

國立臺灣海洋大學  
海洋環境與生態研究所 專題討論#

英文題目：Inducing broadcast coral spawning ex situ: Closed system mesocosm design and husbandry protocol

中文題目：誘導排放配子型珊瑚在非原生環境產卵：設計封閉式系統和飼養方法

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### Abstract

For many corals, the timing of broadcast spawning correlates strongly with a number of environmental signals (seasonal temperature, lunar, and diel cycles). Robust experimental studies examining the role of these putative cues in triggering spawning have been lacking until recently because it has not been possible to predictably induce spawning in fully closed artificial mesocosms. Here, we present a closed system mesocosm aquarium design that utilizes microprocessor technology to accurately replicate environmental conditions, including photoperiod, seasonal insolation, lunar cycles, and seasonal temperature from Singapore and the Great Barrier Reef (GBR), Australia. Coupled with appropriate coral husbandry, these mesocosms were successful in inducing, for the first time, broadcast coral spawning in a fully closed artificial ex situ environment. Four *Acropora* species (*A. hyacinthus*, *A. tenuis*, *A. millepora*, and *A. microclados*) from two geographical locations, kept for over 1 year, completed full gametogenic cycles ex situ. The percentage of colonies developing oocytes varied from ~29% for *A. hyacinthus* to 100% for *A. millepora* and *A. microclados*. Within the Singapore mesocosm, *A. hyacinthus* exhibited the closest synchronization to wild spawning, with all four gravid colonies releasing gametes in the same lunar month as wild predicted dates. Spawning within the GBR mesocosm commenced at the predicted wild spawn date but extended over a period of 3 months. Gamete release in relation to the time postsunset for *A. hyacinthus*, *A. millepora*, and *A. tenuis* was consistent with time windows previously described in the wild. Spawn date in relation to full moon, however, was delayed in all species, possibly as a result of external light pollution. The system described here could broaden the number of institutions on a global scale, that can access material for broadcast coral spawning research, providing opportunities for institutions distant from coral reefs to produce large numbers of coral larvae and juveniles for research purposes and reef restoration efforts.

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摘要

排放配子型的珊瑚其釋放配子和許多環境因子有強烈的關係，包括：季節性的溫度、月週期和晝夜周期等。目前仍缺乏有力的實驗和研究來證實，飼養在完全封閉式的人工養殖系統中珊瑚的釋放配子可能會受到這些環境因子的影響。本實驗設計一個封閉式的養殖水族缸系統，利用微處理器技術準確的模擬新加坡和澳洲大堡礁珊瑚生長的環境條件，包括光週期、季節性的光照、月週期及季節性溫度，加上適當的珊瑚飼養方式，首次成功地誘導排放配子型珊瑚在一個完全封閉式非原生環境的人工養殖系統中釋放配子。實驗物種為新加坡 *A. hyacinthuse*；澳洲大堡礁 *A. trinius*、*A. millepora* 和 *A. microclados*，一共 4 種軸孔珊瑚屬的珊瑚，其皆在封閉式的養殖水族缸系統中飼養超過一年以上的時間，觀察到 29% 的 *A. hyacinthus*、57.14% *A. tenuis*、100% 的 *A. millepora* 和 100% 的 *A. microclados* 的珊瑚群體有進行完整的配子發育，養殖系統中，新加坡的 *A. hyacinthus* 釋放配子的時間最接近野外珊瑚釋放配子的時間，其中 4 個珊瑚群體有配子生成且在同一個月釋放其配子與野外珊瑚預期釋放配子的日期一樣；養殖系統中澳洲大堡礁的珊瑚其釋放配子的日期與野外珊瑚釋放配子的日期相比延遲了三個月，養殖系統中，*A. hyacinthus*、*A. millepora* 和 *A. tenuis* 在日落後釋放配子的時間與野外珊瑚釋放配子的時間一致，推測珊瑚釋放配子的時間可能與滿月有關，但養殖系統中所有物種釋放配子的日期都比野外珊瑚釋放配子的日期較晚，推測可能是受到外部光線干擾的影響。此封閉式的養殖水族缸系統可以應用於全球各機構進行排放配子型珊瑚的飼養及珊瑚釋放配子的研究，也可以進行珊瑚胚胎及幼體的實驗或是進行珊瑚礁的復育。

參考資料：

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