Deep-Sea Research I 91 (2014) 27–35

Contents lists available at ScienceDirect

Deep-Sea Research I

journal homepage: www.elsevier.com/locate/dsri

Life history and seasonal breeding of the deep-sea annelid *Ophryotrocha* sp. (Polychaeta: Dorvelleidae)

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ARTICLE INFO

Article history:
Received 24 March 2014
Received in revised form
10 May 2014
Accepted 13 May 2014
Available online 28 May 2014

Keywords:
Deep sea
Annelid
Reproductive periodicity
Egg laying
Brooding
Development
Feeding
Northwest Atlantic

ABSTRACT

Shallow-water annelids of the genus *Ophryotrocha* have become a popular biological system for exploring ecological, behavioral, developmental, and toxicological questions. Here we report on the successful maintenance in holding tanks, complete life cycle, and reproductive phenology of a first deep-water representative that could be used as a model species. This *Ophryotrocha*, which has yet to be formally described, is large (12–16 mm long) and exhibits simultaneous hermaphroditism. Specimens collected off northeast Newfoundland (eastern Canada) between 500 and 1500 m depth were monitored under flow-through laboratory conditions for over three years. They consistently exhibited seasonal feeding from April to February, followed by a reproductive season between February and May. Gametogenesis was initiated in early January and completed in early to mid-February, followed by courtship, which mainly involved pairs of individuals attached head to tail for hours to days. Transparent gelatinous masses containing 80–110 eggs were laid from mid-February to late-March. Propagules developed in the mass to the 1-chaetiger stage and, at an ambient temperature of ~1–4 °C, offspring emerged 30–45 days post-laying. Only ~40–45% of the eggs laid developed to the 1-chaetiger stage, with evidence of adelphophagy. After emerging from the gelatinous mass, 1-chaetiger stages remained aggregated and were guarded by adults for a few days before dispersing. All parents died following the dispersal of their offspring. The new generation reached sexual maturity in 8–9 months and was ready to reproduce the following January–February. A few cases of segmenting adult worms were also observed. Three complete generations developed successively to sexual maturity over the course of this study.

1. Introduction

Polychaete worms (Annelida: Polychaeta) are well represented in terms of biomass and species richness in most marine and estuarine environments (Fauchald, 1977), where they typically comprise a significant percentage of the total macrofaunal diversity (Gage and Tyler, 1991; Grassle and Maciolek, 1992; Hutchings, 1998; Young, 2003). The reproductive cycle and life history of polychaetes from most ocean basins and ecozones are well covered in the literature (see review by Andries, 2001), with the notable exception of species from the deep sea. Some 20 years ago, Gage and Tyler (1991) remarked that while polychaetes dominate the deep-sea infauna, few studies had been conducted on their reproductive biology. This assessment still stands today, although some data are now available on the fecundity, gametogenesis, spawning and development of species from chemosynthetic habitats (e.g. Eckelbarger et al., 2001; Jollivet et al., 2000; McHugh and Tunnicliffe, 1994; Pradillon et al., 2001; Van Dover et al., 1999; Young, 2003; Zal et al., 1995). In comparison, only a few accounts address the reproductive biology of deep-sea polychaetes living outside chemosynthetic habitats (Blake, 1993; Eckelbarger et al., 2005; Vanreusel et al., 2001).

Developmental modes of most deep-sea polychaetes are also understudied. A number of species were determined to brood their progeny (Young, 2003), including species from an Eastern Pacific seamount (Levin et al., 1994), although it remains uncertain whether development is direct or involves an intermediate larval stage. Indirect development has been proposed to be more common for seep and vent species than for species in non-chemosynthetic habitats (e.g. McHugh, 1989; McHugh and Tunnicliffe, 1994; Rouse

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http://dx.doi.org/10.1016/j.dsr.2014.05.007
0967-0637/