

First record of *Theora (Endopleura) lubrica* Gould, 1861 (Mollusca: Bivalvia: Semelidae) from a Levantine port

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Abstract

Theora lubrica is reported for the first time from Haifa Bay, Israel, in 2006. This Asian semelid bivalve is one of the most invasive ship-transported mollusc species to enter the Mediterranean Sea. It was first recorded in 2001 in Livorno Harbour, Italy, and has since established there a viable population. Its occurrence in ports or port-proximate environments lends credence to shipping serving as its vector.

Key words: *Theora lubrica*, Semelidae, Israel, Mediterranean, port, invasive, alien

Shipping has been implicated in the dispersal of numerous neritic organisms, from protists and macrophytes to fish (Carlton 1985). It is seldom possible to ascertain the precise means of transmission, as some organisms may be conceivably transported by several vectors, yet it is assumed that port and port-proximate aliens are primarily dispersed by shipping. The transport on the hulls of ships generally concerns small-sized sedentary, burrow-dwelling or clinging species, though large species whose life history includes an appropriate life stage may be disseminated as well (Zibrowius 1979, 2002). Water and sediment carried in ballast tanks, even after voyages of several weeks' duration, have been found to contain many viable organisms (Gollasch et al. 2000, Drake et al. 2002). The Mediterranean Sea, a hub of commercial shipping lines and encircled by major ports, is susceptible to ship-borne aliens, whether they occur in fouling communities or in ballast. The global maritime trade connections of Mediterranean ports sustain a large-scale dispersal process of both inbound and outbound biota, and

also serve an important vector for secondary introduction - the dispersal of an alien beyond its primary location of introduction. Of the 183 alien mollusks recorded in the Mediterranean Sea (Galil in press), 48 are considered to be either introduced or secondarily transported by ships. Trade patterns ensure that the Mediterranean exports biota as well as imports: the Atlanto-Mediterranean basket shell, *Theora (Varicorbula) gibba* (Olivi 1792), was collected in 1987 in Port Phillip Bay, Australia, and in rapid succession in Portland and Tasmania (Healy and Lamprell 1996).

The first record of the Western Pacific semelid bivalve *Theora (Endopleura) lubrica* Gould, 1861 outside its native range was from Port Phillip Bay, Australia, where it was already common by 1958 (Wilson et al. 1998), later it was found in the Swan Estuary (Chalmer et al. 1976), Portland harbour (Parry et al. 1997), Devenport in Tasmania, Westernport in Victoria, Botany Bay in New South Wales (Cohen et al. 2001), and Sydney harbour (Berents and Hutchins 2002). In the early 1970s it spread to

Auckland harbour (Climo 1976), Golden Bay and Marlborough (Foster and Willan 1979), and to most other ports of New Zealand (Hayward et al. 1997, Hayward et al. 1999), as well as to ports on the west coast of North America: Los Angeles (Seapy 1974), San Francisco (Carlton 1979). A recent survey of the southern California embayments found it was one of the most abundant alien species (Ranasinghe et al. 2005). In 2001 it was collected inside Livorno harbour, Italy, where a thriving population was found “in an area utilized by ships for goods in transit” (Belena et al. 2002). Everywhere *T. lubrica* has established viable populations within a short time of its arrival (Campani et al. 2004).

In August 2006, in the course of the National Monitoring Program of the Mediterranean coast of Israel, three replicate sediment samples were collected in Haifa Bay, next to Haifa port (32°49.246N, 35°01.187E), at depth of 11 m, using a Van Veen grab (0.08 m²). The samples were preserved in 10% formaldehyde. The sediment was later sieved on 0.25 mm mesh, preserved in 70% ethanol, and sorted. A total of 54 specimens of *T. lubrica* were identified, their size range 2-4 mm; 52 of the specimens were deposited in the National Collections, Tel Aviv University (TAU Mo 57947) and two remain in the molluscan collection of CB, Livorno (Figure 1). The prevalence of juveniles in the samples may suggest a quickly reproducing population. The sample contained also specimens of the following Erythrean alien mollusc species: *Leucotina natalensis* Smith, 1910, *Acteocina mucronata* (Philippi, 1849), *Retusa fourieri* (Audouin, 1827), *Retusa desgenettii* (Audouin, 1826), *Syrnola fasciata* Jickeli, 1882.

Theora lubrica is a fast-growing opportunistic species, with spawning and recruitment occurring year-round. It is highly tolerant of low oxygen levels and disturbed environments and is considered a “pollution indicator” of subtidal muddy sediments (Saito 2006). It “can rapidly colonise disturbed and muddy habitats and is perhaps the most pollution-tolerant mollusc in the harbour, living in contaminated sediments” (Hayward et al. 1999). The widely proposed mechanism for the introduction and spread of *T. lubrica* is larval transport in ballast tanks (Climo 1976, Balena et al. 2002). However, its life history characteristics and preferred habitat position the adult specimens of *T. lubrica* as a likely candidate for uptake with sediment into ballast tanks and sea chests.

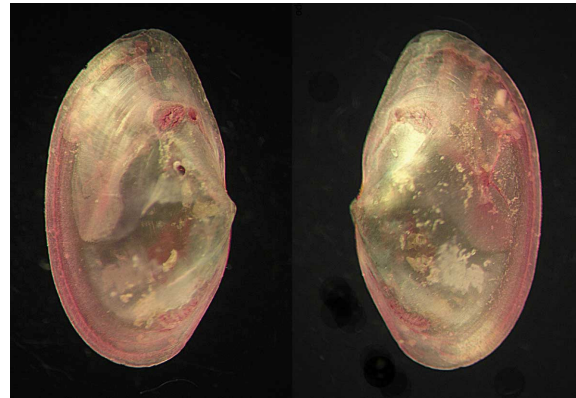


Figure 1. *Theora (Endopleura) lubrica* left and right valves, 4 mm, dorsal view (Photo by Stefano Bartolini)

Balena et al. (2002: 19) cautioned it is “important to search immediately for other populations in different Italian and Mediterranean localities”, and to “evaluate the environmental risk of this kind of bioinvasion”. The Barcelona Convention (1976), initially aimed at reducing pollution, has been updated with the adoption of new protocols. The Protocol concerning Specially Protected Areas (SPA), that had been adopted in 1982 and came into force in 1986, prohibits ‘the introduction of exotic species’ (Article 7e). In 2003 the Mediterranean Action Plan (MAP), United Nations Environment Programme (UNEP), drafted an ‘Action Plan concerning species introductions and invasive species in the Mediterranean Sea’ (UNEP(DEC)MED WG. 232/6). Article 7 recognizes that shipping is a major vector of introduction into the Mediterranean Sea. Article 22 of the Action Plan strongly recommended that “Given the importance of shipping-mediated introductions of non-indigenous species in to the Mediterranean, a regional project be developed to overcome gaps for the Mediterranean countries, and strengthen the capacities of the countries to reduce the transfer of aquatic organisms via ships’ ballast water and sediments and hull fouling”. This clearly should be done with alacrity.

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