

# Predation on freshwater bryozoans by the apple snail, *Pomacea canaliculata*, Ampulariidae, an invasive species in Southeast Asia: a summary report

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**Abstract:** In Southeast Asia an invasive snail from South America is seriously affecting entire populations of freshwater bryozoans. This summary paper describes the unexpected ecological problem. A short video in three segments may be obtained showing the invasive snail and contrasting the feeding behaviors of the alien and indigenous snails.

**Key words:** Bryozoa, Southeast Asia, invasive and indigenous snails, predation, Mollusca.

## Introduction

The cherry snail, also known as golden apple snail, bears the scientific name, *Pomacea canaliculata* LAMARCK 1822. It is classified in the apple snail family Ampulariidae, which includes several species popular with aquarium hobbyists. Growing to nearly the size of a tennis ball (Fig. 1), it was introduced to Taiwan around 1980 to help poor rice farmers earn extra income by raising and selling the snails for human consumption (MUCHIDA 1991). From Taiwan the snails were transported to Japan, Indonesia, Philippines, China, and Thailand (Fig 2). Unfortunately, there was little demand for the tough meat and farmers soon gave up on them. By that time, however, the snails had escaped captivity and were causing increasing damage to young rice seedlings (NAYLOR 1996).

The cherry snail is well adapted to the climate of southern Asia. It thrives in the warm water, females reaching maturity in 3-4 months and laying many thousands of eggs throughout their lifetime. The eggs are deposited in pink masses above the waterline, where they escape aquatic predators (Fig. 1, 3, Video 1). The young feed on a wide variety of living and dead organic material. In rich habitats with little oxygen, the snails

can inhale air through a special long tube to the surface. At times of drought they can bury themselves deep in the soil and estivate there for many months. During the rainy season the snails move easily throughout entire river basins and even migrate overland (see excellent review of cherry snail biology, spread, and impact by COWIE 2002).

As farmers struggle to protect their rice crops, they have turned to inexpensive general pesticides, which profoundly impact many nontarget species of fish and invertebrates. The rice crop itself becomes contaminated as well. As the populations grow, local people have noticed a dramatic decline in the populations of indigenous edible snails (HALWART 1994), including local apple snails (*Pila* spp.) and the chinese mystery snail (*Viviparus malleatus*).

Our particular interest in the cherry snail grew out of the observation that in many ponds and canals in Thailand where the snail is abundant bryozoans are generally absent. While the snails had become notorious as voracious herbivores, they had never been reported to graze on animals. As sessile invertebrates, however, bryozoans would seem vulnerable to predation, and it was reasonable to suspect they were being eaten by the snails.

## Methods

To investigate this possibility we grew several bryozoan species on glass plates measuring 19 cm square, then exposed them to the snails. About 80 % of the plates was occupied by *Plumatella bombayensis* ANNANDALE, *P. vorstmani* TORIUMI and *Hislopia malayensis* ANNANDALE; the remaining space was taken by *Plumatella casmiana* OKA and *P. mukaii* WOOD. In a laboratory test chamber the plate was oriented horizontally with bryozoans facing down. Snails introduced to the chamber could climb up the sides and move directly onto the glass panel (Fig. 4). Pairs of snails measuring 3-4 cm in diameter were introduced to the chamber and observed continuously for at least 30 minutes.

## Results

Cherry snails placed in the chamber mounted the sides almost immediately and began feeding on the bryozoans (Video 2). Their grazing pattern was rapid and deliberate as the snails moved to areas where zooids were most dense, then roamed peripheral regions to pick up remaining pieces. Two snails could clean the entire plate in less than one hour, removing all phylactolaemate bryozoans but only slightly damaging the much smaller and resilient *Hislopia* colonies (Fig. 5).

As mentioned previously, Thailand has its own large, indigenous snails which are often consumed as food. Do these snails also feed on bryozoans? We repeated our trials using *Viviparus* and found that rather than feeding on bryozoans the snails sought out and ingested other organic material on the panel, cleaning around the colonies without damaging them (Video 3). Even after 24 hours of exposure the colonies remained intact. When indigenous apple snails (*Pila* spp.) were placed in the trials they displayed no interest whatever in the bryozoans, passing over them repeatedly without pause. In their natural habitat, *Pila* snails burrow into bottom sediments and feed on organic detritus.

## Discussion

We conclude that the cherry snail is a significant factor in the absence of bryozoans from habitats where they would otherwise be expected to occur. Some bryozoan colonies find refuge on floating or dangling substrata and other places inaccessible to cherry snails, such as the spiny leaves of the red water lily, *Nymphaea lotus*. However, we suspect that most bryozoan species, especially those already uncommon, may be seriously threatened. This situation now joins the growing list of instances where the innocent introduction of an alien species has a profound negative effect on local biota.

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## Video supplement

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1. Female cherry snail laying an egg mass on a cement wall above the water surface at a pond in Bangkok, Thailand. Scale bar = 4 cm.
2. Cherry snail grazing on bryozoans in a laboratory trial, showing the action of the snail radula in tearing off and scooping up pieces of bryozoan colonies.
3. Large indigenous snail (*Viviparus mal-leatus*) feeding on organic debris in crevices between branches of bryozoan colonies without damaging the colonies.

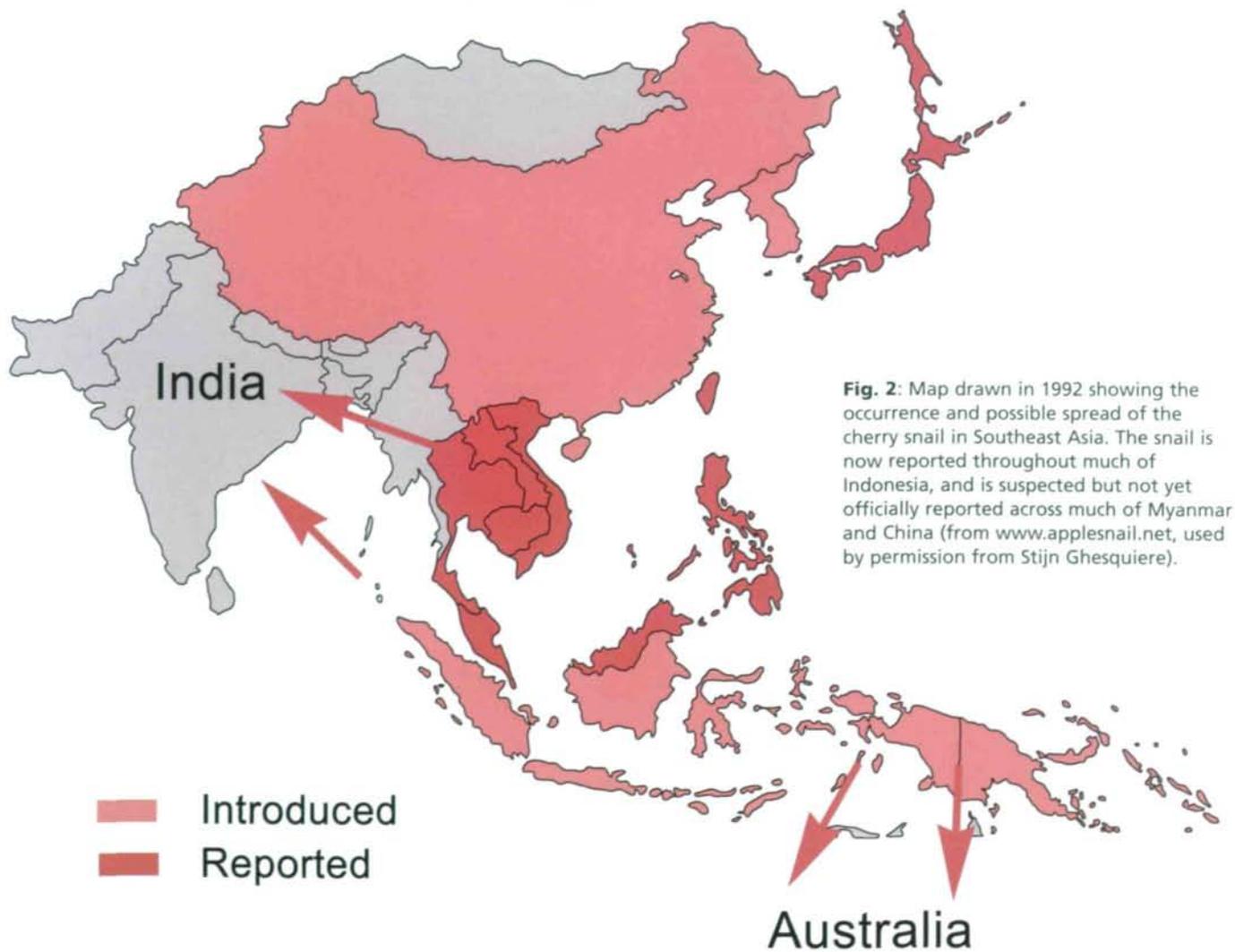
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**Fig. 1:** Female cherry snail laying an egg mass on a cement wall above the water surface at a pond in Bangkok, Thailand. Scale bar = 5 cm.



**Fig. 2:** Map drawn in 1992 showing the occurrence and possible spread of the cherry snail in Southeast Asia. The snail is now reported throughout much of Indonesia, and is suspected but not yet officially reported across much of Myanmar and China (from [www.applesnail.net](http://www.applesnail.net), used by permission from Stijn Ghesquiere).

**Fig. 3:** Egg masses of the cherry snail near a water-filled ditch, a common sight throughout Southeast Asia.



**Fig. 4:** Apple snail devouring bryozoans on a glass panel in a laboratory feeding trial.



**Fig. 5:** Glass panel in which the top half was protected from grazing by apple snails in a laboratory feeding trial.



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