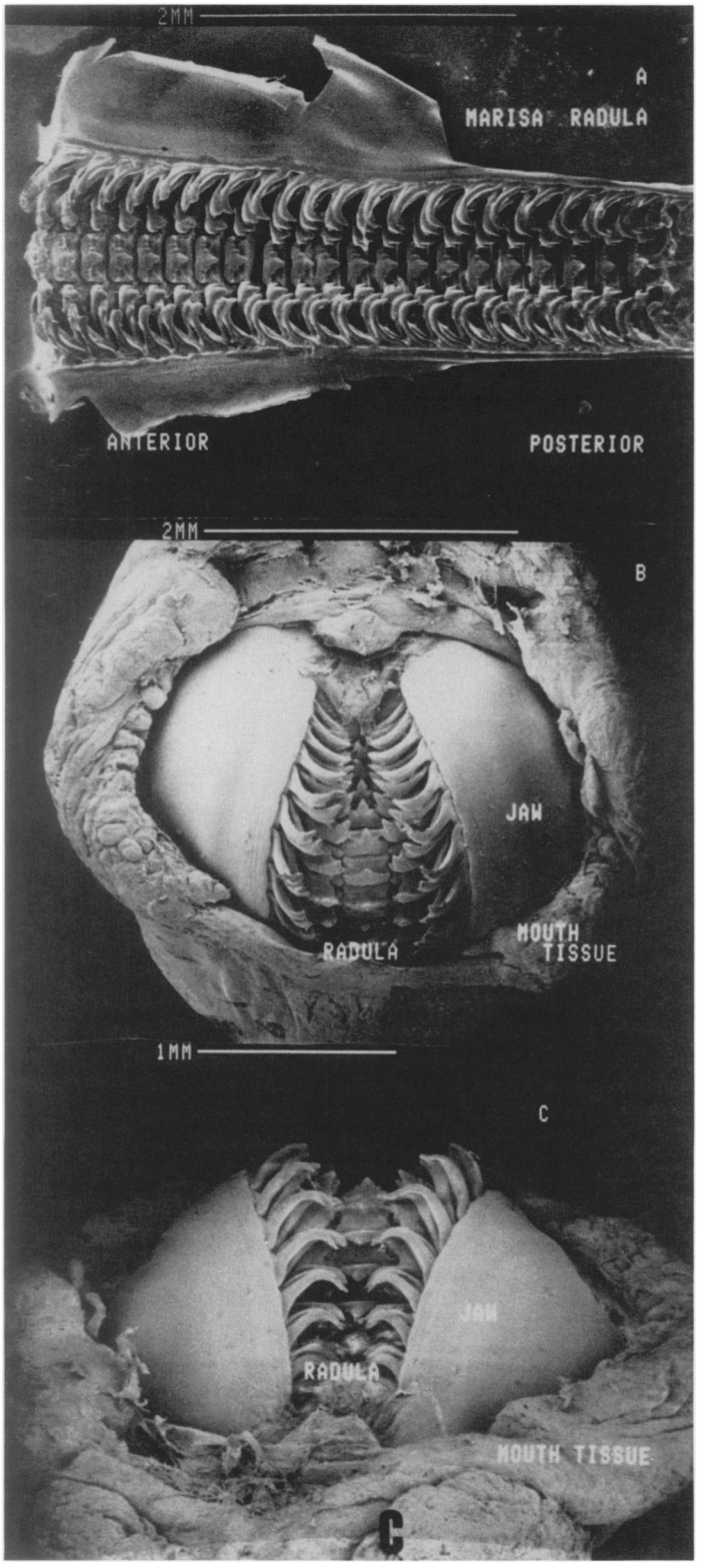
FIG. 1—Scanning electron micrograph of the radula of *Marisa cornuarietis*: A) dorsal view of isolated radula, B) frontal or oral view of intact jaws and radula, C) dorsal view of jaws and sickle-like lateral teeth.


2MM
A
MARISA RADULA
ANTERIOR
POSTERIOR
2MM
B
JAW
RADULA
MOUTH TISSUE
1MM
C
JAW
RADULA
MOUTH TISSUE
C

termine the impacts of *Marisa* on vegetation, native snail populations, or other fauna in the San Marcos and Comal rivers. However, the population size of *Marisa* has increased dramatically since its introduction into the upper Comal Springs. Numerous snails can be seen feeding on vegetation everywhere in the lake, egg masses are numerous on macrophytes, some dense beds of plants have been completely denuded, and the bare lake bottom crisscrossed with snail tracks. Empty shells are numerous in the lake.

No a priori quantitative data are available on the types, densities or distribution of macrophytes in Landa Lake; therefore, it remains to be determined which plant species were affected most by *Marisa*. At present, the dominant macrophytes in the lake are *Cabomba caroliniana* Gray, *Ludwigia repens* Forst., and *Vallisneria americana* Michx.

As of April 1990, the adult snail population in Landa Lake has undergone an apparent crash with dead subadult shells common all over the bottom; extensive sampling at this time produced very few living specimens. The diameters of dead adult shells in Landa Lake were 18.2% smaller (San Marcos: $\bar{X} = 34.2$ mm, $SD = 3.8$, $n = 140$; Comal: $\bar{X} = 28.9$ mm, $SD = 4.1$, $n = 270$) than those collected from the San Marcos River. Jobin (1970) found that adult *Marisa* grew only to 27 mm after 500 days (average life span) of growth under crowded conditions and less vegetation, while, under more benign conditions, the adult diameter of 50 to 60 mm was attained at 500 days. The absence of large snails in Landa Lake may indicate that food shortage caused the population decline. At the same time that few adults were observed in 1990, large numbers of young (<5 mm) snails were easily collected. Studies are underway to establish what further impact this next cohort of ramshorn snails will have on the Comal aquatic ecosystem. Alteration of plant communities by an exotic herbivore like *Marisa* is of special concern in these important systems and might impinge on a variety of other species including endemic species such as fountain darters (*Etheostoma fonticola*), the San Marcos salamander (*Eurycea nana*), and Texas wildrice (*Zizania texana*), which are listed on both federal and state endangered or threatened species lists.

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