

Spawning of *Australostichopus mollis* at its northernmost subtropical locality

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Species: *Australostichopus mollis* (Hutton, 1872), confirmed by F.W.E. Rowe from photographic comparisons (e.g. Coleman 2007)

Location: Elizabeth Reef, eastern Australia at 29°57'S, 159°04'E. The reef is 160 km north of Lord Howe Island and 555 km from the New South Wales coast of Australia. It is the southernmost coral atoll in the world. The site where spawning was observed is on the seaward side of the main lagoon, in a bay on the northwest corner of Elizabeth Reef.

Date and time: 19 February 2007

Moon phase: Waxing crescent (one day after the new moon)

Tide: At or just after low tide

Observer/photographer: Simon L. Hartley

Spawning

The photographs (Fig. 1) clearly shows that spawning animals were in close proximity, with individuals about 3–5 m apart. Many of these spawning pairs and trios were observed during the day of 19 February 2007. The close proximity would favour reproduction success, since the rates of fertilisation of oocytes in echinoderms is known to be highly dependent on distance between mates (Bell et al. 2008).

Individuals were also observed and photographed at elevated locations on the reef where sperm and oocytes could easily be taken by water currents to other spawning individuals and would be carried away from the reef benthos. Some authors have observed small fish (e.g. damselfishes) feeding on the sperm or oocytes of sea cucumbers (Moosleitner 2006; Desurmont 2008), so an erect body pose in elevated positions on the reef would serve to ensure that

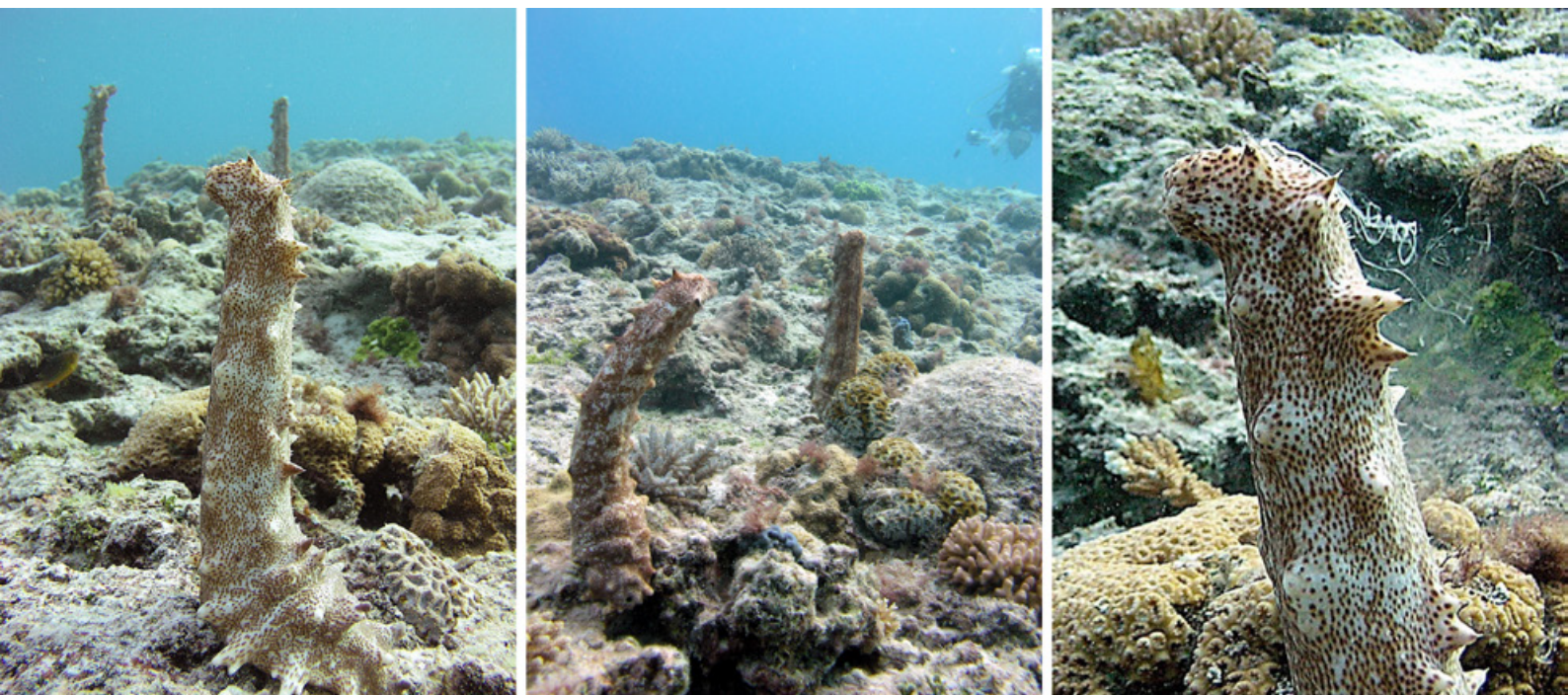


Figure 1. Pairs and trios of *Australostichopus mollis* spawning during the daytime at Elizabeth Reef, off the east coast of Australia (left and middle). A male *A. mollis* releasing sperm from its gonopore at the anterior end of the animal while in the erect spawning pose (right). (Images: S.L. Hartley)

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Figure 2. *Australostichopus mollis* observed moving on the reef surface at night at Elizabeth Reef, Australia. (Images: S.L. Hartley)

oocytes are swept away from the benthos where they could otherwise be eaten.

The observations reported here for *Australostichopus mollis* conform to a general model of individuals spawning in small groups in relatively close proximity and at elevated positions on the reef. Similar observations have been made for other reef-dwelling holothuroids (Muthiga 2008; Desurmont 2008; Byrne and Wolfe 2018; Byrne 2019; Huertas and Byrne 2019).

The spawning event occurred on the day just after the new moon, when the tidal range was 1.93 m (a “spring” tide). Many other observations of coral reef holothuroids spawning in the wild have also occurred around a new moon (Desurmont 2008; Muthiga 2008; Oki et al. 2011; Bédier et al. 2013; Hair et al. 2016; Byrne and Wolfe 2018; Byrne 2019), although some authors have reported spawnings during other lunar phases (e.g. Gaudron 2006; Olavides et al. 2011; Tessier and Letouze 2014; Huertas and Byrne 2019). Many reports of spawning also occurred in the late afternoon, as observed here. The animals were also observed exposed and moving around the reef at night, so are perhaps mainly nocturnally active at this locality (Fig. 2).

Distribution

This is a new and extended record for *Australostichopus mollis* into subtropical waters, and adds to the three stichopodid species previously reported for Elizabeth Reef (Rowe and Filmer-Sankey 1992). We also note that the animals depicted in the photographs appear relatively large, and likely to be greater than the 20 cm maximum length recorded for this species. The species is otherwise distributed in cooler, more southerly localities in the Tasman Sea, including the east coast of New South Wales, as far north as Broken Bay (33°33'S; slightly north of Sydney); south to the east coast of Tasmania; and around New Zealand (Rowe and Gates 1995). Records of *A. mollis* from Bass Strait, southern Australia, west to Fremantle

and the Abrolhos Islands in Western Australia (see Rowe and Gates 1995) refer to a second species (*A. victoriae* Bell, 1887) closely related to *A. mollis* (see Rowe et al. 2017).

The present record from Elizabeth Reef, therefore, extends the previous known geographic distribution of the species by 3½ degrees of latitude (about 390 km). Elizabeth Reef is herewith reported as the northernmost locality for the species. The reef, located more than 160 km north of Lord Howe Island, is a subtropical coral reef, and the animals can clearly be seen among hard corals (Fig. 1). The locality (and likely neighbouring Middleton Reef) might represent a stepping stone to provide some genetic connectivity between populations on the east coast of Australia with those in New Zealand.

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References

- Bédier A., Bourmaud C. and Conand C. 2013. Natural spawning observations on Rodrigues Island, Indian Ocean. SPC Beche-de-mer Information Bulletin 33:53–55.
- Bell J.D., Purcell S.W. and Nash W.J. 2008. Restoring small-scale fisheries for tropical sea cucumbers. *Ocean and Coastal Management* 51:589–593.

- Byrne M. 2019. Other spawning observations. SPC Beche-de-mer Information Bulletin 39:81–82.
- Byrne M. and Wolfe K. 2018. Spawning observations. SPC Beche-de-mer Information Bulletin 38:88–89.
- Coleman N. 2007. Sea stars. Echinoderms of the Asia/Indo-Pacific: Identification, Biodiversity, Zoology. Neville Coleman's Underwater Geographic Pty Ltd ACN 002 043 076. 136 p.
- Desurmont A. 2008. Natural spawning observations. *Stichopus herrmanni*, (curryfish). SPC Beche-de-mer Information Bulletin 27:40.
- Gaudron S. 2006. Observation of natural spawning of *Bobad-schia vitiensis*. SPC Beche-de-mer Information Bulletin 24:54.
- Hair C., Bitalen P., Kanawi P., Leini E. and Southgate P. 2016. Multi-species sea cucumber spawning at Limel-lon Island, New Ireland Province, Papua New Guinea. SPC Beche-de-mer Information Bulletin 36:87–89.
- Huertas V. and Byrne M. 2019. Observation of mass spawn-ing of the sea cucumber *Holothuria coluber* at Lizard Island, Great Barrier Reef, Australia. SPC Beche-de-mer Information Bulletin 39:79–80.
- Moosleitner H. 2006. Observation of natural spawning of *Holothuria tubulosa*. SPC Beche-de-mer Information Bulletin 24:53.
- Muthiga N. 2008. Natural spawning observations. *Pearsono-thuria graeffei* (flowerfish). SPC Beche-de-mer Infor-mation Bulletin 27:41.
- Oki K., Taquet C. and Yasuda N. 2011. Natural spawning observation of *Actinopyga mauritiana*. SPC Beche-de-mer Information Bulletin 31:59.
- Olavides R.D.D., Rodriguez B.D.R. and Juinio-Meñez M.A. 2011. Simultaneous mass spawning of *Holothuria scabra* in sea ranching sites in Bolinao and Anda munic-ipalities, Philippines. SPC Beche-de-mer Information Bulletin 31:23–24.
- Rowe F.W.E. and Filmer-Sankey P. 1992. Echinoderms. p. 88–90 and 190–192. In: Longmore R. (ed). Kowari 3. Reef biology: A survey Elizabeth and Middleton Reefs, South Pacific. Canberra: Australian National Parks and Wildlife Service Publication.
- Rowe F.W.E. and Gates J. 1995. Echinodermata. p. 510. In: Wells A. (ed). Zoological Catalogue of Australia, vol. 33. Canberra: Commonwealth Scientific and Industrial Research Organisation.
- Rowe F.W.E., O'Hara T.D. and Bardsley M. 2017. 11. Holo-thuroidea. p. 612. In: Byrne M. and O'Hara T.D. (eds). Australian echinoderms: Biology, ecology and evolu-tion. Canberra: Commonwealth Scientific and Indus-trial Research Organisation.
- Tessier E. and Letouze P. 2014. Mass spawning of *Holothuria fuscopunctata* in New Caledonia. SPC Beche-de-mer Information Bulletin 34:54.