

Spawning observations of the sea cucumbers *Stichopus chloronotus* and *Holothuria isuga* from One Tree Reef lagoon, southern Great Barrier Reef

Maria Byrne¹

Introduction

Despite the important ecological roles of tropical aspidochirotid holothuroids in coral reef ecosystems and their commercial value, for many species we have a limited understanding of their reproductive biology. Spawning observations of aspidochirotid in nature have been reported in the *Beche-de-mer Information Bulletin* over the years, and address gaps in knowledge of their reproduction and spawning behaviour. In this contribution, spawning observations of *Stichopus chloronotus* and *Holothuria isuga* in the lagoon at One Tree Island (23°30'S and 152°05'E) in the southern Great Barrier Reef are reported. While reproduction of *S. chloronotus*, an abundant epifaunal and shallow water species, has been well studied (Tan and Zulfigar 2001; Conand et al. 2002), this appears to be the first observation of the reproductive biology of *H. isuga*. *Holothuria isuga* is common in the lagoon at One Tree Island and is usually located just below the sediment surface. It is a large species, up to half a meter in length in the non-contracted state.

A recent study of reproduction and spawning of *Stichopus herrmanni* from One Tree lagoon and elsewhere, indicated a breeding season that spans the summer months, and that aggregated-coordinated spawning coincides with the new moon and continues 1–2 days following it (Balogh et al. 2019). This indicates that gamete release is influenced by the lunar cycle. Male *S. herrmanni* spawn first.

Spawning observations

Stichopus chloronotus

Date: 26 October 2018

Time: 16:00–17:00

Lunar phase: Full moon + 2 days

Spawning in *S. chloronotus* was observed in a location called The Gutter where water enters and exits the lagoon. The tide was low, and the lagoon was ponded. The lagoon at One Tree Reef is completely surrounded by reef and so at low tide the water does not flow out resulting in a ponded (no exchange) state. The animals were in 0.5 m of water. In total, 12 animals were observed spawning in an area approximately 100 m x 50 m. All of these were males. They remained on the surface of the substrate (Fig. 1A–C). Some individuals elevated their anterior end slightly (Fig. 1A). Sperm was released from the gonopore as a blob that remained concentrated until it was gently dispersed by water movement (Fig. 1B and C). There was no evidence of spawning on the following day at the same location, time and tide conditions.

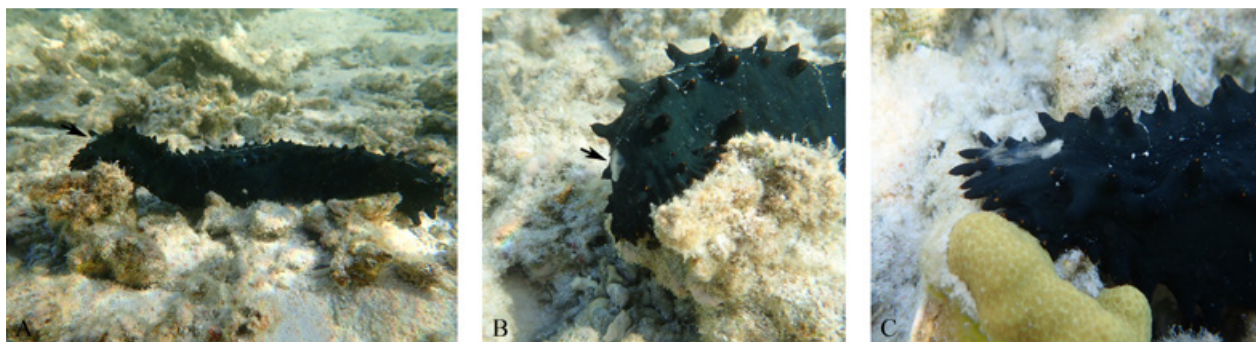


Figure 1. *Stichopus chloronotus* spawning. A) and B): Male with anterior end slightly elevated and with a blob of sperm released from the gonopore (arrows). C): A different male with the sperm being slowly dispersed by water movement. (Images: ©Maria Byrne)

¹ School of Life and Environmental Sciences, University of Sydney, NSW 2006, Australia. Email: maria.byrne@sydney.edu.au

Holothuria isuga

Date: 23 January 2019

Time: 16:00

Lunar phase: Full moon + 2 days

Spawning in *H. isuga* was observed in the lagoon at a location called Shark Alley where this species is common in sediment (Fig. 2A–C). The tide was low, and the lagoon was ponded. The animals were in 2 m of water. In total, five animals were observed on top of the sediment in an erect spawning posture along approximately 200 m of Shark Alley. These were all males, and the sperm was released from the anterior end and dispersed by water movement (Fig. 2 C). In this location *H. isuga* are dispersed in the sediment and are generally 3–5 m apart during reproduction (M. Byrne pers. obs.). Coincident with these observations, the nearby population of *Acanthaster* sp. (crown-of-thorns sea star) was also releasing gametes, with both males and females were spawning.

Discussion

The spawning of *S. chloronotus* in late October may be at the start of the spawning season as this species is reported to spawn in the southern Great Barrier Reef in November and February (Franklin 1980). *S. chloronotus* may spawn other times of the year, as seen elsewhere (e.g. Tan and Zulfigar 2001).

This is the first report of *H. isuga* spawning and was seen in January (summer), as is also the case for a suite of co-occurring species (e.g. *Stichopus herrmanni* and *Holothuria atra*) (Harriott 1982; Balogh et al. 2019). To determine the reproductive season of *S. chloronotus* and *H. isuga*, more extensive observations and details of gonad development are needed.

Similar to the pattern observed for other aspidochirotid (Babcock et al. 1992; Balogh et al. 2019), male *S. chloronotus* and *H. isuga* spawned first. At One Tree lagoon this is often seen late in the afternoon (M. Byrne, pers. obs.). The presence of sperm in the water, especially when the lagoon is ponded, may serve as a pheromonal cue for females, which appear to wait to release their eggs until after dusk. This may be a mechanism to prevent predation on the eggs by diurnal fishes. Spawning in *S. chloronotus* and *H. isuga* may be triggered by the lunar cycle as it occurs around the full moon.

For *Stichopus herrmanni*, spawning has been observed over many years and is known to occur around the new moon (Balogh et al. 2019). It will be interesting to continue documenting spawning in sea cucumbers and the timing of these events with respect to lunar phases.

Acknowledgements

Thanks to Dione Deaker for the images of *Holothuria isuga* and Matt Clements for assistance with figures.

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Figure 2. *Holothuria isuga* spawning. A) and B): Spawning males elevated above the floor of the lagoon. C): Anterior end showing sperm being released and dispersed by water movement. (Images: ©Dione Deaker, University of Sydney)