

## Simultaneous mass spawning of *Holothuria scabra* in sea ranching sites in Bolinao and Anda municipalities, Philippines

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The Bolinao-Anda reef system in Pangasinan, north-western Luzon is among the many areas in the Philippines where sea cucumbers and invertebrate fisheries thrived in the 1970s and 1980s. These fisheries, however, have collapsed in the last two decades due to overfishing. With improvements in hatchery technology for sandfish (*Holothuria scabra*), the University of the Philippines Marine Science Institute was able to establish five-hectare sea cucumber ranching sites in the municipalities of Bolinao and Anda (Fig. 1). The first batch of juveniles released in Bolinao and Anda was in December 2007 and December 2008, respectively. We are studying the feasibility of community-supported sea ranching sites to provide supplemental income to our sea ranch operators (composed of marginal fishers), and its potential to help replenish depleted stocks. We have released 16,711 individuals in Bolinao and 20,549 in Anda, to date.

In recent months, we have received anecdotal accounts of solitary sandfish spawners in the managed area from sea ranchers who guard and co-manage the site. For the first time, however, we not only verified spontaneous spawning of sandfish at the sea ranch but also documented a simultaneous mass-spawning event at both the Bolinao and Anda sites on 23 February 2010 from 11:00 to 15:00 (a day after the first quarter moon, and on a rising tide) during our regular site visits. We conducted rapid surveys at both sea ranching sites to estimate the number and density of spawners.

At Anda, we first observed five male spawners at around 11:00. An hour later, a female spawner released gametes in two bursts, followed by four male spawners. In Bolinao, we first observed a spawner at around 12:45 (Fig. 2). Also about an hour later, we found that 15 individuals had

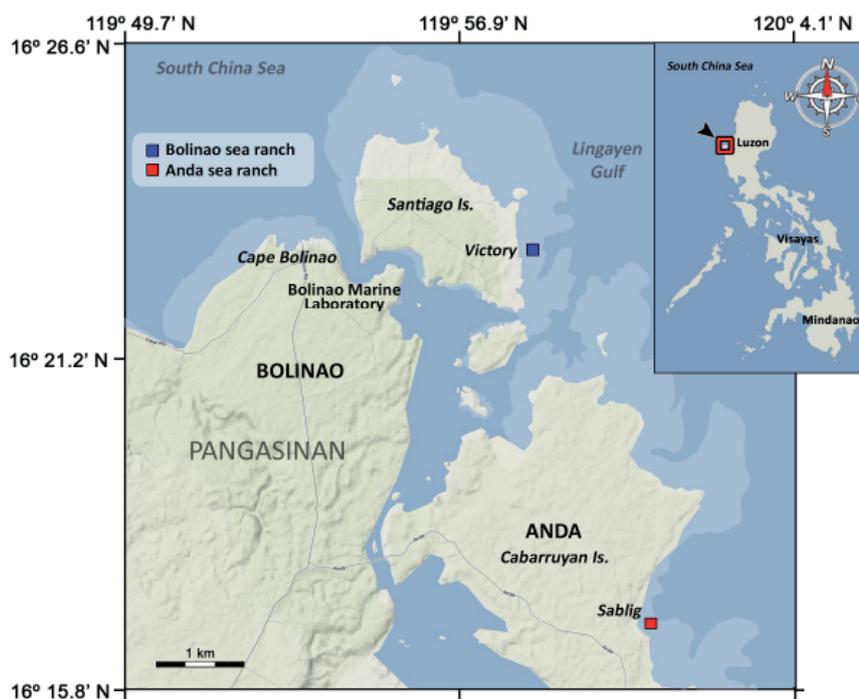


Figure 1. Location of Bolinao and Anda sea ranching sites, off the island of Luzon in the Philippines.

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**Figure 2.** *Holothuria scabra* specimens spawning at the Anda sea ranch site.

**Table 1.** Summary of observational data on sandfish mass spawning inside sea ranching sites (23 February 2010).

Site	Search effort	Ratio of spawners	Density of spawners
Bolinao sea ranch	~700 m <sup>2</sup> (45 min)	19.7% (38 out of 181)	0.0543 ind m <sup>-2</sup> (estimated 543 ind ha <sup>-1</sup> )
Anda sea ranch	1,600 m <sup>2</sup> (1 h)	34% (60 out of 175)	0.0375 ind m <sup>-2</sup> (estimated 375 ind ha <sup>-1</sup> )

spawned within 1–5 m of each other inside a 100-m<sup>2</sup> sea pen, and 23 other spawners in the “nursery” and “buffer” zones of the sea ranch. We observed 60 spawners (weight range = 250–750 g, mean weight = 402 ±76 g) in Anda, and 38 spawners (weight range = 150–400 g) in Bolinao sea ranch. We estimate a ratio of 5 males for every 1 female at both sites.

Synchrony of gamete release, high densities of free-spawners and large population sizes have been reported to increase fertilization success (Levitan and Sewell 1998). While minimum density figures for successful sea cucumber spawning are not yet available, theoretic densities in the range of 10–50 ind ha<sup>-1</sup> may be able to avoid depensation for most tropical sea cucumbers, provided that there are groups of more than 10 individuals within 5–10 m of one another (Bell et al. 2008). Spawning densities for both sites are above those suggested by Bell et al. (2008), and the spawning synchrony is, at least, a contributing factor for fertilization success. The natural observation of mass spawning, in addition to the large proportion of adults for Bolinao and Anda sites from empirical data on population parameters (Juinio-Meñez et al. unpublished data), show positive implications on the potential of sea ranching

sites to serve as functional reproductive reserves that could provide sources of larvae and recruits needed for the restoration of stocks.

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