

## High density of flower urchin, *Toxopneustes pileolus*, in Houbihu Lagoon, southern Taiwan

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### Abstract

Prior to 2003, flower urchins (*Toxopneustes pileolus*) were nearly absent in Houbihu Lagoon (120° 44' 50.83" E, 21° 56' 49.43" N) in southern Taiwan because of harvesting by locals and fishermen. In 2003, Kenting National Park classified this lagoon as a protected area due to its high diversity of marine life. After eight years of protection, flower urchins have become abundant in the lagoon. This report documents the high density of flower urchins,  $8.60 \pm 0.21$  per m<sup>2</sup>, at Houbihu Lagoon may be the highest reported density of flower urchins. The thick coral debris bed of the lagoon provides food, covering material, and habitat for flower urchins, ensuring their high density.

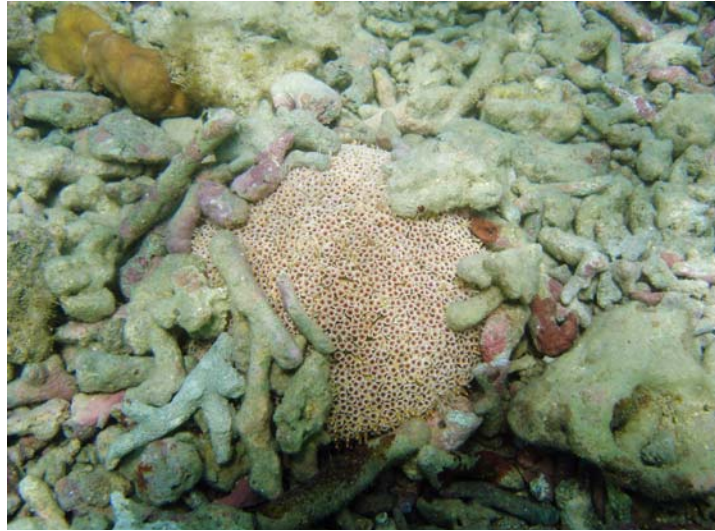
**Key words:** Sea urchin, *Toxopneustes pileolus*, Echinoderms, Density

### Introduction

The flower urchin, *Toxopneustes pileolus* (Lamarck 1816), is widely distributed in the shallow waters of the Indo-West Pacific reefs (Clark and Rowe 1971) (Fig. 1). It is a relatively large urchin with a test diameter <15 cm and primarily consumes coralline algae encrusting coral debris. This species is occasionally observed by the senior author Shyh-min Chao in reef substrates

in southern Taiwan. All records from the Indian Ocean, Fiji, and southern China indicate that its density is very low (Chang and Woo 1957; McClanahan 1998; Coppard and Campbell 2005). It occurs at a high density ( $1.14 \pm 0.22$  per m<sup>2</sup>) in Suruga Bay, Japan (Takayuki and Shimpei 1998).

The Houbihu Lagoon (120° 44' 50.83" E, 21° 56' 49.43" N) is a small reef lagoon



**Fig. 1.** The flower urchin *Toxopneustes pileolus*; test diameter = 14 cm.

(area only 0.33 km<sup>2</sup>) in Kenting National Park, southern Taiwan. In 2003, Kenting National Park classified this lagoon as a protected area due to its high diversity of marine life (Chao 2005, 2006). Prior to 2003, flower urchins were nearly absent from the Houbihu Lagoon, largely because of harvest by locals and fisher folk (personal observation).

The substrate of the Houbihu Lagoon is smooth and shallow, composed mainly of sand and coral debris. The water level at spring tide is 0.5-3.0 m. Living corals are sparse. Round mass coral (*Porites lutea*) and branching coral (*Porites nigrescens*) were the most common corals. Encrusting coralline algae are abundant on coral debris. Protected seaward by an outer reef, waves and currents inside the lagoon are weak, making this habitat suitable for flower

urchins and other sea urchins (Chen et al. 2010). After eight years of protection, flower urchins are now abundant in Houbihu Lagoon (Fig. 2). Natural spawning of flower urchins occurred several times in this lagoon (Chen and Soong 2010).

To calculate flower urchin density, four 10x10 m<sup>2</sup> quadrates were placed in Houbihu Lagoon in September 2010. Since flower urchins were unequally distributed, we set another four 2x2 m<sup>2</sup> quadrates in areas with high flower urchin concentrations to calculate highest densities. In the lagoon, density of flower urchins was 17.0± 5.3 (mean ± s.d.) per 100m<sup>2</sup>. The estimated total number of flower urchins was 56,100. Where flower urchins were aggregated, density was 8.60±0.21 (mean ± s.d.) per m<sup>2</sup>, representing the highest density ever reported (Fig. 2).



**Fig. 2.** High density of flower urchins in the Houbihu Lagoon, southern Taiwan.

Takayuki and Shimpei (1998) noticed flower urchins were abundant only among dead branching corals (*Acropora tumida*) in Suruga Bay, Japan. They suggest an interaction between flower urchins and *Acropora tumida*. In the Houbihu Lagoon, however, *Acropora tumida* were few and sparsely distributed. Most flower urchins in the Houbihu Lagoon were living on substrates with thick debris containing fragments of many coral species, including several species of *Acropora*. Since the abundant coralline algae lives on coral debris, this thick bed of coral debris is probably the main habitat of flower urchins. During winter months and typhoons, when surf is high, flower urchins need to half-buried in coral debris for shelter from wave action. They also need a covering of coral debris to protect them from strong ultraviolet

light (Verling et al. 2002; Kehas et al. 2005). Thus the thick coral debris bed at the Houbihu Lagoon provides food, covering materials, and shelter for flower urchins. Since the sea urchin population at the Houbihu Lagoon is abundant, with 17 species (Chen et. al. 2010), this lagoon is important for sea urchin conservation, particularly for flower urchins.

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## 後壁湖潟湖高密度的喇叭毒棘海膽

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### 摘 要

本研究報告描述於2010年9月在後壁湖潟湖發現高密度的喇叭毒棘海膽，最大密度為 $8.60 \pm 0.21$ 隻/m<sup>2</sup>，此潟湖在2003年之前幾乎沒有喇叭毒棘海膽。由於海洋生物多樣性高，此潟湖於2003年被墾丁國家公園劃定為海洋保護區，經過8年的保護，潟湖內的喇叭毒棘海膽數量豐富，這可能是文獻上已知喇叭毒棘海膽最高密度之記錄。潟湖中大面積厚的死珊瑚碎片區提供了喇叭毒棘海膽的食物、覆蓋物及棲地，造成了高密度的喇叭毒棘海膽。

**關鍵詞：**海膽，喇叭毒棘海膽，棘皮動物，密度。