

Colonisation of Fremantle Harbour and Cockburn Sound, Western Australia by the eastern Australian scallop *Scaechlamys livida* (Lamarck, 1819)

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Abstract

The eastern Australian scallop *Scaechlamys livida* (Lamarck, 1819) is recorded from Cockburn Sound and Fremantle Harbour, Western Australia. It was first recorded in Cockburn Sound in the 1980s and has now become a permanent part of the molluscan fauna of both Fremantle Harbour and Cockburn Sound.

Key words: Introduced species, *Mimachlamys asperima*, Pectinidae, marine

Introduction

Worldwide, the introduction of exotic species is one of the major threats to biodiversity (Carlton and Geller 1993). In the marine environment there are three primary mechanisms by which species introductions have occurred: through the discharge of ballast water into ports or the arrival of fouling species on the hulls of ships (both of which are inadvertent) or deliberate introductions, such as through aquaculture (Carlton 1985). Like other places in the world, many exotic species have been introduced into Western Australia (Huisman et al. 2008), a number of which are molluscs. The Pacific oyster, *Crassostrea gigas* (Thunberg, 1793), was introduced for aquaculture in Oyster Harbour, Albany, in 1947 but did not survive. However the species survived in Tasmania (Thomson 1952, 1959) and has since spread to New South Wales, Victoria and South Australia in southeastern Australia (Hewitt et al. 2004). The black mussel is raised commercially at Albany and in Cockburn Sound as *Mytilus edulis* Linnaeus, 1758, but the taxonomic status and origins of this species are uncertain. It may actually be *M. galloprovincialis* (Lamarck, 1819). Another mussel, *Musculista senhousia* (Benson, 1842), has established large populations in Cockburn Sound and the Swan River estuary (Slack-Smith and Brearley 1987). *Theora fragilis* (A. Adams, 1856) has been reported in the Swan River (Chalmer et al. 1976). Three species of nudibranchs have also been recorded: *Godiva quadricolor* (Barnard, 1927) in Cockburn Sound (Willan 1987); *Polycera hedgpethi* (Marcus, 1964) at Albany and Augusta (Willan and Coleman 1984; Wells and Bryce 1993) and *Okenia pellucida* Burn, 1967 at Fremantle (Willan and Coleman 1984). The three species have been introduced from very different sources. *Godiva quadricolor* is a South African species that has also been introduced to Sydney (Willan 1987). *Polycera hedgpethi* was thought to be an introduction from California, where it was originally described. However, the natural range is obscure and it has

also invaded a several other Australian ports (Wilson 2006). Similarly, the natural range of *O. pellucida* is unknown; it was described from Sydney (Rudman 2004). The European oyster *Ostrea edulis* (Linnaeus, 1758) was recently recorded from Albany based on analyses of genotypes (Morton et al. 2003). Beechey and Willan (2007) have reported the Asian columbellid snail *Mitrella bicincta* (Gould, 1860) from Cottesloe as well as from New South Wales.

All of the above introductions into Western Australia have been from outside Australia. There is a growing awareness that species can also be moved from one part of Australia to another. We report such an introduction here, establishment of the eastern Australian scallop *Scaechlamys livida* (Lamarck, 1819) into Fremantle Harbour and Cockburn Sound, Western Australia.

Materials and Methods

Staff of the Western Australian Museum (WAM) identified voucher specimens for the CRIMP (2000) survey for introduced species in Cockburn Sound. As part of this exercise, one of us (HM) identified a species of scallop as *Scaechlamys livida*. WAM reference collections were searched for additional specimens. Contact was also made with long-term members of the Western Australian Shell Club to obtain further information regarding records of *S. livida* from Cockburn Sound or other areas in south Western Australia. Shells only were examined in this study.

Results

Previous surveys of the area

From 1958 to 1960, the marine group of the Western Australian Naturalists' Club conducted a detailed survey of marine benthic invertebrates of Cockburn Sound (Wilson et

al. 1978), with the sound being divided into 178 numbered grid squares. Samples were taken from the centre of each block by diving, dredging or shore collecting. Incidental collecting was undertaken after 1960. *Mimachlamys asperima* (Lamarck, 1819) was recorded in 29 blocks in the 1958–1960 survey. Many records were based on live scallops, and the species was listed as abundant at several stations. The species was also collected at four of the post-1960 stations (Wilson *et al.* 1978). Specimens from this

survey and other Naturalist Club material later formed the initial mollusc collection in the Western Australian Museum. Surveys of the molluscs of the Swan River were undertaken in the late 1960s and early 1970s (Chalmer *et al.* 1976), and Wells (1984) collated WAM information on molluscs in southwestern Australian estuaries, including the Swan. All of these studies, and Wells and Bryce (1986), listed *M. asperima*, but *Scaechlamys livida* (Figure 1a; b) was never collected in any of the above studies.



FIGURE 1. Exterior view of right valves. A. *Scaechlamys livida* (Lamarck, 1819) Fremantle Harbour, Western Australia (WAM S 14964); B. *S. livida*, Stradbroke Island, Queensland (Hugh Morrison Collection); C. *S. squamata* (Gmelin, 1791) Minabe, Wakayama, Japan (Hugh Morrison Collection); and D. *Mimachlamys asperima* (Lamarck, 1819) Woodmans Point, Cockburn Sound, Western Australia (WAM S 14965).

Lamprell and Whitehead (1992) list the range of *S. livida* as from northern Western Australia to central New

South Wales. Raines and Poppe (2006) also show *S. livida* in north Western Australia. However, there are no records from

northern Western Australia in the WAM collections; the only records in WAM are from New South Wales and Queensland. Northwestern Australian specimens in WAM previously attributed to *S. livida* are currently being described as a new species (H. Dijkstra, pers. comm. to HM).

Western Australian material of *Scaechlamys livida* examined

Woodmans Point, Cockburn Sound, 28 Aug 1985 (Frank Turnbull Collection TC 1428); between the shipyards and Alcoa, southwestern Cockburn Sound, 10 Dec 1989 (WAM S33048); mussel farm near the Kwinana Grain terminal, 1992 (WAM S33049); 7 m, barge wreck, Rous Head, 2004 (WAM S 14964); Woodmans Point, 1991, 1991 & 2000 (WAM S33050; S33053; S33051); Rottnest Island, H. Morrison Coll., 2002; Whitfords, H. Morrison Coll., 2002; naval base, southwest Garden Island, March 2005 (Museum Victoria F131574; F131583; F131591; F131599; F132050; F132060; F132064; F132086; C.Y. O'Connor Beach, Fremantle, Jan 2007 (WAM S33043); BHP Jetty, southern Cockburn Sound, 11 Feb 2007 (WAM S33045).

Comparison of *Scaechlamys livida* with *Mimachlamys asperima*

Scaechlamys livida lives in essentially the same habitat as *M. asperima*, attached to rocks and jetty pilings in shallow waters in areas such as Fremantle Harbour and Cockburn Sound. Both species are commonly overgrown with a bright red sponge. The CRIMP (2000) report listed *S. livida* as occurring at four stations, and *M. asperima* as being at four different stations (Figure 2). The CRIMP report also listed another unidentified species of *Chlamys*. However, the identifications of *M. asperima* and the unidentified *Chlamys* were done by students at Murdoch University and cannot be verified as the material has been discarded; no *M. asperima* were present in the material identified at WAM. This emphasises the need for maintaining voucher specimens against which identifications can be checked by future researchers. There are no other scallops in the local area with which *S. livida* and *M. asperima* could be confused. For these reasons, the two species are compared here.

Scaechlamys livida (Figure 1 A,B): Up to 7 cm high; slightly inequilateral, left valve more convex; auricles unequal; byssal gape pronounced; colourful (often brown or purple, or orange, yellow, or white), internal colours lighter but similar; 10–12 very strong, low, flattened radial ribs on left side with flat, translucent scales, much stronger near shell margin, up to 8 mm long, 4 mm wide. Interstices between ribs each with 4–5 fine radial lines. Right valve with 20–25 ribs, but lower than on left valve.

Scaechlamys squamata (Gmelin, 1791) is a similar western Pacific species that ranges from southern Japan to Indonesia (Raines and Poppe 2006). *Scaechlamys squamata* (Figure 1 C) differs from *S. livida* in it has fewer primary ribs (five to seven instead of 10–12), with smaller, narrower scales which are confined to the centre of the ribs.

Mimachlamys asperima (Figure 1 D) is similar in size,

but reaches 9 cm. It also has variable colour patterns, often brown or purple. The key differences between this species and *S. livida* are the ribs, which are fewer, larger and stronger in *S. livida*, and have much more pronounced scales. The radial ribs of *M. asperima* are much lower and are not as distinct; they tend to occur as a series of three ribs close together with the central rib largest and all three having fine scales less than 1 mm high.

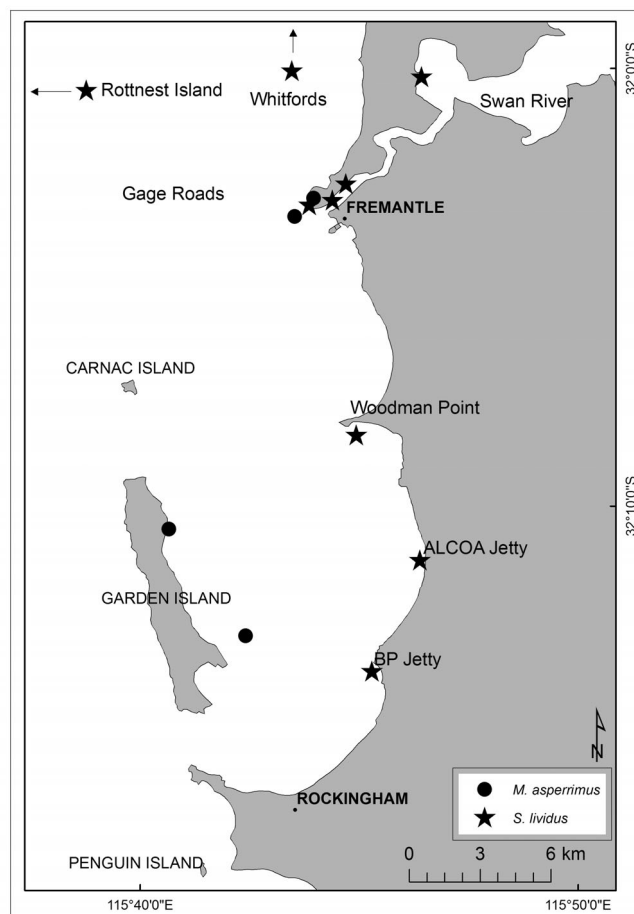


FIGURE 2. Sites at which the scallop *Scaechlamys livida* (Lamarck, 1819) has been recorded in Fremantle Harbour, Western Australia. Also shown are the sites where the CRIMP (2000) survey recorded *Mimachlamys asperima* but is unconfirmed (see text).

Discussion

Data from the WAM collections and anecdotal sources indicate that *S. livida* was first recorded in Cockburn Sound about 1985 and was not there during the late 1950s. Numerous records since then indicate that it is now a permanent resident in Cockburn Sound and Fremantle Harbour.

There is an active movement of ships between the eastern states, particularly between Sydney, and Fremantle, suggesting the invasion of *S. livida* into the Cockburn Sound was due to shipping, with the scallop either attached to the hull or as veligers in ballast water. It is likely that scallops can be transported through either medium. In normal weather conditions a vessel can move from Sydney to Fremantle in

five days (G. Valenti, Fremantle Port Authority, pers. comm.). In the early years most introductions resulted from species fouling on the hulls of ships. The post World War II change in ballasting from dry to wet increased introductions significantly during the 1970s and 1980s (Culver and Kuris 1999; Carlton and Geller 1993). Thus *S. livida* may have been able to reach Cockburn in ballast water with veligers settling from the discharged ballast water settling on suitable habitat and establishing a viable population.

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