



Habitat utilisation, growth and predation of *Cucumaria frondosa*: implications for an emerging sea cucumber fishery

J. J. SO

Ocean Sciences Centre, Memorial University, St. John's, NL, Canada

J.-F. HAMEL

Society for the Exploration and Valuing of the Environment, St. Philips, NL, Canada

A. MERCIER

Ocean Sciences Centre, Memorial University, St. John's, NL, Canada

Abstract Biological traits of the sea cucumber *Cucumaria frondosa* (Gunnerus) relevant to both ecological and management perspectives were investigated in the Newfoundland region. Abundance, size and fitness of adults were maximal on hard substrates. Larvae settled ~5 weeks post-spawning and juveniles reached a maximum length of 6 mm after 24 months. Additional size classes of sea cucumbers kept under natural environmental conditions exhibited slow seasonal growth attuned to phytoplankton blooms, indicating that ~25 years may be required to reach market size. Juveniles of the predator sea star *Solaster endeca* (L.) readily fed upon 1.5–2 mm long sea cucumbers. Predation rates on adult *C. frondosa* by adult *S. endeca* were modulated by temperature and biased towards injured specimens, suggesting that trawling may exacerbate predation pressure. The combination of slow growth and high predatory pressure enhanced by fishing activities emphasises the need for precautionary management of this emerging fishery in Atlantic Canada.

KEYWORDS: distribution, echinoderm, Holothuroidea, management, *Solaster endeca*, trawl.

Introduction

Several exploratory fisheries are being carried out to determine if certain under-utilised species could be commercially sustainable following the decline in traditional harvests. At the forefront of emerging fisheries in Atlantic Canada is the orange-footed sea cucumber, *Cucumaria frondosa* (Gunnerus). Current harvests are limited to exploratory licences granted in Nova Scotia, New Brunswick and Newfoundland (Hamel & Mercier 2008) using a modified scallop trawl designed specifically to catch sea cucumbers and minimise bycatch (DFA 2002; Barrett *et al.* 2007). With the fishery poised to enter the commercial phase, developing a sustainable management strategy

becomes a priority. Sea cucumber fisheries in particular have a poor history of sustainability, and species are often overfished because of their slow recruitment rates, ease of catch and high commercial value (Uthicke & Conand 2005; Toral-Granda *et al.* 2008).

Although research on *C. frondosa* has been ongoing for decades (Hamel & Mercier 2008), the advent of a northwest Atlantic sea cucumber fishery has prompted new interest in fisheries-related questions. Previous studies detailed some of the basic biology of this species, including localised spatial distributions, larval development and settlement, juvenile growth and ecology (Hamel & Mercier 1996a), reproductive cycle (Coady 1973; Hamel & Mercier 1995, 1996a, b, c, d; Singh *et al.* 2001) and feeding (Hamel & Mercier 1998;

Correspondence: Annie Mercier, Ocean Sciences Centre, Memorial University, 0 Marine Lab Road, St. John's, NL, Canada A1C 5S7 (e-mail: amercier@mun.ca)