

Diet and feeding behaviour of the sea cucumber *Cucumaria frondosa* in the St. Lawrence estuary, eastern Canada

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Abstract: Combined laboratory and field experiments showed that sea cucumbers (*Cucumaria frondosa*) from the St. Lawrence estuary in eastern Canada have well-defined feeding cycles with marked seasonal and tidal variations. Typical feeding behaviour involved extension of the tentacles, which were then successively introduced into the oral cavity. Field observations and analysis of intestinal contents and indices demonstrated that *C. frondosa* fed mainly during spring and summer. Their diet comprised an abundance of phytoplanktonic cells (*Coscinodiscus centralis*, *Chaetoceros debilis*, *Skeletonema costatum*, and *Thalassiosira gravida*), with occasional ingestion of small crustaceans and a variety of eggs and larvae. Food types found in the digestive tract were closely related to the periodic abundance of plankton species in the water. Fewer individuals were observed feeding during fall and winter; they mostly ingested nonliving particles and the intestinal indices were low. In field populations, feeding rates were highest during ebb and rising tides, whereas under laboratory conditions without tidal variation, individuals showed no distinct feeding periods. However, individuals maintained under laboratory conditions and periodically provided with phytoplanktonic cells demonstrated a strong ability to detect the food in the water and react accordingly by extending their tentacles and beginning to feed. The results of the study suggest that food availability, rather than physical parameters such as temperature or current, best explains the cyclic feeding behaviour of *C. frondosa* at seasonal and tidal scales.

Résumé : Des expériences en laboratoire et sur le terrain ont démontré que l'holothurie *Cucumaria frondosa* a une alimentation cyclique qui fluctue en fonction des saisons et des marées dans l'estuaire du Saint-Laurent, dans l'est du Canada. La manipulation des aliments se fait typiquement par extension des tentacules qui sont ensuite introduits successivement dans la cavité orale. Les observations sur le terrain et l'analyse des contenus et des coefficients intestinaux démontrent que *C. frondosa* se nourrit surtout au printemps et en été. Le régime alimentaire se compose d'une grande quantité de cellules phytoplanctoniques (*Coscinodiscus centralis*, *Chaetoceros debilis*, *Skeletonema costatum* et *Thalassiosira gravida*) et, à l'occasion, de petits crustacés et d'oeufs et de larves divers. La nature des aliments trouvés dans le tube digestif suit de près l'abondance périodique des espèces planctoniques dans l'eau. L'alimentation a été observée chez un moins grand nombre d'individus à l'automne et en hiver; les animaux consomment alors des particules non vivantes et leurs coefficients intestinaux sont faibles. Sur le terrain, l'alimentation est maximale durant le reflux et à marée haute, alors qu'en laboratoire, en l'absence des mouvements de marée, les animaux n'ont pas de période d'alimentation définie. Cependant, les individus gardés en laboratoire qui reçoivent périodiquement des cellules phytoplanctoniques sont très habiles à reconnaître la présence de nourriture dans l'eau et réagissent en étirant leurs tentacules et en se nourrissant. Les résultats indiquent que c'est la disponibilité de la nourriture, plutôt que des variables physiques comme la température ou le courant, qui explique le mieux le comportement alimentaire cyclique de *C. frondosa* en fonction des saisons et des marées.

Dense populations of the dendrochirotid holothurian *Cucumaria frondosa* can be found on rocky substrates in the gulf and estuary of the St. Lawrence River in eastern Canada (Hamel and Mercier 1995, 1996a). Several aspects of the biology of this species have been studied over past decades, including its spatial distribution (Hamel and Mercier 1996a), behaviour (Jordan 1972), reproductive cycle and development (Runnström 1918; Runnström and Runnström 1919; Hamel and Mercier 1996a, 1996b, 1996c), settlement,

growth (Hamel and Mercier 1996a), and escape response to predators (Legault and Himmelman 1993). However, very little is known of its feeding biology. Aside from the works of Filimonova and Tokin (1980) on the structure and functional peculiarities of the intestine and Sutterlin and Waddy (1976) on tentacle movements during feeding, to our knowledge the diet and feeding habits of this species remain poorly described.

The first goal of the study was to establish the seasonal feeding patterns of *C. frondosa*. The contents of the first 2 cm of the descending intestine from 30 individuals were analysed every month between April 1992 and September 1993. The animal and vegetal contents of this portion of the digestive tract were virtually undigested, which was also observed during a study of the sea cucumber *Psolus fabricii* (Hamel et al. 1993). The individuals were dredged off Sainte-Anne-des-Monts, along the south shore of the lower St. Lawrence estu-

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