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Planulation periodicity, settlement preferences and growth of two deep-sea octocorals from the northwest Atlantic

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ABSTRACT: Adaptations and life history strategies have rarely been studied in deep-sea corals. Here we present laboratory data on the timing of larval release, reproductive output, substratum selectivity and growth of 2 alcyonaceans (Cnidaria, Octocorallia) from the bathyal zone of eastern Canada. Planulation patterns in 2 *Drifa* species were significantly influenced by seasonal productivity and the lunar cycle, and larval output was greater in larger colonies (from shallower depths). After release, planulae of *Drifa* sp. shifted their buoyancy to move between the bottom and the water column, whereas planulae of *D. glomerata* were largely demersal and crawled on the substratum until settlement (typically occurring after 1 to 30 d in both species). Settlement trials showed that planulae settled more readily on rough natural surfaces covered with biofilm than all other substrata tested and that larvae of colonies from deeper habitats were less selective than those originating from shallower habitats. In both species, the 8 primary mesenteries (and tentacle buds) appeared within 24 h post settlement, and polyps reached a maximum size after 2 to 3 mo. The first branching polyp was observed after ca. 9 mo of growth in *D. glomerata*, whereas no direct evidence of branching was detected in *Drifa* sp. over 21 mo of observation, although 2- and 4-polyp colonies were later discovered in the holding tank with adults. Together, these findings highlight dual traits of resilience (i.e. extended breeding period, long-lived larvae) and vulnerability (i.e. substratum selectivity, slow growth) in deep-sea corals.

KEY WORDS: Deep-sea · Corals · Reproduction · Brooding · Settlement · Growth · *Drifa*

INTRODUCTION

Deep-sea corals are important constituents of marine ecosystems (Buhl-Mortensen & Mortensen 2005, Costello et al. 2005). Although there is increasing concern over their destruction worldwide (Roberts et al. 2006, Miller et al. 2009), research on the reproductive biology of deep-water and cold-water corals remains scarce. Determining reproductive output, recruitment and growth of deep-sea corals is crucial in assessing their regeneration potential in the context of deep ocean management. To date, most of the limited information has focused on hexacorals in the order Scleractinia (Waller 2005, Waller & Tyler 2005, Waller et al. 2005, Flint et al. 2007) and a few octocorals in the order Pennatulacea (Eckelbarger et al. 1998, Pires et al. 2009), whereas little attention has been given to soft corals (Alcyonacea) (Cordes et al. 2001, Sun et al. 2009, 2010), despite their prevalence and importance in deep-sea habitats (Freiwald et al. 2004, Watling & Auster 2005). Reproduction in octocorals has mainly been investigated in shallow-water Alcyoniidae, Xeniidae, and Gorgoniidae from the tropical Pacific, Red Sea, and the Caribbean (Benayahu 1991, Shlesinger et al. 1998). Comparatively little research has been conducted on the reproduction and development of

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