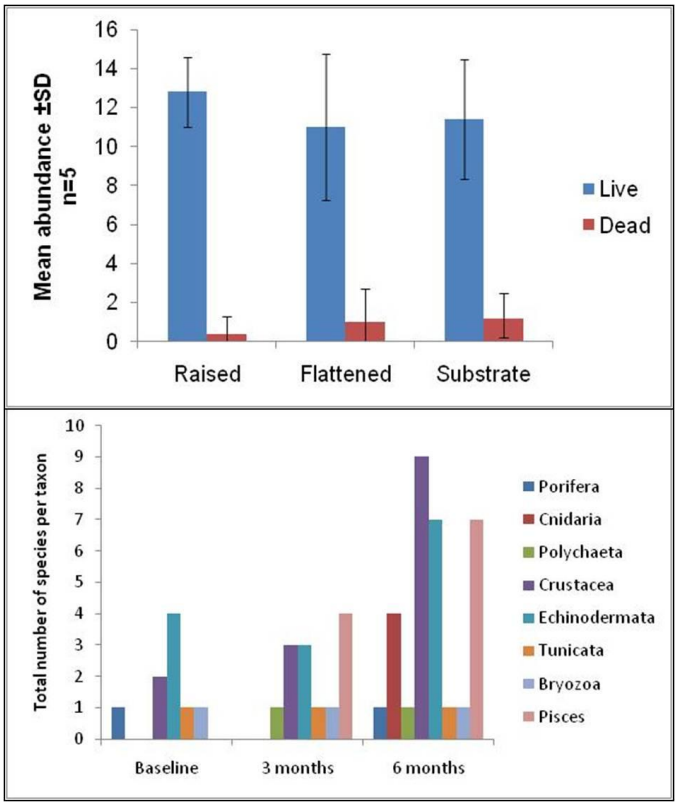

Fig 4. Effect of treatments on horse mussel survival (top) and epifauna community (bottom) after 6 months.

differences in horse mussel densities among treatments (Fig. 4). The group are continuing to monitor the experiment and the long term results should be interesting both for science and for divers in Strangford Lough.

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Biology and conservation status of the endemic Maltese top-shell *Gibbula nivosa* (A. Adams, 1851) (Trochidae)

By Julian Evans, Joseph A. Borg & Patrick J. Schembri

The Maltese top-shell, *Gibbula nivosa*, was first described by A. Adams in 1851, who, however, did not state from where the specimens he described had originated. Comparisons of Adams' type material with shells collected from around the central Mediterranean island of Malta established that *G. nivosa* occurs at this locality (Ghisotti, 1976), while it has never been recorded from anywhere else in the Mediterranean, despite extensive searches by shell collectors (Schembri, 1985). Such a situation is practically unique amongst marine molluscs within the whole Mediterranean region (Palazzi, 1978) and *G. nivosa* is now firmly established as a Maltese endemic (Ghisotti, 1976) and is protected under local and European Union legislation as well as by international conventions (the Bern Convention and Barcelona Convention).

However, *G. nivosa* appears to be rare even within the Maltese Islands themselves. For instance, Palazzi (1978) searched 13 sites for this species but found live individuals only in St. Thomas Bay, although three years later Cachia (1981) recorded live specimens from Santa Marija Bay and Delimara as well. Since shells of *G. nivosa* had become sought after by shell collectors and were appearing in the catalogues of professional shell dealers, Palazzi invited malacologists and shell collectors to refrain from collecting this species because it risked becoming extinct as a result of over-collection. Despite this and the legal protection it was subsequently afforded, there were no records of live individuals for over 25 years (between 1981 and 2006), in spite of intensive searches carried out at St. Thomas Bay and Santa Marija Bay (Schembri *et al.*, 2007). Given its disappearance from localities where it used to occur, *G. nivosa* was considered to be critically endangered (Schembri *et al.*, 2007).

Fig 1. Individuals of *Gibbula nivosa* on a cobble substratum, collected from Marsamxett Harbour. (Photo: Julian Evans)

In 2006, we discovered a population of *G. nivosa* in Marsamxett Harbour (Fig. 1), while two live individuals were also encountered off western Comino in 2008, which proved that the Maltese top-shell is not extinct. Interestingly, at both sites the snails were recorded from a cobble/pebble substratum and not seagrass (*Posidonia oceanica*) meadows, which was their reported habitat at St. Thomas Bay (see Evans *et al.*, 2010). We subsequently carried out studies on the population in Marsamxett Harbour in order to obtain basic information on the ecology and behaviour of *G. nivosa* – biological data which, despite being essential for conservation management of the species, was previously unavailable. Our results indicated that the snails have a circadian activity pattern with nocturnal foraging, which may have evolved in response to diurnal

predation. Recruitment was observed around September suggesting that *G. nivosa* spawns in early summer as the sea temperature rises. Although the snails did not show gregarious behaviour, their distribution in the field was slightly aggregated giving rise to spatial variation in population density. The overall population size in Marsamxett Harbour was estimated at around 100,000 individuals in January 2008; however, large temporal fluctuations in abundance were also recorded, implying that population size is very variable and may be much lower than the estimated value at certain times of the year.

Given these new data, we re-evaluated the conservation status of *G. nivosa*. The estimated extent of occurrence of this species is less than 100 km^2, while its actual area of occupancy is less than 10 km^2 (Fig. 2). The species is known only from a single location (Malta) and the entire population is fragmented (the only confirmed populations are found at Marsamxett Harbour and Comino). Finally, a decline in its extent of occurrence has been observed since the populations at St. Thomas Bay and Santa Marija Bay appear to have become extinct. Thus, *G. nivosa* should still be considered as critically endangered under the 2001 IUCN Red List criteria (CR B1ab(i)+2ab(i); IUCN, 2001). More details of our study on *G. nivosa* are given by Evans *et al.* (in press).

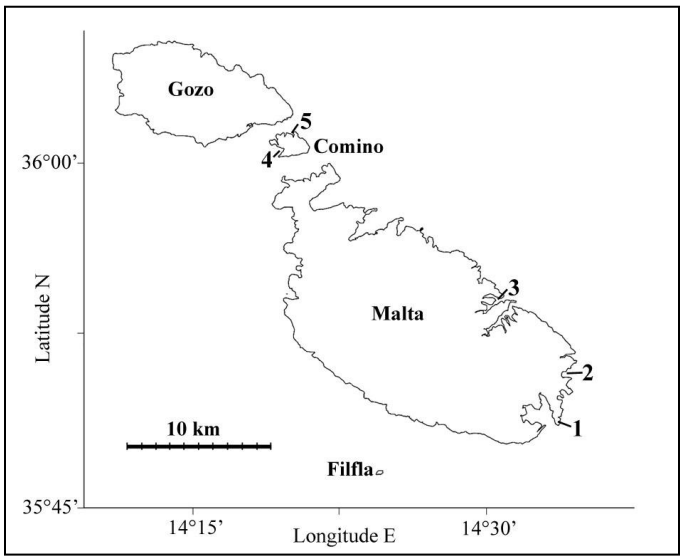

Fig 2. Map of the Maltese Islands showing the locations from where live individuals of *Gibbula nivosa* have been recorded: 1– Delimara, 1981; 2 – St. Thomas Bay, 1981; 3 – Marsamxett, 2006; 4 – SW Comino, 2008; 5 – Santa Marija Bay, 1981.

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Cone snails in the spotlight

By Howard Peters

Throughout the tropics, burgeoning human populations in coastal areas are increasing stress on marine life through over-extraction and destructive fishing practices (Pandolfi *et al.*, 2003). On land, coastal development, shoreline structures, agriculture and forest clearance disrupt marine ecosystems, while discharge of nutrients and other pollutants into the seas result in the death of many species (Rogers, 1990). Coral reefs and associated ecosystems of mangrove forests and seagrass beds are in long term decline exacerbated by elevated sea-surface temperatures and acidification from the burning of fossil fuels (Kleypas *et al.*, 1999). The results can be seen in a global diminution of coral cover, increased abundance of algae and a sharp decline in structural complexity of reefs and the impoverishment of reef biodiversity (Alvarez-Philip *et al.*, 2009).

Tropical seas are of critical importance in supplying goods and services to the nations whose shores they bound (Moberg & Folke, 1999). However, the impact of habitat degradation on populations of marine molluscs seldom receives the same levels of exposure as that of finfish, primarily because of their relatively minor contribution to human protein requirements and to the general belief that invertebrates are reasonably resistant to extirpation or extinction owing to their wide distribution and the likelihood of hidden pockets of survivors (Jamieson, 1993). The paucity of statistical data on mollusc abundance and species richness when compared to fish is a reflection of their lesser importance in fisheries management despite many artisanal communities being dependent upon them and even though such taxa are comparatively easy to assess.

Researchers at the Environment Department of the University of York, UK, are looking into the threats facing all 600-plus