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Alien Freshwater Clams in the Hawaiian Islands[1]

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Cowie (1997) reviewed Hawaiian records of alien nonmarine snails and slugs but did not address alien nonmarine bivalves. This note summarizes the literature on alien freshwater clams of the Families Corbiculidae and Sphaeriidae that have been reported to occur in the Hawaiian Islands and presents evidence refuting the suggestion that sphaeriids were introduced to the Hawaiian Islands prehistorically; they are instead modern introductions.

Corbiculidae

Corbicula fluminea (Müller, 1774)

Corbicula fluminea is a highly invasive freshwater clam of Asian origin (Counts 1986; Sousa *et al*. 2008) that first made its appearance in the Hawaiian Islands when living individuals were found for sale in an O'ahu market (Burch 1978). *C. fluminea* is now well established on that island (Devick 1991a; Eldredge 1994; Burch 1995; Englund & Filbert 1999; Englund & Godwin 2002; Englund *et al*. 2003; Brasher *et al*. 2004; Englund & Arakaki 2004) and has also been reported from the islands of Kaua'i (Heacock 1991; Devick 1991a; Eldredge 1994; Englund *et al*. 2002), Lāna'i (Staples & Cowie 2001), Maui (Hau 1991; Devick 1991a; Eldredge 1994; Higashi *et al.* 2008; Parham *et al*. 2008), and Hawai'i (Devick 1991a; Eldredge 1994; Englund *et al*. 2001).

Sphaeriidae

Musculium lacustre (Müller, 1774)

Musculium partumeium (Say, 1822)

Pisidium casertanum (Poli, 1791)

All three of these species are native to North America; *Musculium lacustre* has also been reported from Europe and Japan, while *Pisidium casertanum* also occurs in Eurasia, Central and South America, Africa, Australia, and New Zealand (Herrington 1962). In the Hawaiian Islands, Bryan (1915: 436-437, 440) reported unidentified species of *Sphaerium* and *Pisidium* to occur on "Oahu, Molokai, Kauai, and perhaps other islands of the group," and Devick (1991b) and Eldredge (1994) reported the presence of an unidentified species of *Musculium* on O'ahu and Maui. *Musculium* was formerly regarded as a subgenus of *Sphaerium*, and Bryan's records may well refer to taxa now generally classified in *Musculium*. Herrington (1962) reported *M. lacustre* (as *Sphaerium lacustre*) to occur in the Hawaiian Islands but cited no authority or specimens to support that assertion; Miller (1966) included Hawai'i within range of the species on Herrington's authority. Its occurrence in the Hawaiian Islands requires verification. Burky *et al.* (2000) reported *M. partumeium* and *P. casertanum* to be present in taro ponds at Ke'anae, Maui, and subsequently Higashi *et al*. (2008) and Parham *et al*. (2008) reported *M. partumeium* and an unidentified species of *Pisidium* from the same Maui watershed.

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Although a discussion of the details of the suprageneric classification of the Sphaeriidae is beyond the scope of this note, it should be noted that Lee & Ó Foighil (2003) have proposed a substantial revision of the generic-level classification of the Sphaeriinae that would transfer *P. casertanum* to the genus *Cyclocalyx* Dall, 1903; they also contend that this widely distributed species is not monophyletic.

Burky *et al*. (2000:163) stated with regard to *M. partumeium* and *P. casertanum* that "it is probable that these clams have been continuously reintroduced in association with taro cultivation and the exchange of root stock from elsewhere in Polynesia ... over the approximately 1,500 year history of native Hawaiian culture." While it is true that at least two and as many as four species of land snails were introduced to the Hawaiian Islands as a result of the pre-contact voyages of the Polynesians, all of these have been reported archaeologically from a number of other islands in tropical Polynesia and all are widely distributed in the region (Christensen & Weisler 2013). Sphaeriid clams, on the other hand, are absent from tropical Polynesia except for the few modern Hawaiian records (Bogan 2008), and recent studies of nonmarine mollusks from archaeological excavations in Hawaiian wetlands have revealed no evidence of their presence here prior to initial European contact in AD 1778 (Christensen unpubl.). Accordingly, all available evidence indicates that sphaeriids now established in the Hawaiian Islands were transported here by modern commerce, not by the voyages of the pre-contact Polynesians.

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