Natural spawning observations

New observations are presented for four species from different sites. These are very interesting as the reproductive biology is important for conservation and needs to be investigated for many commercial species.

1- *Holothuria whitmaei* (black teatfish)

Observer: Svea-Mara Wolkenhauer (CSIRO, Australia; swolkenhauer@hotmail.com)

Location: East of Lotty's Lagoon, Coral Bay, Western Australia. Coral sand among dead coral rubble and live coral, 5–6 m depth.
Date: August 2002.

Notes: Single male specimen. No evidence of spawning (or reproductive behaviour) in nearby specimens.

Observer: Glenn Shiell

Location: East of Lotty's Lagoon, Coral Bay, Western Australia. Coral sand among dead coral rubble and live coral, 5–6 m depth.
Date: January 2003.

Notes: Twelve male specimens observed spawning within a confined area (~ 40 m^2). Investigation of specimens located nearby found no evidence of spawning (or reproductive behaviour) on a larger scale. No females were observed spawning at any stage, nor were they observed exhibiting behaviour consistent with reproductive activity.

Observer: Glenn Shiell

Location: Southwest of Pt Maud, Coral Bay. Coral sand among live coral, 5–6 m depth.
Date: April 2003.

Notes: Single male specimen. No evidence of spawning (or reproductive behaviour) in nearby specimens. None of the observed spawning events appeared to correlate with any physical environmental factors. No consistent patterns emerged with respect to tidal or lunar influences; water temperature varied markedly between spawning events.

2- *Pearsonothuria graeffei* (flowerfish)

Observer: Nick Hill (Maluane/Zoological Society of London; nicholas.hill04@imperial.ac.uk).

Location: Vamizi Island, Mozambique (on the northern side of the island), reef flat, ~ 2–8 m depth.
Date: 26 May 2003 (late afternoon, the exact time was not recorded)

Figure 1.
Pearsonothuria graeffei in the spawning position (Photo Nick Hill).

Notes: During a coral reef survey conducted on the northern side of Vamizi Island, in the north of the Querimbas Archipelago, Mozambique, on 26 May 2003, the holothurian *Pearsonothuria graeffei* was observed spawning in a shallow reef area on the reef flat, in depths of 2–8 m. There were multiple sea cucumbers doing this at the same time that we observed on that particular dive, although none were closer than a few meters away from each other. They all looked like the same species. Although there were other holothurians on the reef, only *P. graeffei* was observed spawning

Observer: Nyawira Muthiga (Wildlife Conservation Society, Mombasa Kenya; nmuthiga@wcs.org).

Location: Vabbinfaru Island, North Male Atoll, Maldives. (on the west side of the island adjacent to Banyan Tree Resort) (N325042 E476451)
Depth: ~ 1–2 m
Date: 7 June 2005
Observation time: late afternoon.
Moon phase: new moon

Notes: During a coral reef survey conducted by the Wildlife Conservation Society (WCS) in collaboration with the Banyan Tree Resort in the Maldives in June 2005, the holothurian *Pearsonothuria graeffei* was observed spawning on the reef edge off Vabbinfaru Island, North Male Atoll. Along belt transects laid parallel to the reef, two researchers observed only a few individuals of *P. graeffei*, located short distances from each other, spawning – *P. graeffei* density along these transects was 2–3 ind 100 m^{-2}. Individuals were raised up in the classic spawning position (Fig. 2), spurting a discontinuous stream of gametes on the late afternoon of 7 June 2005 on a cloudy day.

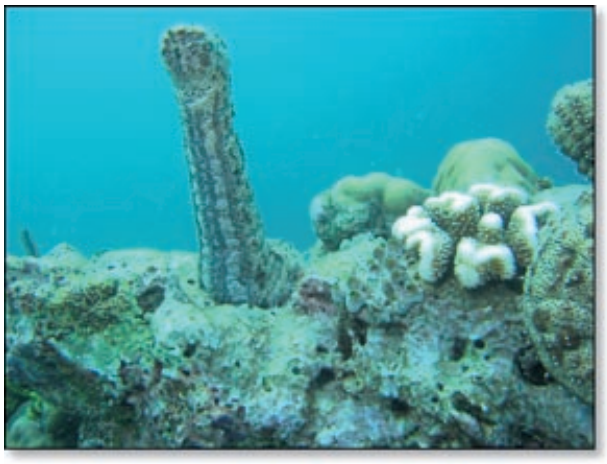

Figure 2.
Pearsonothuria graeffei in the spawning position (Photo Christian Perthen).

Observer: Udo Engelhardt (Reefcare International Pty Ltd; reefcare@ozemail.com.au) and Riaz Aumeeruddy (Island Conservation Society; icsscience@seychelles.sc)

Location: Aride Island, Seychelles
Date: 5 November 2007 (15:10)

Notes: Aride Island forms part of the granitic islands of the Seychelles and it is the northern most granitic one. The island is a Nature Reserve, which also comprises a band of 200 m of sea around the island. Fishing is prohibited inside the reserve. The island is surrounded by a reef, which is partly granitic and partly carbonate.

In November 2007, a survey was conducted to establish the ecological status and characteristics of corals and reef-associated invertebrate communities at Aride Island. Sea cucumbers were part of the invertebrates that were surveyed. *Pearsonothuria graeffei* was found to be one of the most abundant species along with *Stichopus chloronotus* and *Actinopyga mauritiana*. On 5 November 2007, two individuals of *P. graeffei* were found spawning on the reef at around 15:10. These individuals had the typical characteristics of spawning sea cucumbers, with the anterior part of the body stretched and in a vertical position, while the posterior part of the body remained on the substrate (see Figs. 3 and 4). These are the first known observations of sea cucumbers spawning at Aride Island.

Figure 3.
Pearsonothuria graeffei in the spawning position, Seychelles (Photo U. Engelhardt).

Figure 4.
Male *Pearsonothuria graeffei* spawning, Seychelles (Photo U. Engelhardt).

3. *Stichopus herrmanni* (curryfish)

Observer: Aymeric Desurmont (Fisheries Information Specialist, SPC, New Caledonia; aymericd@spc.int).

Location: Baie des Citrons, Noumea, New Caledonia. (22°15'S and 166°25'E)
Depth: 2–4 m
Dates: 7, 8 and 9 January 2008
Observation time: 17:00–18:30.
Tide: high at 19:21, 20:03 and 20:42, respectively.
Moon phase: new moon on 8 January

Notes: The Baie des Citrons is a popular city beach in Noumea, New Caledonia. The bay is host to many sea cucumber species that are not fished. It has been the scene of several sea cucumber natural spawning observations, already described in past issues of this bulletin (Issues #18, p. 38; #20, p. 37; #21, p. 28; and #23, p. 38).

The bay is fringed on both sides by coral reefs, which form a small "drop off", with the top of the reef at 1–2 m depth, while the sandy-muddy bottom lies at 3–4 m. On the southern side of the bay, a dozen specimens of *Stichopus herrmanni* usually lie on the sand at the foot of the reef, spread almost regularly every 10–15 m.

On the first day of the observation (7 January), most of the *S. herrmanni* usually found in this area were not visible. One of them was found on top of a big coral head spawning. It was releasing gametes every 2–3 minutes during the time of the observation (50 min). It is interesting to note that this movement towards a high location to spawn has been observed for the same species in the same area (Desurmont 2003).

On the same day, in the middle of the bay, in a flat sandy-muddy area with patches of seagrass, another specimen of *S. herrmanni* was found spawning on top of a 20-cm high sand "pinnacle", with another specimen beside it showing no sign of spawning behaviour.

On the second day (8 January), the same specimen that was found spawning on the reef the previous day, was in exactly the same spot, spawning again (Fig. 5). Another specimen had climbed the reef close to the first one (± 3 m) (Fig. 6). Both were releasing gametes every 2–3 minutes, not necessarily synchronically, during all the time of the observation (60 min). A third specimen was found 50 m away, also on top of a big coral head, spawning.

On the third day (9 January), the specimen observed spawning on the reef on days 1 and 2 was still at the same location, on top of the same small coral head, but showed no sign of spawning behaviour. The other two animals observed spawning the previous day were in the exact same places, and were spawning again.

On the fourth day (10 January), at approximately the same time, the three animals had moved down to the bottom of the reef, on the sandy area where they are usually found. No other spawning events were observed.

During the four days of observations, none of the many other sea cucumber species present in the bay (*Bohadschia vitiensis, Holothuria atra, H. coluber, H. edulis, H. scabra versicolor* and *Stichopus chloronotus*) showed any sign of spawning behaviour.

Reference

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Figure 5. This *Stichopus herrmanni* had climbed to the top of a coral head to spawn. It was observed spawning, at the same spot, on two consecutive days (Photo A. Desurmont).

Figure 6. Damselfish feeding on the sperm spawned by *Stichopus herrmanni* (Photo A. Desurmont).

4- *Holothuria tubulosa*

In situ observation of sexual reproduction of *Holothuria tubulosa* Gmelin, 1788 (Echinodermata: Holothuroidea) in the Azores (NE Atlantic)

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The aspidochirote *Holothuria tubulosa* Gmelin, 1788 is widely distributed in the Mediterranean Sea and in the Atlantic from Gibraltar to the Bay of Biscay (Tortonese 1965). It lives on rocky substrata, soft sediments and phanaerogam seagrass beds, in depths that vary between 5 m and 100 m, being one of the predominant species of the benthic macrofauna in the *Posidonia oceanica* meadows (Boudouresque and Meinesz 1982).

H. tubulosa is one of the four species of sea cucumbers — *H. sanctori* Delle Chiaje, 1823; *H. forskali* Chiaje, 1841; *Eostichopus regalis* (Cuvier, 1817) —found in the Azores. Although *H. forskali* Chiaje, 1841, is considered to occur in the area, systematic studies are urgently needed for confirmation.

Since it plays a central role in recycling bottom detritus (Massin 1982; Bulteel et al. 1992), *H. tubulosa* would thus be particularly interesting to complement the set of bioindicators for surveying metal contamination in ecosystems (e.g. the *P. oceanica* meadows) (Warnau et al. 2006).

H. tubulosa, as with most Holothuroidea species, has separate sexes, albeit with no sexual dimorphism, and fertilization is external. It has an annual reproductive pattern, in which different phases of gonadal development are differentiated: reabsorption of the gonad after the post-spawning period; gonad recovery stage; growing stage; maturity stage, spawning stage and post-spawning stage (Despalatovic et al. 2004).

In the Mediterranean, and specifically in the case of *H. tubulosa*, spawning has been observed in the Adriatic Sea (Despalatovic et al. 2004), the Spanish Mediterranean coast of Costa Brava (Valls 2004), the Alboran Sea (Ocaña and Tocino 2005), and the Aegean Sea (peninsula of Chalkidike) as reported by Moosleitner (2006) in the years 1972, 1994, 1997 and 2003.

In the Azores, *H. tubulosa* spawning occurs in the summer months (so far observed in July and August) during the afternoon, which may follow the annual pattern, during warm sea temperatures (22–26°C) and being synchronous in both sexes, as stated by Despalotovic et al. (2004) in the Adriatic Sea.

Spawning of *H. tubulosa* in the Azores was first recorded by FADC on 16 August 1996, at Monte da Guia (Faial Island, Azores), close to Ilhéu Negro (Porto Pim beach) (38°52.29'N 28°62.90'W) at a depth of 19 m, but due to the low water visibility photo records were compromised.

The second record (AAB and LFM on 26 July 2007, three days before full moon) occurred in the southern coast of Terceira Island (Azores) at Salgueiros rocky shore (38°64.85'N 27°09.68'W). The tide was low (0.6 m), water temperature was 22°C, depth ranged from 2 m to 4 m, and the bottom comrpised sandy areas with sparse boulders. Observation time was during daylight from 18:30–19:30, solar time.

For the Salgueiros site, spawning was already occurring by the start of observations (18:30), where numerous individuals (>50) were visibly active and by the end of it (19:30) some individuals were already recovering from their spawning vertical position.

Photographic records of the spawning are presented in Figure 7 (male posing vertically on the rock surface, raising half of its body and releasing sperm); Figure 8 (female posing vertically on the rock surface and releasing eggs); Figure 9 (closeup at the sperm release); Figure 10 (closeup of the egg release).

During this one-hour observation, it was noticed that not only males were in a higher density, but sperm release (Figs. 7 and 9) was more constant in short intervals varying from one to three minutes. On the other hand, a single observed female released eggs (Figs. 8 and 10) in intervals of 10 minutes, during a 30–minute-long observation.

As proposed for other species (see Ocaña and Tocino 2005; Moosleitner 2006), some males begin the spawning event, and their sperm includes informative substances that push other males and females to participate

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in the spawning. Posing with half (or up to two-thirds) of the body vertically provides a maximum dispersion of the gametes into the environment.

The relationship between spawning events and moon phases can not be clearly established from the data collected, but there seems to be a preference for spawning close to a full moon as already stated by other authors (Despalotovic et al. 2004; Moosleitner 2006).

No predation on the reproductive material was observed. Although *Coris julis* (Linnaeus, 1758) is a common and abundant species in the Azores, no fish were observed feeding on the spawning event, as Moosleitner (2006) did in the Aegean Sea.

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Figure 7. Male *H. tubulosa* posing vertically on the rock surface, raising half of its body and releasing sperm.

Figure 8. Female *H. tubulosa* posing vertically on the rock surface and releasing eggs.

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Figure 9. Detail of male *H. tubulosa* sperm release.

Figure 10. Detail of female *H. tubulosa* egg release.