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Planulation, larval biology, and early growth of the deep-sea soft corals *Gersemia fruticosa* and *Duva florida* (Octocorallia: Alcyonacea)

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Abstract. Although the reproductive biology and early life-history stages of deep-sea corals are poorly understood, such data are crucial for their conservation and management. Here, we describe the timing of larval release, planula behavior, metamorphosis, settlement, and early juvenile growth of two species of deep-sea soft corals from the northwest Atlantic. Live colonies of *Gersemia fruticosa* maintained under flow-through laboratory conditions released 79 planulae (1.5–2.5 mm long) between April and early June 2007. Peak planulation in *G. fruticosa* coincided with peaks in the chlorophyll concentration and deposition rates of planktic matter. Metamorphosis and settlement occurred 3–70 d post-release. The eight primary mesenteries typically appeared within 24 h, and primary polyps grew to a height of ~6–10 mm and a stalk diameter of ~1 mm within 2–3 months. Planulae of *Duva florida* (1.5–2.5 mm long) were extracted surgically from several colonies and were successfully reared in culture. Primary polyps reached a height of ~3–4 mm within 2–3 months. No budding of primary polyps was observed in either species over 11–13 months of monitoring, suggesting a very slow growth rate.

Additional key words: reproduction, brooding, octocoral, cnidarian

Over 65% of corals (i.e., 3336 of ~5080 known species) occur at depths >50 m and are devoid of symbiotic algae (Cairns 2007). Yet, most of our knowledge of corals is derived from the 35% of species that are symbiotic and live in shallow-water reefs. As concern over the rapid destruction of deep-sea ecosystems spreads, the slowly growing body of knowledge on deep-water corals only serves to highlight our limited understanding of their basic biology (Rogers 2005; Roberts et al. 2006). While reproductive patterns and the ecology of early life stages are among the key elements in determining how populations might suffer and recover from disturbances, very few data are available on the sexual proliferation of deep-sea corals. Most attention has been focused on deep-sea scleractinians of the subclass Hexacorallia (Waller 2005; Waller & Tyler 2011; Mercier et al. 2011a). Within the subclass Octocorallia, which includes ~3000 extant species subdivided into three main orders (Daly et al. 2007), the reproductive processes of deep-sea representatives have been studied in a small number of Pennatulacea and Alcyonacea (reviewed by Simpson 2009). The latter order comprises morphologically diverse species of soft corals and sea fans (gorgonians) with numerous representatives in the deep ocean (Freiwald et al. 2004; Watling & Auster 2005; Wareham & Edinger 2007). Yet, few data are available on the sexual reproduction and larval ecology of cold-water and deep-water alcyonaceans (Lawson 1991; Cordes et al. 2001; Orejas et al. 2002; Hwang & Song 2007; Orejas et al. 2007; Sun et al. 2009, 2010a,b; Mercier & Hamel 2011). The rarity of information on the reproductive biology of deep-sea corals is largely due to the many challenges inherent to the collection of deep-sea material, and to the constraints associated with *in situ* studies and captive breeding of live specimens.

Research on both shallow-water and deep-sea soft corals has revealed that environmental factors, including temperature, primary and secondary productivity, lunar cycle, and depth, can affect patterns of and behaviors related to gamete and larval release (Benayahu & Loya 1983; Ben-David-Zaslow et al. 1999; Sun et al. 2010a,b; Mercier et al. 2011a,b).

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