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ORIGINAL ARTICLE

Protracted oogenesis and annual reproductive periodicity in the deep-sea pennatulacean *Halipteris finmarchica* (Anthozoa, Octocorallia)

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Abstract

Halipteris finmarchica is one of the most common species of deep-sea pennatulacean corals in the Northwest Atlantic; it was recently determined to act as a biogenic substrate for other species and as a nursery for fish larvae. Its reproductive cycle was investigated in colonies sampled in 2006 and 2007 along the continental slope of Newfoundland and Labrador (Canada). *Halipteris finmarchica* exhibits large oocytes (maximum diameter of 1000 μm), which are consistent with lecithotrophic larval development. Female potential fecundity based on mature oocytes just before spawning was ~6 oocytes · polyp^{-1} (500–6300 oocytes · colony^{-1}); male potential fecundity was 16 spermatocysts · polyp^{-1} (5500–57,400 spermatocysts · colony^{-1}). Based on statistical analysis of size-probability frequency distributions, males harboured one cohort of spermatocysts that matured inside 8–11 months, whereas females harboured two distinct cohorts of oocytes; a persistent pool of small ones (≤400 μm) and a small number (~20%) of larger ones that grew from ~400 to >800 μm over a year. Despite this difference in the tempo of oogenesis and spermatogenesis, a synchronic annual spawning was detected. A latitudinal shift in the spawning period occurred from south (April in the Laurentian Channel) to north (May in Grand Banks and July–August in Labrador/Lower Arctic), following the development of the phytoplankton bloom (*i.e.* sinking of phytodetritus). Prolonged oogenesis with the simultaneous presence of different oocyte classes in a given polyp is likely not uncommon in deep-sea octocorals and could hamper the detection of annual/seasonal reproduction when sample sizes are low and/or time series discontinued or brief.

Introduction

Pennatulaceans (Octocorallia: Pennatulacea), commonly called sea pens, are colonial corals that anchor themselves into soft sediment (mud, sand), allowing them to colonize large areas of the sea floor from the inter-tidal zone down to the abyssal plain (Williams 2011). Sea pens can occur sparsely or form large aggregations [*e.g.* large fields of deep-sea *Pennatula* spp.; (Baker *et al.* 2012)], suggesting that they may provide an important structural habitat to other organisms (Tissot *et al.* 2006; Baillon *et al.* 2012; Baker *et al.* 2012) by increasing the complexity of the soft-bottom sea floor. Despite this potentially important role and the existence of ~200 species (Williams 2011), sea pens are still poorly known, rendering their management and protection problematic. Sea pens have already been identified as vulnerable species (NAFO 2008; Murillo *et al.* 2011) due to their sensitivity to human disturbances such as trawl fisheries (Brodeur 2001).

Understanding the reproduction of a species is important to determining its resilience to disturbance. Despite the fact that sea pens are more abundant in the deep sea