THE ATLANTIC-MEDITERRANEAN BIVALVE, *CORBULA GIBBA* (OLIVI) (CORBULIDAE: MYOIDEA) IN PORT PHILLIP BAY, VICTORIA

JOHN M. HEALY AND KEVIN L. LAMPRELL

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Established populations of the common European corbulid bivalve, *Corbula (Varicorbula) gibba* (Olivi, 1792) are recorded for the first time from Australia within Port Phillip Bay, Victoria. Aside from a tendency to exhibit pink radiating bands, the Victorian specimens are indistinguishable from typical French and British populations. The species appears to have been introduced to Australia sometime after the mid-1980's, as it was not recorded in benthic surveys of Port Phillip Bay up to 1972 or encountered by local collectors prior to 1983. Although we cannot identify the precise geographical origin of the Victorian population on morphological features, the recent plague-level outbreak of the polychaete *Sabella spallanzanii* in Port Phillip Bay suggests a Mediterranean origin. Presumably this species has been spread via release of ballast water. □ *Corbula gibba, Mollusca, Bivalvia, introduced species.*

John M. Healy, Department of Zoology, University of Queensland, 4072, Queensland, Australia; Kevin L. Lamprell, Malacology Section, Queensland Museum, P.O. Box 3300, Queensland 4101, Australia; *received 16 January 1996.*

Accidental or in some cases deliberate introduction of foreign marine species, has, and continues to be a serious problem in ports throughout the world. While certain species may be transported as adults attached to ships' hulls, a number of species are apparently being conveyed as larval stages in ballast water (Carlton, 1985, 1987, 1989; Williams et al., 1988; Carlton et al., 1990). To survive such long voyages, these larvae are necessarily hardy and represent species common within their native habitat. The recent plague-proportion spread of the Mediterranean tubiculous polychaete *Sabellaria spallanzanii* throughout Port Phillip Bay – an event now threatening the viability of a major scallop fishery – has highlighted the importance of understanding changes occurring in local shallow water faunas around the Australian coastline. Within the Mollusca, accidentally introduced species of bivalves have in recent years posed a serious challenge to industry and/or the ecological health of marine and freshwater habitats. The fouling damage incurred by the spread of the European "zebra mussel' *Dreissena polymorpha* throughout the lakes of the United States (Hebert et al., 1989; Topping, 1991) is one notable example of the serious ecological and potential economic impact of an introduced bivalve species.

In recent years authors have documented the sudden appearance of foreign bivalve species in Australian waters including the Japonic mytilids *Musculus imus* (Bartsch) and *Musculista senhousia* (Benson) to Western Australia (Kendrick & Slack-Smith, 1982; Slack-Smith & Brearley, 1987), the Japonic ostreid *Crassostrea gigas* (evidently a deliberate introduction) and the New Zealand venerid *Paphia largilliertii* . During our studies of Australian Corbulidae (basket clams), our attention was drawn to an apparently unknown species from Port Phillip Bay by Mr. R. Burn of the Museum of Victoria. This corbulid had not been taken in two extensive benthic surveys of the bay between 1958 and 1972, nor had it been gathered by local collectors prior to 1983 (R. Burn pers comm.). Thus we suspected an introduced species. We could find no closely comparable Asian or American species. However, there was very close resemblance between the mystery Australian corbulid and the common Atlantic-Mediterranean *Corbula (Varicorbula) gibba* (Olivi, 1792). We illustrate and describe Australian specimens of *C. gibba* and compare them to Atlantic material adding a discussion on the implications of this introduction.

MATERIALS AND METHODS

Australian material (all Port Phillip Bay, Victoria): Hampton Beach - several specimens (coll. G. Macaulay). Mornington (20 miles from Hampton), from mud on the back of scallop trawlers docked on 3 Nov. 1991 (preserved in 10% formalin in sea water; coll. G. Macaulay) (K.Lamprell collection). Southern Port Phillip Survey 1986-1990 Marine Research Group of

Victoria (Museum of Victoria) - Lots NMVF 60444, 60541-60551 all dredged in 6-16m of water.

European material: France: 2 specimens from Bretagne (P. van Pel); England: alcohol-preserved specimens dredged off Shellness, Beer and Milford Haven (all England) (Natural History Museum, London). Ireland: alcohol-preserved specimens dredged off Dublin (Natural History Museum, London).

SYSTEMATICS

Superfamily MYOIDEA

Family CORBULIDAE

Corbula (Varicorbula) gibba Olivi,1792

Corbula nucleus Lamarck,1818.

DESCRIPTION. Shell to length of 13.5 mm, solid, posterior side longer than anterior; right valve much larger and encompassing the left valve marginally, with umbone extending beyond the margin of the left valve; both valves with a well defined postero-umbonal ridge. Sculpture: right valve with well developed, flat, moderately wide, concentric ridges; interstices narrow; left valve with fine, closely set, raised, concentric ridges crossed by several raised, radial ridges which extend from the umbones to the margins. Colour: white, with variable brown or reddish radial rays; internally white or deep purple; periostracum on right valve, thin, light brown, left valve light brown towards the umbones, thick, dark brown, concentric concentric layers marginally.

HABITAT. In sandy mud, obtained from scallop trawlers and by diver in littoral mud and sand.

DISTRIBUTION. Widely distributed throughout the Atlantic Ocean, Mediterranean Sea and extending into the Black Sea (Yonge, 1946; Tebble, 1966; Hrs-Brenko, 1981); Port Phillip Bay, Victoria.

COMPARISONS. We find no characters to separate the Port Phillip Bay specimens from Atlantic and Mediterranean *Corbula gibba*, other than a tendency to reach a smaller size (Fig. 1). Conceivably this could be an environmentally induced effect due to suboptimal nutrient levels or growth conditions. Commonly the Port Philip specimens showed pink-purple colouration on the inside of the valves and/or one or more coloured rays externally, whereas most Atlantic and Mediterranean material examined showed no or slight traces of colour (some colouration and external coloured rays present in examined material from Bretagne, France). Again this may be due to suboptimal conditions for Port Phillip Bay animals or reflect retention or exaggeration of juvenile colouration. Specimens with no trace of purple colour were also common in the Port Phillip Bay material, and for this reason we do not regard colour differences between Australian and Atlantic material as highly significant (unfortunately very few of the Atlantic and Mediterranean specimens available were of the juvenile size-class).

DISCUSSION. *Corbula (Varicorbula) gibba* has an extensive geographical range in the Atlantic (Norway south to Angola) and the Mediterranean (including the Black Sea [Hrs-Brenko, 1981]). Suter (1913) reported the species (as *C. nucleus*) from the Chatham Islands, east of the South Island of New Zealand, but this needs to be confirmed. In many areas *C. gibba* may be the most abundant subtidal bivalve (for example, off the English coast (Yonge, 1946), some workers in fact using the species for population analyses (Hrs-Brenko, 1981). Corbulid species can survive long periods in the ballast water of ocean going vessels, and then go on to generate heavy or at least significant populations in foreign harbours (e.g. the Chinese corbulid *Potamocorbula amurensis* in San Francisco Harbour - Carlton et al., 1990). It is not possible to identify the precise geographical origin of the Victorian population of *C. gibba* on morphological features. The recent heavy infestation of the Mediterranean tubeworm *Sabella spallanzanii* throughout large areas of Port Phillip Bay does however suggest a possible source (via ballast water) for these bivalves.

Although *Potamocorbula amurensis* is now approaching plague proportions in San Francisco Bay (reaching densities of over 10000/ m^2) and out-competing endemic species for settlement space (Carlton et al., 1990; Nichols et al., 1990), there is no direct evidence to suggest that *Corbula gibba* will cause similar problems in Port Phillip Bay. Nevertheless *C. gibba* is known to occur in enormous numbers at certain localities in the Atlantic (>450/m^2) and can inhabit a variety of sediment types (coarse sand to fine mud, but preferring sand) and are capable of thriving even in substantially polluted areas (Hrs-Brenko, 1981). For these reasons we feel that the population of *C. gibba* in Port Phillip Bay should continue to be monitored, particularly in relation to

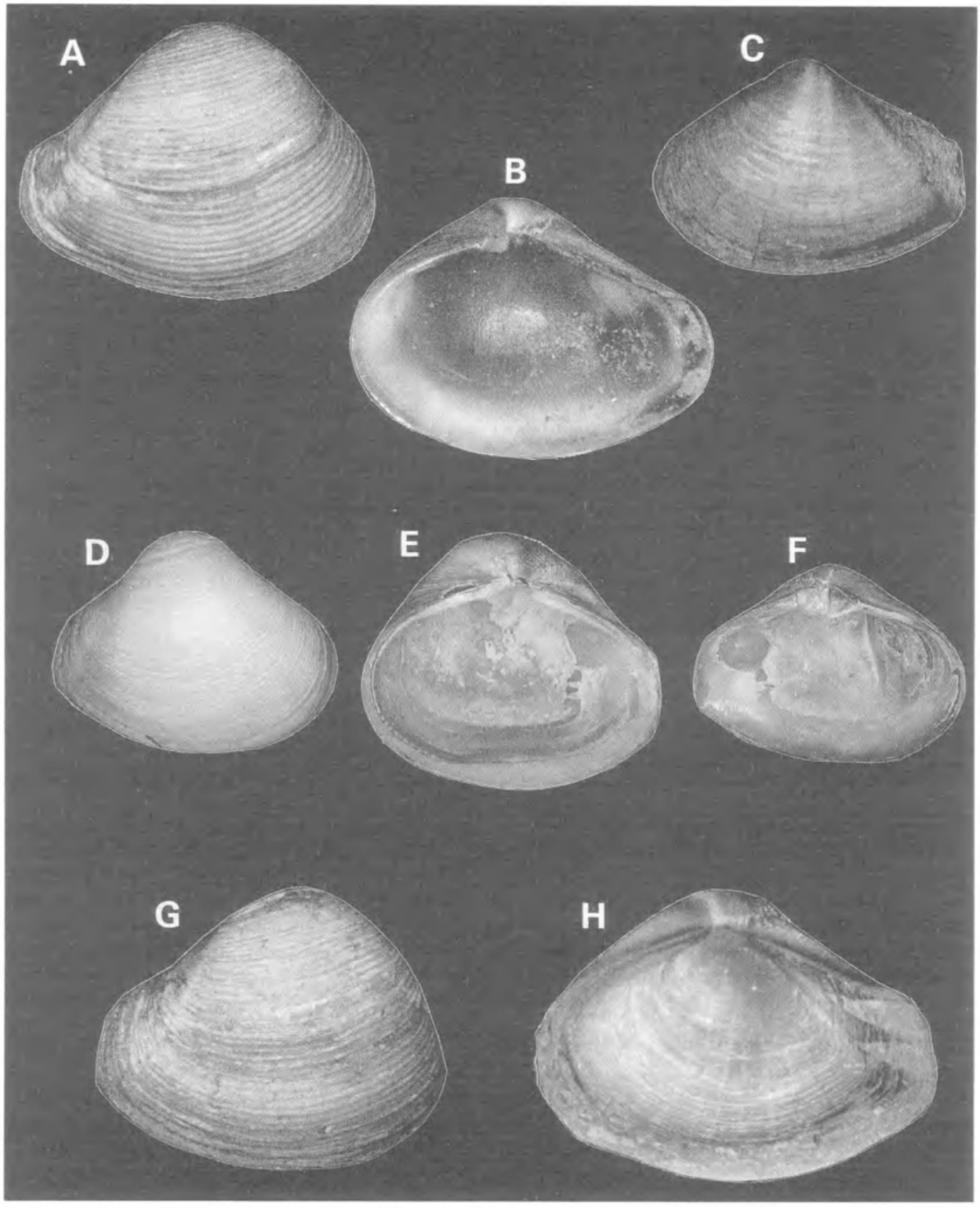

FIG. 1. *Corbula (Varicorbula) gibba* (Olivi, 1792). A-C from silty mud 2-4m, Sandringham Harbour, Port Phillip Bay. D-F, Bretagne, France. G-H, dredged off Shellness, England. A, external view of right valve (valve length 10.8 mm). B, internal view of right valve (valve length 10.8 mm). C, external view of left valve (valve length 9.9 mm). D, external view of right valve (valve length 12.6 mm). E, internal view of right valve (valve length 13.5 mm). F, internal view of left valve (valve length 12.0 mm). G, external view of right valve (valve length 12.5 mm). H, paired valves viewed from left valve (length of right valve 11.5 mm).

the impact of this species on the settlement success of native bivalves within the Bay. Bearing in mind the problems caused by the Asian corbulid *Potamocorbula amurensis* in the San Francisco area, vessels operating out of Port Phillip Bay should not take on ballast water within the Bay. Similarly, the practice of emptying ballast water from foreign vessels in Port Phillip Bay should be discontinued.

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LITERATURE CITED

CARLTON, J.T. 1985. Transoceanic and interoceanic dispersal of coastal marine organisms: the biology of ballast water. Oceanography and Marine Biology Annual Review 23: 313-371.

1987. Patterns of transoceanic marine biological invasions in the Pacific Ocean. Bulletin of Marine Science 41: 452-465.

1989. Man's role in changing the face of the ocean: biological invasions and implications for conservation of near- shore environments. Conservation Biology 3: 265-273.

CARLTON, J.T., THOMPSON, J.K., SCHEMEL, L.E. & NICHOLS, F.H. 1990. Remarkable invasion of San Francisco Bay (California, USA) by the Asian clam *Potamocorbula amurensis*. I. Introduction and dispersal. Marine Ecology Progress Series 66: 81-92.

FORBES, E. & HANLEY, S. 1853. A history of British Mollusca and their shells. Vol. 1,4. (John Van Voorst: London). pp 180-185.

HEBERT, P.D.N., MUNCASTER, B.W. & MACKIE, G.L. 1989. Ecological and genetic studies on *Dreissena* polymorpha (Pallas) : a new mollusc in the Great Lakes. Canadian Journal of Fisheries and Aquatic Science 46: 1587-1591.

HRS-BRENKO, M. 1981. Population studies of *Corbula gibba* (Olivi), Bivalvia, Corbulidae, in the northern Adriatic Sea. Journal of Molluscan Studies 47 (1): 17-24.

KENDRICK, G.W. & SLACK-SMITH, S. 1982. *Musculus imus* (Bartsch) in Western Australia. Australian Shell News 37-38: 4.

NICHOLS, F.H., THOMPSON, J.K. & SCHEMEL, L.E. 1990. Remarkable invasion of San Francisco Bay (California, USA) by the Asian clam *Potamocorbula amurensis*. II. Displacement of a former community. Marine Ecology Progress Series 66: 95-101.

REEVE, L.A. 1843-1844. Monograph on the genus *Corbula*. In L.A. Reeve (ed.) Conchologica Iconica; or, illustrations of the shells of molluscous animals 2:5 pls. (pl. 1, Aug. 1843; pl. 2 Sept; pl. 3 Jan. 1844; pl. 4 April; pl. 5 May).

SLACK-SMITH, S.M. & BREARLEY, A. 1987. *Musculista senhousia* (Benson, 1842); a mussel recently introduced into the Swan River Estuary, Western Australia. (Mollusca: Mytilidae). Records of the Western Australian Museum 13 (2): 225-230.

SUTER, H. 1913. Manual of the New Zealand Mollusca. (John Mackay: Wellington) 1120p.

TEBBLE, N. 1966. British bivalve seashells. A handbook for identification. (British Museum (Natural History):London).

TOPPING, J. 1991. Zebra mussels: North American environmental and economic nightmare of the nineties. Biome 11(1): 2pp.

VOKES, H.E. 1945. Supraspecific groups of the pelecypod family Corbulidae. Bulletin of the American Museum of Natural History 86 (1): 1-32.

WILLIAMS, R.J., GRIFFITHS, F.B., VAN DER WAL, E.J. & KELLY, J. 1988. Cargo vessel ballast water as a vector for the transport of non-indigenous marine species. Estuarine and Coastal Shelf Science 26: 409-420.

YONGE, C.M. 1946. On the habits and adaptations of *Aloidis (Corbula) gibba*. Journal of the Marine Biological Association of the United Kingdom 26(3): 258-276.

ZHUANG, Q. & CAI, Y. 1983. Studies on the Corbulidae (Bivalvia) off Chinese coasts. Transactions of the Chinese Malacological Society 1: 57-68.