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Rediscovery of *Newcombia canaliculata* (Baldwin, 1895) (Gastropoda: Achatinellidae) and *Laminella venusta* (Mighels, 1845) (Gastropoda: Amastridae)¹

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INTRODUCTION

There have been at least 752 native land snail species recognized from the Hawaiian Archipelago, but many of these are already extinct or threatened (Cowie *et al.* 1995). Although extinction estimates as high as 95% have been reported for some families (Régnier *et al.* 2015), it is often difficult to determine if a species is extinct, or just extremely rare and difficult to find (Keith *et al.* 2017), especially without adequate surveys (Hirano *et al.* 2018).

Since the 1980s, most studies of land snails across the archipelago, focused on taxa within the subfamily Achatinellinae (e.g. Thacker & Hadfield 2000; Holland & Hadfield 2004; Cowie & Holland 2008) with a few studies within the Succineidae (Rundell *et al.* 2004; Holland & Cowie 2007; Cowie & Holland 2008). For example, the island of Moloka'i once boasted 85 species from eight families (Cowie *et al.* 1995), and there are only nine described species of *Partulina* on Moloka'i (Cowie *et al.* 1995). Yet, published research from the last half century reporting on land snails of Moloka'i have been almost exclusively focused on achatinelline species (Hadfield & Miller 1989; Kobayashi & Hadfield 1996; Thacker & Hadfield 2000; Holland & Hadfield 2004; Hadfield & Saufler 2008; Price *et al.* 2015), with few, if any other land snails recorded or mentioned (for exceptions see Rundell *et al.* 2004; Holland & Cowie 2007). While there are numerous and complex factors that have likely played a role in the lack of studies on other land snails broadly, this pattern may be partly explained by the erroneous assumption that most land snails had already suffered the same fate as many of those in the Achatinellinae, an idea that was prevalent among the research and conservation community in Hawaii over the last few decades. This assumption,

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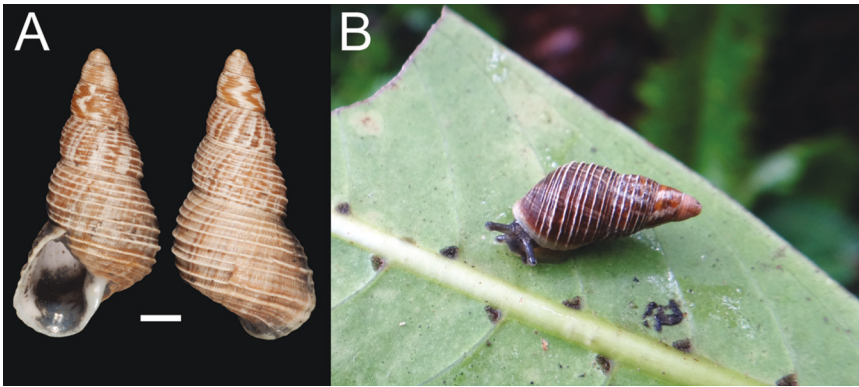


Figure 1. A) *Newcombia canaliculata* (ANSP 65713), scale bar = 2 mm; purported holotype (Johnson 1996) B) Live *Newcombia canaliculata* (BPBM 284174).

further fueled by an already narrow focus on this single subfamily may explain the dearth of survey efforts aimed at understanding the conservation status of Hawaiian land snails more comprehensively. Over the last decade we have built a strong network of conservationists, researchers, and resource managers that have begun to help us fill the gaps in knowledge about Hawaiian land snails. Recent survey efforts (Yeung & Hayes unpublished) have revealed that indeed many Hawaiian land snails have most likely been lost forever. At the same time these efforts have provided a more accurate picture of Hawaiian land snail extinctions, and a better understanding of the conservation status of those that remain has begun to emerge. As Solem (1990) noted, there is still time left to save many species, and through continued and increasing surveys in remote areas, we are realizing the vision of C. Montague Cooke, Jr. and those he inspired (Solem 1990). Here we report the notable rediscovery of two species of endemic snails from two of the most threatened, and frequently studied families in the islands, Achatinellidae and Amastridae. While both species are endemic to Hawai'i, the circumstances and story of their rediscovery is neither unique to Hawai'i, nor as unexpected as they may appear. Like other recent rediscoveries of presumably extinct taxa (Gargominy 2008; Brook 2012; Hirano *et al.* 2018) on Pacific islands, these taxa were found surviving in high elevation, often difficult to access, refugia. Many such refugia may still exist, and as Solem (1990) noted, they may be the last places where these jewels of the Pacific still exist, and if we have any hope of saving them, we have to look, and then act. We hope publishing and extolling such rediscoveries will serve as a reminder that hope still exists.

Achatinellidae

Newcombia canaliculata (Baldwin, 1895)

Notable rediscovery

(Fig. 1)

Newcombia canaliculata belongs in the Achatinellinae, a Hawaiian endemic land snail subfamily with 99 species (Cowie *et al.* 1995). It was originally described from “Hālawā” on the island of Moloka'i in 1895 and was subsequently recorded in the same and other localities: Hālawā (BPBM 51611, 24844, 134572, 107588; collection dates: 1912–1931);

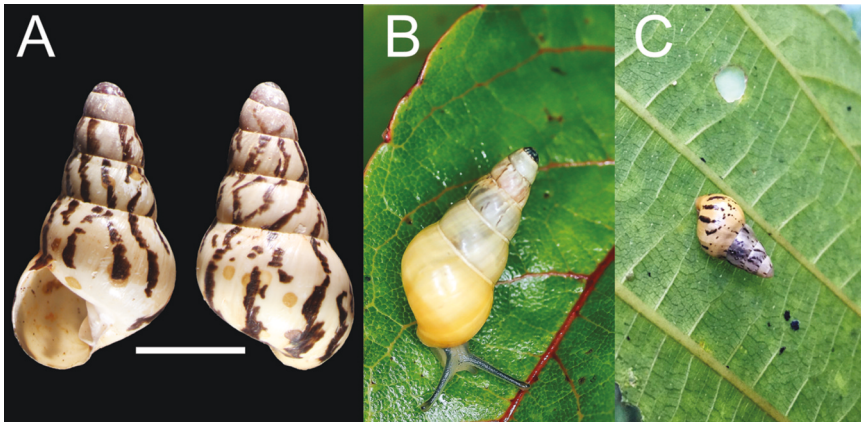


Figure 2. A) *Laminella venusta* (BPBM 191652), topotypic material as “original type has been destroyed by fire” (Hyatt & Pilsbry 1911: 347–348), scale bar = 5 mm; B and C) Live adult and subadult *Laminella venusta* (BPBM 284175), respectively.

Kawaikapu (BPBM 59832, 59833, 59835, 59836, 59834A; 1922); Keopukaloa (BPBM 134534–6, 107587, 117325–8, 134570, 184286–9; 1931–1935); Wailau (BPBM 24858, 24862, 51605, 129268; 1912–1933). Other museums (Museum of Comparative Zoology, National Museum of Natural History, Academy of Natural Sciences of Drexler University, Delaware Museum of Natural History, Carnegie Museum of Natural History) have similar records (locality and collection date) and there are no known museum or published records of this species after 1935. In July 2015, Keahi M. Bustamente (KMB), Chris Johns (CJ), and Geena Hill (GH) recorded a *Newcombia* sp. on Moloka‘i. In January 2018, Norine W. Yeung (NWy), Kenneth A. Hayes (KAH), David R. Sischo (DRS), James K. Espaniola and KMB revisited the locality and NWy and KAH identified this species as *Newcombia canaliculata* (Fig. 1B). The population size was not estimated but numerous adults, subadults, and juveniles were recorded at multiple locations, primarily on *olopua*, *Nestegis sandwicensis* (A. Gray) O.Deg., I.Deg. & L.A.S.Johnson (Oleaceae). Eighteen adults were live collected for captive rearing by DRS. The exact locality data are not listed here for conservation purposes but are kept in the State of Hawaii Department of Land and Natural Resources Snail Extinction Prevention Program and Bishop Museum Malacology databases. Tissue samples (BPBM 284175) have been collected and deposited at the Bishop Museum. Any individuals that die in the captive populations will be vouchered at the Bishop Museum (BPBM 284175). *Newcombia canaliculata* and the Maui endemic, *Newcombia cumingi* (Newcomb), are now the only two *Newcombia* species, out of seven described species, known to be extant.

Amastridae

Laminella venusta (Mighels, 1845)

Notable rediscovery

(Fig. 2)

Laminella venusta belongs in the Amastridae, a Hawaiian endemic land snail family with 325 described species. Prior to this report, only 20 extant species of Amastridae were left

(Régnier *et al.* 2015; Hayes, Chung, Yeung, unpublished). However, the rediscovery of *Laminella venusta* brings the total number of extant amastrid species to 21, and it is the only extant amastrid known from Moloka'i. There were 14 described *Laminella* species and, until recently, only two, *Laminella sanguinea* (Newcomb) (O'ahu endemic) and *L. aspera* Baldwin (Maui endemic), were considered extant (Régnier *et al.* 2015). *Laminella venusta* was originally described from O'ahu. However, Hyatt & Pilsbry (1911: 348) provided localities only on Moloka'i and stated that "no such shell occurs on Oahu". This species has been recorded on various Moloka'i localities such as: East 'Ōhi'a Gulch (BPBM 134425; 1931); Kalua'aha (BPBM 24814, 24092, 24103, 24780, 24793; 1912); Kamalō (BPBM 36855; 1913); Mapulehu (BPBM 24164, 24819, 24824, 51636, 102902, 102903, 191652, 191658; 1912–1943); 'Ōhi'alele (BPBM 47000, 47014; 1919); Oloku'i (BPBM 24863, 24864; 1912); Ualapue (BPBM 24223, 24235; 1912). Other museums (Museum of Comparative Zoology, National Museum of Natural History, Florida Museum of Natural History, Academy of Natural Sciences of Drexler University, Delaware Museum of Natural History, Denver Museum of Nature and Science, Carnegie Museum of Natural History, Illinois Natural History Survey) have similar records (locality and collection date) with the last known museum record in 1967 (UF167339). During the reconnaissance survey for *Newcombia canaliculata* (Baldwin) in January 2018, nine *Laminella venusta* (Figs. 2B, C) individuals were discovered on a *hāhā*, *Cyanea* cf. *solenocalyx* Hillebr. (Campanulaceae). Previous records (BPBM 24164, 24092, 24223) have reported this species on *olonā*, *Touchardia latifolia* Gaudich (Urticaceae). Because of the imminent threat from rat predation, the omnivorous snail [*Oxychilus alliarius* (Miller)], and predatory flatworms, in the area with these snails, all individuals were collected for captive rearing by DRS. Tissue samples (BPBM 284175) have been collected and deposited at the Bishop Museum, and any individuals that die in the captive population will be vouchered as well (BPBM 284175). The exact locality data are not listed here for conservation purposes but are kept in the State of Hawaii Department of Land and Natural Resources Snail Extinction Prevention Program and Bishop Museum Malacology databases.

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