

tion by B. Watkins (pers. comm.) of a tightly coiled individual rolling along the sea bed in a current near Komodo Island.

Conservation issues

Thelenota rubralineata is a spectacular animal and perhaps one of the most beautiful macro-invertebrates in the tropical Pacific. If population numbers are increasing in the western Pacific, it could become targeted and ultimately overexploited by the beche-de-mer industry, as has happened for several high-value sea-cucumber species throughout the Indo-Pacific. Not one commercially traded echinoderm species, threatened sea cucumbers included, is currently listed under the CITES convention and only one echinoderm, an echinoid (*Echinus esculentus*), is on the IUCN Red List. There may be a good case for Appendix III listing of threatened beche-de-mer species (such as *Holothuria nobilis* and *H. fuscogilva*) and, perhaps, pre-emptive listing for *Thelenota rubralineata* in view of its rarity and vulnerability. At country level, *T. rubralineata* is deserving of at least localised protection, as at Bunaken, on the basis that its ecotourism value to the recreational diving industry, particularly as an attraction for underwater photographers, probably exceeds its value dried at market.

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Recent developments in the commercialisation of the northern sea cucumber *Cucumaria frondosa*

by Jean-François Hamel & Annie Mercier¹

After 12 years spent as the subject of scientific research, market surveys, technological transfer and public-awareness campaigns, the sea cucumber, *Cucumaria frondosa*, distributed along the coasts of Quebec, eastern Canada, will officially begin a commercial career in Spring 1999.

Tonnes of *Cucumaria frondosa* are accidentally dredged daily by dozens of fisherman during the scallop harvest season along the St Lawrence Gulf and Estuary. At present, the sea cucumbers are returned to the sea, where a high proportion of them finds only death. Aside from a serious ecological disturbance, this situation represents a considerable economic loss for the fisheries industry, which is always searching for new ways to strengthen its activities in eastern Canada. Considering the decreasing availability of other sea products, this promising resource could give a new

life to dwindling seafood factories and unemployed fishermen.

Despite the great abundance of *Cucumaria frondosa* along the coasts of Quebec, the people involved in the commercialisation of the species are very keen to avoid a second Galapagos crisis. The extensive knowledge gathered on the general ecology, reproductive biology, spatial distribution and migration behaviour of *C. frondosa* in the past decade should be very helpful in developing an exemplary fisheries programme.

Considering the very slow growth rate of this species, which can take 10 years to reach the commercial size, great care must be taken to protect the resource and avoid rapid stock depletion. Luckily, many conditions favour a sustainable harvest in the St Lawrence Gulf and Estuary. Sea cucumbers are

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mainly distributed on rocky habitats within 10-15 km of the coast. Although most of the distribution area is accessible to fisherman, a good proportion of the habitat, comprised of steep cliffs and rough terrain, remains inaccessible to fishing apparatus. These protected zones will ensure that a good part of the sea-cucumber population remains untouched and fully reproductive. Furthermore, as an outcome of a size-dependent migration, large individuals of the commercial size are found deeper than juveniles, which remain in the shallow waters above 20 m, where dredging activities are unlikely to occur. The depth at which the adults concentrate, usually below 40 m, prohibits harvest by scuba divers. Commercial harvest will thus begin by using the by-catch of scallop and other fishermen before a specialised fishery is developed.

Starting the commercialisation of sea cucumbers in Quebec has not been an easy thing. The first reports published early in the 1980s were not very favourable to *Cucumaria frondosa*. Nonetheless, Mme Monette Dion from Les Entreprises Ondines Inc., located in Saint-Anne-des-Monts on the Gaspesian Peninsula, was never discouraged. Convinced that the previous feasibility studies were not solid and that the accidental catches of sea cucumbers could be used instead of wasted, she started anew with the product, preparing samples and promoting *Cucumaria frondosa* on the North American, European and Asian markets. All the while she was trying to attract the attention of the government. Her perseverance finally gained her the support of the local population as well as the authorities. Today, the sea cucumber *Cucumaria frondosa* is considered to be one of the most interesting unexploited species in eastern Canada. Mme Dion has already received financial assistance to develop her project, seek technological transfer and deal with potential clients.

The comments that Les Entreprises Ondine Inc. received after sending samples to Asian importers were very encouraging. Although *Cucumaria frondosa* is smaller than most tropical species such as *Holothuria scabra* or *Holothuria fuscogilva*, its dark body wall, pinkish muscle bands and abundant protuberances seem appealing, whereas its phytoplanktonic diet apparently gives it a special taste appreciated by specialists around the world. Les Entreprises Ondine Inc. will soon undertake the pilot phase in the commercialisation of beche-de-mer and other by-products, with the collaboration of the government and local industries. The future looks promising. Last October, an international event brought some of the greatest chefs in the world together in Quebec City and the Canadian team entered the competition with a new local product... sea cucumber 'à la Québécoise'!

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