

## MASTER'S THESIS

### Status of the apple snail *pomacea canaliculata* in Hong Kong twenty years after its invasion, with emphasis on its distribution, secondary production and trophic relationship

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**Status of the Apple Snail *Pomacea canaliculata* in Hong Kong  
Twenty Years after its Invasion, with Emphasis on its  
Distribution, Secondary Production and Trophic Relationship**

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**A thesis submitted in partial fulfillment of the requirements  
for the degree of  
Master of Philosophy**

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## Abstract

*Pomacea canaliculata* (Lamarck, 1822) is a freshwater gastropod native to South America. It has become an important invasive species and agricultural pest worldwide, especially in southeast Asia. However, many aspects of its ecology were still largely unknown. In this study, I updated the distribution of *P. canaliculata* in Hong Kong and examined the environmental determinants of its habitat preference. I investigated the population dynamics and secondary productions of three *P. canaliculata* populations from different habitats, and explored their relationships with habitat characteristics and seasonal environmental fluctuations. Besides, I examined the gut content of the snails from these study sites. In laboratory experiments, I quantified the predatory effect of *P. canaliculata* on five species of local freshwater gastropods, and measured the snail's consumption rate, growth and fecundity when fed with ten species of macrophytes which possess different physical and chemical traits.

Sites inhabited by *P. canaliculata* were characterized by high levels of phosphate and alkalinity, although the snail could be occasionally found in streams where dissolved ion concentrations and nutrient levels were low. Most of the inhabitable sites in New Territories have been occupied by *P. canaliculata*, while Hong Kong Island remains uninhabited probably due to unsuitable hydrology. Lantau Island has habitable sites for the snail, and thus is susceptible for invasion in the future. Abundance of the snail was highly correlated to temperature and water level. Annual secondary production of studied *P. canaliculata* populations were  $115 \text{ g m}^{-2} \text{ y}^{-1}$  in a shallow pond,  $159$

$\text{g m}^{-2} \text{y}^{-1}$  in a rice paddy and  $217 \text{ g m}^{-2} \text{y}^{-1}$  in a drainage channel receiving agricultural runoff. These values are among the highest ever recorded in freshwater gastropods, indicating that the snail is highly successful in local freshwater habitats and can play an important role in material cycling and energy transfer along local wetlands.

Gut content analysis revealed that the snail consumed various food items but predominantly feeds on detritus and macrophytes. This feeding habit is different from other local freshwater gastropods and the trophic niche separation could have facilitated the invasion of the snail. Results of laboratory experiments showed that the snail devoured heavily the eggs and neonates of other local gastropods. It even attacked the adults of some pulmonates with a fragile shell and without an operculum. These data indicate that *P. canaliculata* may threaten local gastropod populations. The snail exhibited generally higher consumption rate, growth rate and fecundity when fed with four species of cultivated vegetables, probably due to their higher nutritional value and weaker physical and chemical defense than wild plants. This result indicates that crop cultivation may have enhanced the colonization of the snail by providing more ideal food for the apple snail.

The results of my study have confirmed that the *P. canaliculata* is very common in various freshwater habitats in Hong Kong. It has become a dominant benthic animal in many types of freshwater ecosystems. Given the laboratory evidence of predation on other snails and selective herbivory, more work should be conducted to assess the impact of this snail on the biodiversity and functioning of non-agricultural wetland ecosystems.

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