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# A revision of New Zealand landsnails of the genus *Cytora* Kobelt & Möllendorff, 1897 (Mollusca: Gastropoda: Pupinidae)

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ABSTRACT: The endemic New Zealand cyclophoroidean genus *Cytora* is revised. A total of 42 species are recognised, of which 23 are described as new. All taxa are described and illustrated with colour photographs and scanning electron microscope images.

KEYWORDS: Mollusca, Gastropoda, Pupinidae, *Cytora*, revision, taxonomy, distribution, new taxa.

## Introduction

The New Zealand landsnail fauna is depauperate at the family level, yet secondarily is extraordinarily rich at the species level. Most of the species diversity is contained within the families Pupinidae, Athoracophoridae, Rhytididae and, especially, Charopidae and Punctidae, as the consequence of extensive endemic cladogenesis and speciation (Barker 2005). There is concern about the conservation status of this unique fauna, as extensive habitat loss and degradation have accompanied human settlement of the archipelago over the past millennium. However, progress in formulating robust conservation strategies has been severely constrained by lack of modern taxonomic treatments. Indeed, a high proportion of the New Zealand landsnails remain undescribed (Barker 2005).

The Architaenioglossa are represented in the New Zealand terrestrial landsnail fauna by the cyclophoroidean genera *Liarea* Gray, 1852 and *Cytora* Kobelt & Möllendorff, 1897. In this paper we describe the *Cytora* fauna.

## Materials and methods

**Taxonomy**

Unless preceded by acronyms AIM, BMNH or CM (see below), all material examined (3406 lots) was at Museum of New Zealand Te Papa Tongarewa (registration numbers preceded by 'M.'). All material with good locality data is plotted on distribution maps. Full details on locality data are provided in the text only for type material; all other examined material is referred to only by registration numbers. However, comprehensive details for all examined accessions are stored in Te Papa's collections information system and are available on request (B.A. Marshall) or via the Internet (http://collections.tepapa.govt.nz). Much of the material was collected by Pauline C. Mayhill (1026 lots), David Roscoe (611 lots) and Bruce Hazelwood (536 lots).

Selected specimens were photographed in colour using AutoMontage™ software. These or others were subsequently mounted, carbon- and gold/palladium-coated, and examined by scanning electron microscopy to enable the documentation of microscopic character states.

The following conchological measurements were made using microscope graticules for shells of 30 mature animals from the type locality or collection stations in its vicinity: protoconch diameter; shell height; shell diameter; spire angle (degrees); umbilicus width; aperture width perpendicular to shell axis; aperture height parallel to shell axis; spire height. From these measurements the following ratios were calculated: shell height to diameter; umbilicus width to shell diameter; aperture width to shell diameter; spire height to aperture height. Additional measurements were made from the selected individual(s) used in light and scanning electron microphotography.

Information about biology and macroecology was derived from specimen labels, Geographic Information Systems (GIS) databases and expert knowledge. We have provided comments on the conservation status of all species, with reference to previous assessments by McGuinness (2001), Brook (2002a) and Hitchmough (2002), the latter two based on the nationally agreed standard classification criteria of Molloy *et al.* (2002). For all taxa, including those recognised for the first time, we have provided our own assessments of conservation status using the Molloy *et al.* (2002) criteria.

**Abbreviations used in the text**

AIM – Auckland Institute and Museum, Auckland
BMNH – Natural History Museum, London
CM – Canterbury Museum, Christchurch
NMNZ – Museum of New Zealand Te Papa Tongarewa, Wellington
NZMS 260 – New Zealand Map Series metric grid reference (Infomap: New Zealand Department of Survey and Land Information)
SEM – scanning electron microscopy

**Index to Taxa**



# Systematics

Superfamily CYCLOPHOROIDEA.
Family PUPINIDAE L. Pfeiffer, 1853.
PUPINIDAE L. Pfeiffer, 1853: 98. Type genus: *Pupina* Vignard, 1829.

Subfamily LIAREINAE Powell, 1946.
LIAREIDAE Powell, 1946: 70. Type genus: *Liarea* L. Pfeiffer, 1853.
CYTORIDAE Climo, 1969: 227. Not available: no diagnosis.

REMARKS: *Liarea* Gray, 1852 and *Cytora* Kobelt & Möllendorff, 1897 are the only cyclophoroidean genera in the extant New Zealand landsnail fauna. The systematic affinities of these genera have not been fully resolved, reflecting in large part the poor understanding of the evolutionary history and unstable higher systematics of cyclophoroideans globally (Barker 2001). Suter (1913)

recognised affinities of *Cytora* with Cyclophoridae *sensu stricto*, and *Liarea* with snails now classified not as cyclophoroideans but rather as omphalotropine Assimineidae. In Cyclophoridae *sensu lato*, Thiele (1929) assigned *Cytora* to Cyclophorinae and *Liarea* to Pupininae. However, Morton (1952) and Climo (1971, 1973) have shown that anatomically these genera have more features in common than either have with extralimital taxa. Thus Climo (1975) and Powell (1979) treated these New Zealand genera as belonging to an endemic family.

Nonetheless, Ponder & Warén (1988) have assigned *Cytora* and *Liarea* to Liareinae in Pupinidae. This assignment to Pupinidae was followed by Spencer & Willan (1996), Spencer *et al.* (2002), Barker (2005) and Bouchet & Rocroi (2005). For nomenclatural stability, and pending a molecular-based phylogenetic study, in the present work we regard *Cytora* and *Liarea* as pupinids.

## Genus *Cytora* Kobelt & Möllendorff, 1897

*Cytora* Kobelt & Möllendorff, 1897: 85. Type species (by tautonomy): *Cyclophorus cytora* Gray, 1850; Recent, northern New Zealand (gender feminine).

*Murdochia* Ancey, 1901: 24. *Nomen nudum*. Introduced collectively for New Zealand species referred to *Lagochilus* Blanford, 1864, none of which, however, were associated by name: fails to conform to ICZN (1999) Article 12.

*Cyclophorus* as applied by various authors to New Zealand material. (Not Montfort, 1810: 290. Type species *Helix volvulus* O.F. Müller, 1774, by monotypy).

*Cyclostoma* as applied by various authors to New Zealand material. (Not Lamarck, 1799: 74. Type species *Nerita elegans* O.F. Müller, 1774, by monotypy).

*Leptopoma* as applied by various authors to New Zealand material. (Not L. Pfeiffer, 1847: 47. Type species *Cyclostoma vitreum* Lesson, 1830, by subsequent designation of Kobelt, 1878).

*Lagocheilus* and *Lagochilus* as applied by various authors to New Zealand material. (Not *Lagochilus* Blanford, 1864: 452 (em. *Lagocheilus*). Type species *Cyclophorus scissimargo* Benson, 1856, by original designation).

*Japonia* as applied by various authors to New Zealand material. (Not Gould, 1859: 425. Type species *Cyclostoma barbata* Gould, 1859, by subsequent designation of Kobelt, 1878).

DIAGNOSIS: Shell dextrally coiled, less than 7 mm in height, ranging in shape from tall conical to depressed; last adult whorl of mature animal generally constricted (i.e. more narrow than expected if it were the geometric continuation of the spire whorls); aperture more or less circular, with single or double peristome, at most weakly reflexed. Protoconch 410–930 µm in diameter and of 1.60–2.25 whorls. Teleoconch of 2.2–5.2 whorls. Last part of protoconch and entire teleoconch ornamented with collabral riblets. Periostracum on teleoconch smooth, or produced at summits of riblets as thin lamellae, and sometimes elaborated as hair-like processes. No apparent sexual dimorphism in shell characters. Operculum thin, horny, not calcareous, with central to subcentral nucleus and few whorls. Animal possessing short tentacles, each rounded at the apex, and with eyes situated on a lobe at the outer base. Pallial cavity lacking a ctenidium or other specialised respiratory structures; its roof composed of smooth vascularised epithelium; with broad hypobranchial gland extending along the right side of the roof. Buccal organ equipped with a pair of chitinous jaw plates appressed to the roof of the buccal cavity. Radula taenioglossate, having formula 2+1+1+1+2; central tooth with basal plate contracted near its base, broadly rounded to a head bearing five to seven cusps, of which the median one is often largest; lateral and inner marginal teeth of similar structure; marginal teeth elongated, obliquely oriented, more slender than laterals, the basal plate characterised by a rectangular lateral reflection separated from the cuspid head by a distinct notch. Dioecious. Males possessing a tubular vas deferens, arising from the testes located in the shell apical whorls, emergent from the visceral organs at the posterior of the pallial cavity to run forward as a prostatic organ just below the rectum, then penetrates the length of the cephalic penis and its apical intromittant organ; penis with one or more prominent lateral swellings. Female with ovaries located in shell apical whorls, connected via narrow, much convoluted renal gonoduct to the broad, glandular-walled pallial oviduct that runs immediately below the rectum to open at the anterior of the pallial cavity.

REMARKS: The above diagnosis is a composite, reflecting our current understanding of the conchological, opercular, radular and reproductive anatomical variation among species. It should be noted, however, that the reproductive anatomy of the type species of the genus is presently not known.

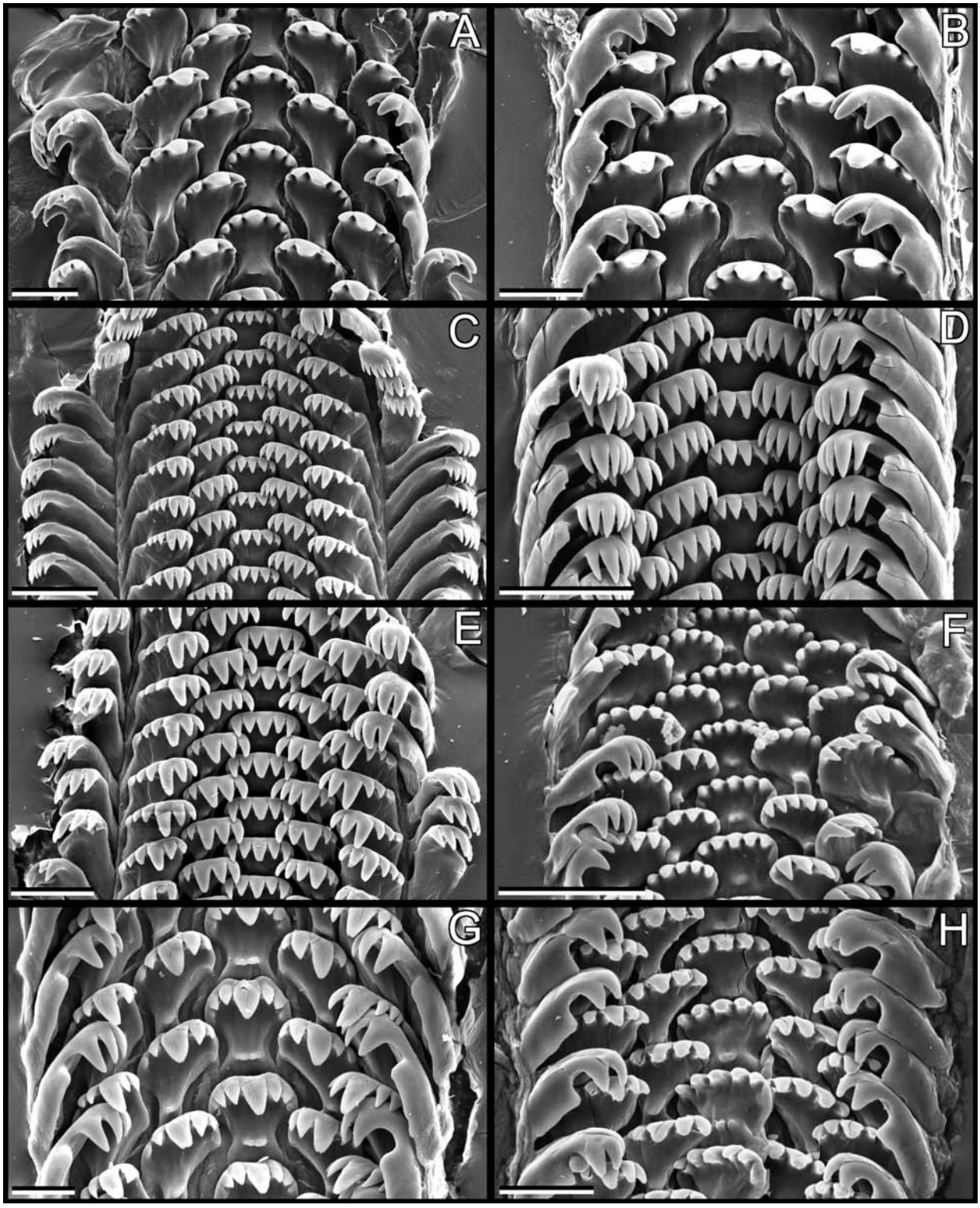


Fig. 1 Radulae of *Liarea* and *Cytora* species (SEM). A, B, *Liarea egea* (Gray, 1850), Awhitu Peninsula, Harveys Bush, M.82304; C, D, *Cytora annectens* (Powell, 1948), Three Kings Islands, Great Island, M.29235; E, *Cytora brooki* n.sp., SE of Cape Reinga, Tapotupotu Bush, M.17715; F, *Cytora cytora* (Gray, 1850), Hunua Range, Cosseys Dam, M.156437; G, *Cytora depressa* N. Gardner, 1968, SW of Nelson, Motueka River gorge, M.124873; H, *Cytora fasciata* (Suter, 1894), NW of Te Kuiti, Tawarau Forest, M.169871. Scale bars 10 μm (G, H), 20 μm (A–F).

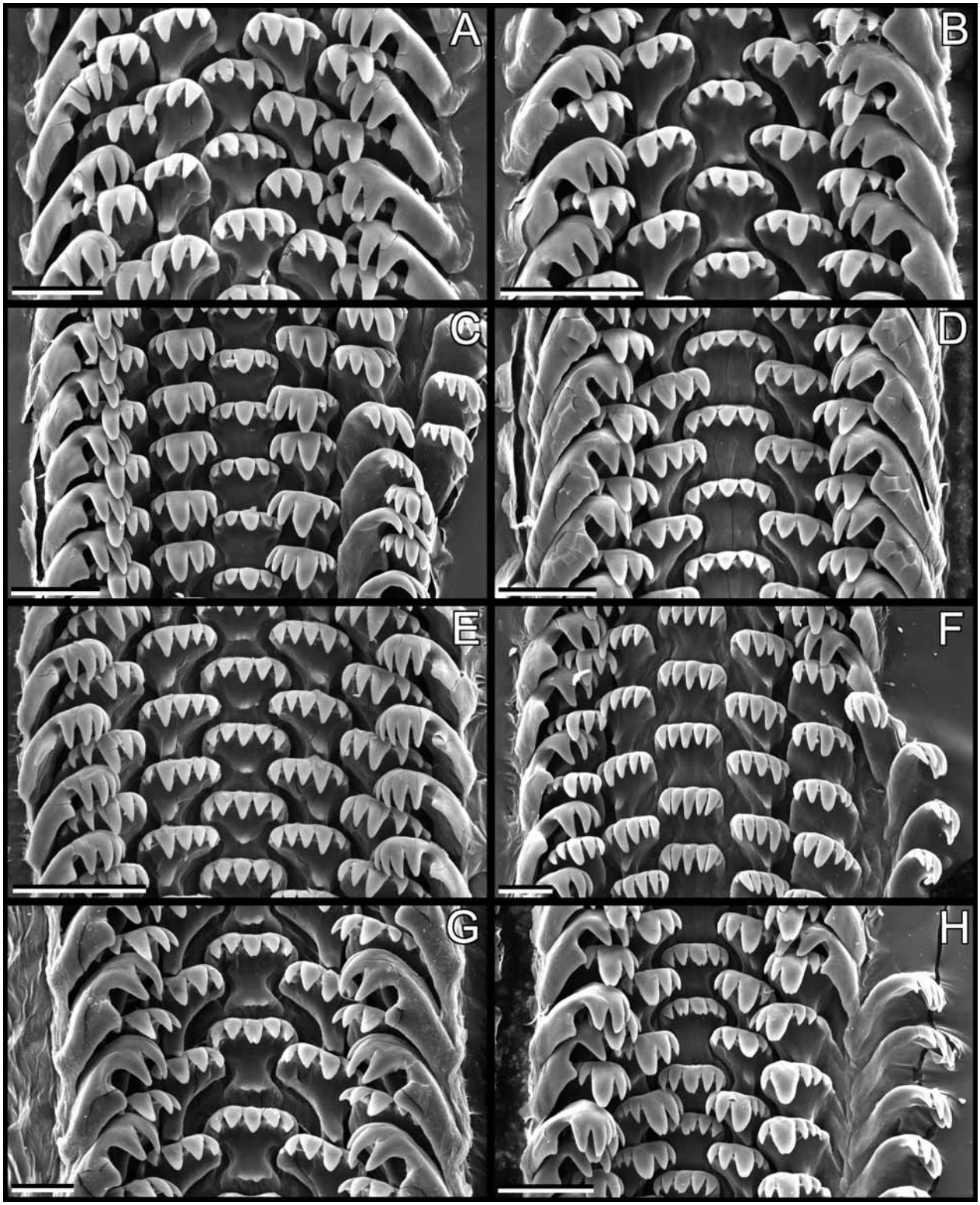


Fig. 2 Radulae of *Cytora* species (SEM). A, *Cytora hedleyi* (Suter, 1894), Auckland, Birkenhead M.177719; B, *Cytora kamura* n.sp., N of Picton, Mt Robinson, M.36360; C, *Cytora hirsutissima* (Powell, 1951), Three Kings Islands, Great Island, M.29266; D, *Cytora lignaria* (L. Pfeiffer, 1857), E of Cape Reinga, bush near Unuwhao Peak, M.177717; E, *Cytora pannosa* (Hutton, 1882), NE of Westport, Charming Creek Track, M.177718; F, *Cytora pallida* (Hutton, 1883), Kaipara, Okahukura Peninsula, beside Burma Road, M.168341; G, *Cytora paparoa* n.sp., E of Punakaiki, Pororari River valley, M.177720; H, *Cytora solitaria* (Powell, 1935), Three Kings Islands, Great Island, M.177716. Scale bars 10 mm (A, F, G), 20 mm (B–E, H).

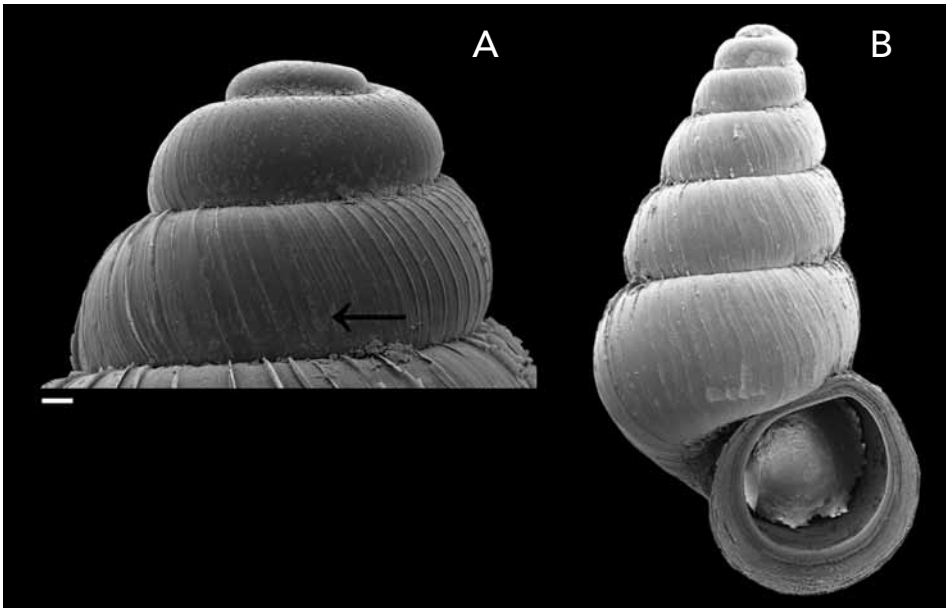


Fig. 3 Lateral views of whole shell (B) and protoconch (A) (protoconch–teleoconch boundary arrowed) of *Liarea egea* (Gray, 1850), Whangaparaoa, Wade Heads Reserve, M.38483 (6.45 x 3.80 mm). Scale bar 100 µm.

*Liarea* and *Cytora* are the only cyclophoroideans present in New Zealand. Based on light microscopy, Climo (1970) commented on the marked similarity in radular dentition among members of *Liarea* and *Cytora*. Electron microscopy of radulae in the present work (Figs 1 and 2) has confirmed the absence of dentition characters that may differentiate *Liarea* and *Cytora*. The penis of the male in these two dioecious genera is characteristically provided with an apical intromittant organ, which is pierced by the vas deferens (Morton 1952; Climo 1970, 1973).

Climo (1970) remarked that 'The only marked difference between the two genera are those associated with shell morphology; *Liarea* usually has a distinct colour pattern and a double continuous peristome, whereas *Cytora* is drab, usually without colour markings, and lacks the double continuous peristome.' Nonetheless, the conchological distinction between the two nominal genera is weak. Indeed, *Lagochilus bicarinata* Suter, 1907 was long regarded as allied to *Cytora* (e.g. Rees 1961), but was transferred to *Liarea* by Climo (1970) because of its colour pattern and double peristome. The results from our present revisionary work indicate considerable variation among *Cytora* species in shell form, size, ornamentation and colour patterning, which in part overlap with that seen in *Liarea* – typified by *Liarea egea* (Gray, 1850) (Fig. 3). Consistent with Climo's (1970) interpretation, *Cytora* species generally lack the double peristome that has been regarded as diagnostic for *Liarea*, but we note that *C. solitaria* (Powell, 1935) possess a double peristome not unlike *Liarea* species.

The recognition of *Liarea* and *Cytora* as distinct genera is supported by phylogenetic analyses based on 16S DNA sequences (Barker *et al.* in prep.).

***Cytora annectens* (Powell, 1948)**

(Figs 1C,D, 4A, 5B, 6A,B)

*Murdochia annectens* Powell, 1948: 274, pl. 53, fig. 3.

*Cytora annectens*.- Powell, 1957: 90, pl. 27, fig. 16; Climo, 1973: 572, fig. 9B, 19C, D, H; Climo, 1975: 468; Powell, 1979: 86, pl. 23, fig. 3; Gardner, 1994: 22, text fig.; Brook, 2002a: 15; Brook, 2002b: 71; Hitchmough, 2002: 115.

TYPE MATERIAL: Holotype AIM AK 71046: Three Kings Islands, Great Island, 800 m NE from SE landing, on underside of decaying wood in leaf mould, kanuka (*Leptospermum*) scrub.

MATERIAL EXAMINED (34 lots): Type material (see above), M.29228 (many), M.29229 (4), M.29230 (13), M.29231 (many), M.29232 (20), M.29233 (11), M.29234 (5), M.29235 (5), M.29236 (4), M.29237 (4), M.29238 (5), M.29239 (6), M.29240 (2), M.29241 (4), M.37756 (8), M.155526 (10), M.155538 (10), M.155549 (5), M.155574 (8), M.155596 (5), M.155606 (5), M.155657 (many),

M.155663 (11), M.155693 (2), M.155712 (15), M.155721 (3), M.155735 (many), M.155809 (4), M.155819 (12), M.155828 (10), M.155850 (15), M.155859 (many), M.177694 (7).

REDESCRIPTION: Shell up to 6.66 mm high, higher than wide (height/width ratio 1.27–1.59), narrowly conical (spire angle 45–57°), spire 1.47–1.82 times as high as aperture, narrowly umbilicate. Protoconch and first one to two teleoconch whorls yellowish or reddish brown; pattern on subsequent whorls strongly bimodal in all populations: either pale yellowish brown to whitish with dark reddish-brown line bordering suture adapically, submedian band, outer basal band and umbilical area, or (less frequently) same except that adapical area between peripheral band and suture solid reddish brown. Periostracum on teleoconch produced at summits of collabral riblets as thin lamellae on spire and base, numbering typically seven per mm at end of third whorl, summits very finely crenulate in two series, the larger crenulations in repeating pattern that forms up to 10 or 11 rows on spire whorls (visible by refraction on live-collected, permanently wet specimens – largely destroyed in dry specimens).

Protoconch of about 1.7 convex whorls, 620–780 µm wide, most of first whorl smooth and glossy, remaining *c.* 0.7 whorl traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 5.20 broadly convex whorls; first three whorls with peripheral angulation that is obscured by succeeding whorls, periphery becoming rounded on fourth whorl, thereafter broadly rounded; spire whorls rather evenly expanding, last adult whorl slightly constricted and insertion point gently descending; suture moderately well defined. Base more broadly rounded than periphery, tightly rounded to subangulate at umbilical rim; umbilicus funnel-shaped. Sculpture of weak, weakly sigmoidal, widely spaced, prosocline, collabral riblets that are surmounted by periostracal lamellae; additionally with fine collabral and more or less obscure spiral growth lines. Aperture roundly D-shaped.

Radula (Fig. 1C,D) with characteristics of the genus.

DISTRIBUTION: Great Island, Three Kings Islands (Fig. 5B).

BIOLOGY: Detritivore. Lives on the ground in litter, under stones and among ground-layer plants. Habitats comprise shrubland, and *Kunzea* and broadleaved forests (Powell 1948; Climo 1973; Brook 2002a,b).

CONSERVATION STATUS: Not mentioned by McGuinness (2001). Listed as 'range restricted (one location; recovering)' by Hitchmough (2002) and Brook (2002a). This species was evidently scarce about the time of discovery in the middle of the twentieth century (Powell 1948, 1951), but surveys following eradication of the goats from Great Island in 1946 indicate marked recovery in numbers (Climo 1973; Brook 2002a,b). Our assessment is that the species is not of immediate conservation concern, but is 'range restricted' according to the criteria of Molloy *et al.* (2002).

REMARKS: Of the four *Cytora* species restricted to the Three Kings, *C. annectens* most closely resembles *C. filicosta*, differing in attaining larger size, in being larger relative to the number of whorls, in having a larger protoconch, and in having less prominent periostracal lamellae. The two species are allopatric, *C. annectens* being restricted to Great Island, whereas *C. filicosta* occurs on North East, South West and West islands.

***Cytora aranea* (Powell, 1928)**

(Figs 4B, 5C, 6C,D)

*Murdochia aranea* Powell, 1928: 365, fig. 1.

*Cytora aranea*.- Powell, 1957: 90, pl. 27, fig. 17; Rees, 1961: 16; Climo, 1970: fig. 1D, M; Powell, 1979: 86, pl. 23, fig. 6; Gardner, 1994: 7, text fig.

TYPE MATERIAL: Holotype AIM AK 72099: North Island, Hokianga Harbour, Opononi, under decaying leaves in native bush, W.E. La Roche, Apr. 1928.

MATERIAL EXAMINED (26 lots): Type material (see above), M.36941 (2), M.38155 (4), M.58141 (2), M.62539 (1), M.63296 (1), M.74060 (fossil – many), M.89929 (2), M.97505 (2), M.98251 (1), M.124264 (1), M.124318 (21), M.124326 (7), M.124327 (3), M.124345 (2), M.124391 (12), M.124392 (6), M.124746 (5), M.156674 (8), M.163607 (4), M.163949 (3), M.163977 (3), M.164020 (1), M.164091 (2), M.164184 (1), M.178062 (11).

REDESCRIPTION: Shell up to 3.62 mm high, higher than wide (height/width ratio 1.92–2.27), narrowly and weakly cyrtoconoid (spire angle 26–36°), spire 2.30–2.60 times as high as aperture, narrow umbilicus partially obscured by columella. Translucent, rather uniform light reddish brown, protoconch darker in some specimens. Periostracum on teleoconch produced at summits of collabral riblets as thin lamellae on spire and base, numbering about eight per mm at end of third whorl.

Protoconch of 1.60–1.80 convex whorls, 500–600 µm wide, last third to quarter whorl traversed by weak,

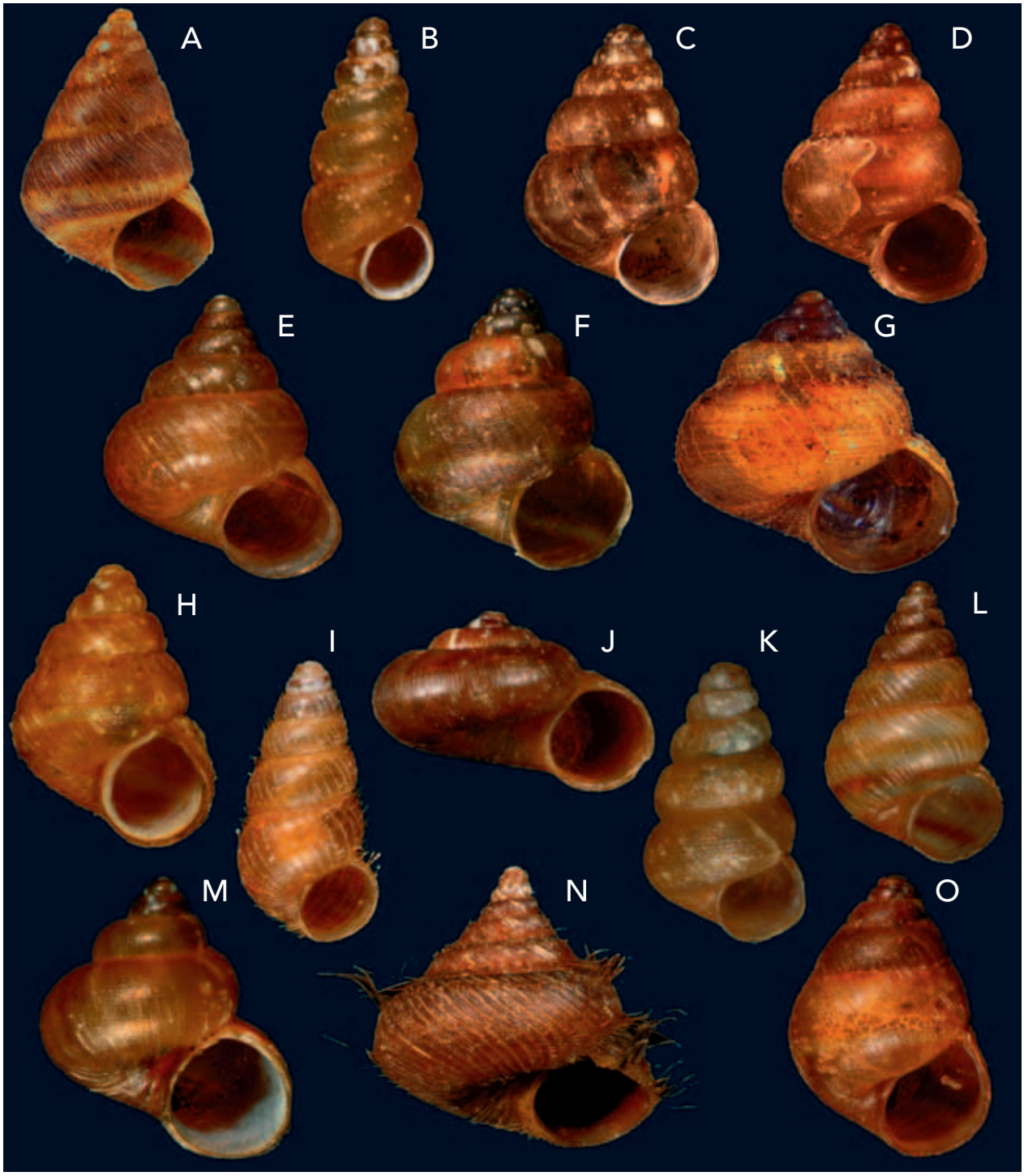


Fig. 4 Shells of *Cytora* species. A, *Cytora annectens* (Powell, 1948), Three Kings Islands, Great Island, M.29232 (5.60 x 3.80 mm); B, *Cytora aranea* (Powell, 1928), WSW of Kaikohe, Waima Forest, M.164020 (3.65 x 1.70 mm); C, *Cytora calva* (Hutton, 1882), beside Otira–Kumara highway, Jacksons, neotype, M.174790 (3.25 x 2.25 mm); D, *Cytora chiltoni* (Suter, 1896), WNW of Murchison, Buller River valley, Fern Flat, holotype, M.125086 (2.85 x 2.10 mm); E, *Cytora brooki* n.sp., SE of Cape Reinga, Tapotupotu Bush, holotype, M.179665 (4.80 x 4.15 mm); F, *Cytora climoi* n.sp., NW of Collingwood, holotype, M.179666 (2.50 x 2.05 mm); G, *Cytora cytora* (Gray, 1850), Ngaruawahia, Hakirimata Track, M.168599 (2.50 x 2.50 mm); H, *Cytora fasciata* (Suter, 1894), Stratford Reserve, M.97872 (2.75 x 1.95 mm); I, *Cytora hispida* N. Gardner, 1967, Spirits Bay, Waterfall Gully, M.38239 (3.30 x 1.65 mm); J, *Cytora depressa* N. Gardner, 1968, ENE of Upper Takaka, M.88889 (2.65 x 4.00 mm); K, *Cytora gardneri* n.sp., SW of North Cape, paratype, M.72442 (1.90 x 1.13 mm); L, *Cytora filicosta* (Powell, 1948), Three Kings Islands,

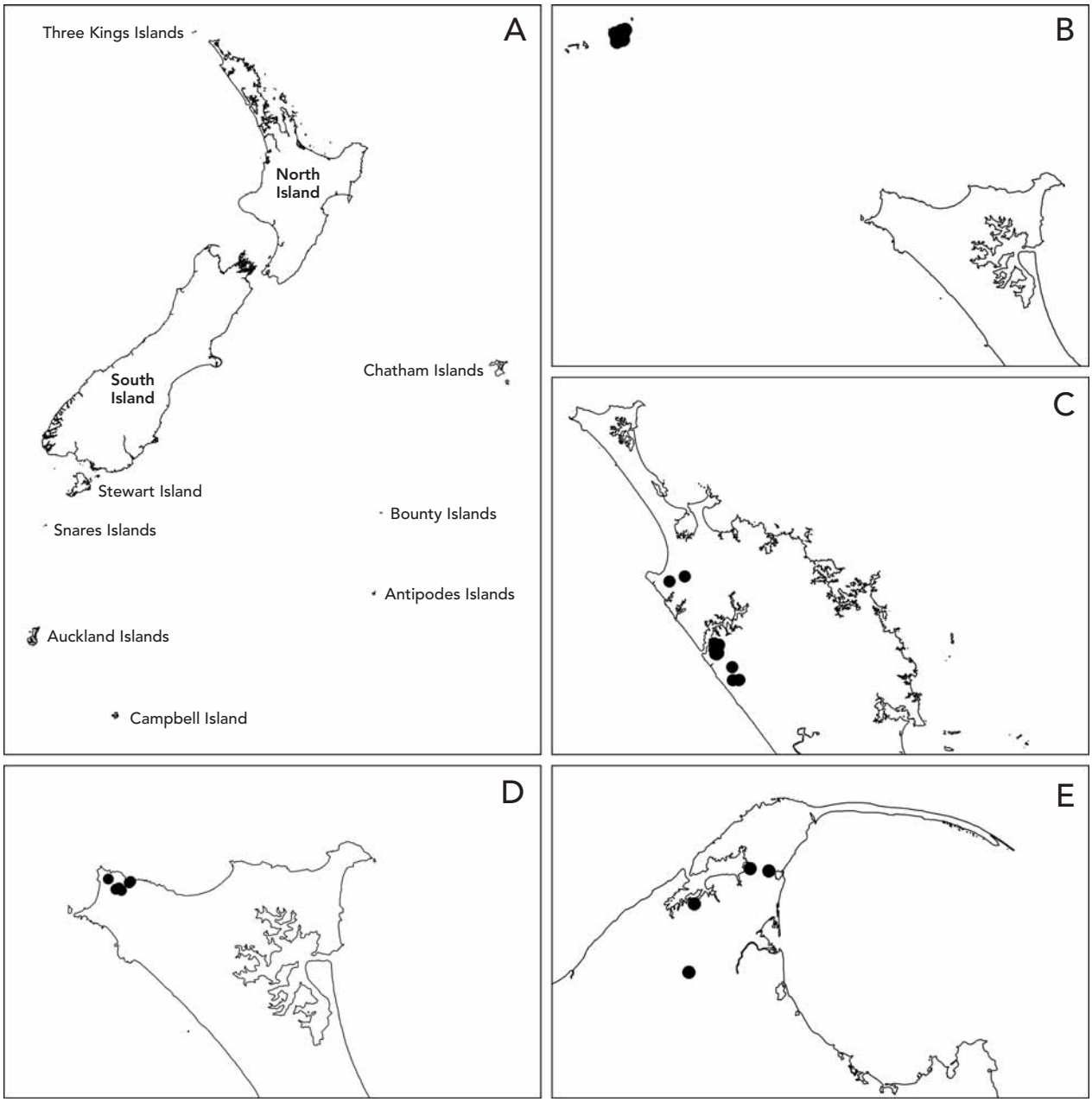


Fig. 5 Distributions of *Cytora* species within New Zealand. A, map of New Zealand region showing location of main islands mentioned in the text; B, *Cytora annectens* (Powell, 1948); C, *Cytora aranea* (Powell, 1928); D, *Cytora brooki* n.sp.; E, *Cytora climoi* n.sp.

rounded, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch; elsewhere smooth.

Teleoconch of up to 4.90 convex whorls, periphery broadly rounded at all stages of growth, spire whorls rather evenly expanding; last adult whorl slightly constricted, insertion point gently descending immediately behind adult outer lip; suture strongly impressed. Base rather smoothly curved into umbilical chink. Sculpture of weak to well-developed, more or less straight, widely spaced,

South West Island, M.36432 (4.30 x 2.72 mm); M, *Cytora hedleyi* (Suter, 1894), W of Auckland, Omanawanui Track, M.156405 (2.30 x 2.15 mm); N, *Cytora hirsutissima* (Powell, 1951), Three Kings Islands, Great Island, M.155506 (5.65 x 5.80 mm); O, *Cytora goulstonei* n.sp., SE of Kaeo, beside Waiare Road, holotype, M.164803 (3.15 x 2.30 mm).

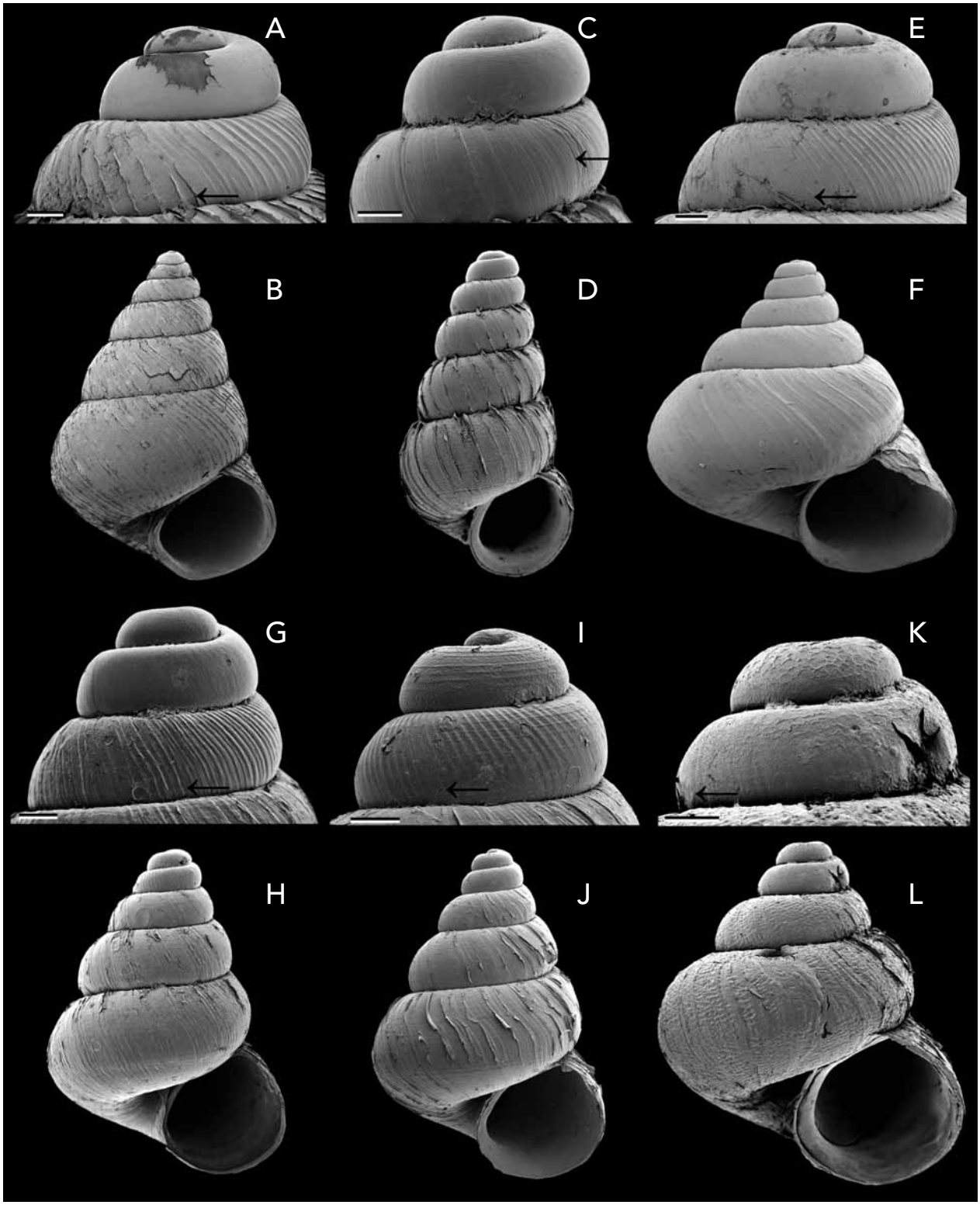


Fig. 6 Lateral views of whole shells and protoconchs (protoconch–teleoconch boundary arrowed) of *Cytora* species (SEM). A, B, *Cytora annectens* (Powell, 1948), Three Kings Islands, Great Island, M.29232 (B, 5.70 x 3.90 mm); C, D, *Cytora aranea* (Powell, 1928), E of Omapere, Waiotemarama Gorge, M.124318 (D, 3.00 x 1.55 mm); E, F, *Cytora brooki* n.sp., SE of Cape Reinga, Tapotupotu Bush, paratype, M.137045 (F, 4.30 x 4.20 mm); G, H, *Cytora calva* (Hutton, 1882), beside Otira–Kumara highway, Jacksons, M.73144 (H, 2.90 x 2.10 mm); I, J, *Cytora chiltoni* (Suter, 1896), Greymouth, King Domain, M.100721 (J, 2.80 x 1.95 mm); K, L, *Cytora climoi* n.sp., NW of Collingwood, paratype, M.124940 (L, 2.10 x 1.85 mm). Scale bars 100 µm.

prosocline, collabral riblets that are surmounted by periostracal lamellae; additionally with fine, weak, crowded spiral threads that appear and gradually enlarge on second whorl, and fine collabral growth lines. Aperture roundly ovate, thin inner lip rim gently flared over umbilical chink.

DISTRIBUTION: North Island: living between Kaitaia and Dargaville, western Northland (Fig. 5C). Fossil in dunes southeast of Cape Reinga (M.74060).

BIOLOGY: Litter-dwelling detritivore. Evidently confined to broadleaved forests to about 420 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora aranea* is highly distinctive in the combination of narrowly attenuated shell, uniformly pigmented teleoconch, and axially lamellar periostracum. It most closely resembles *C. hispida* Gardner, 1967 in shape, but that species has spines on the periostracal blades, among other differences (see below).

***Cytora brooki* new species**

(Figs 1E, 4E, 5D, 6E,F)

*Cytora* sp. aff. *C. ampla* Brook, 1999d: 390; McGuinness, 2001: 636.

*Cytora* sp. 1 (NMNZ M.154911) Hitchmough, 2002: 121.

*Cytora* sp. 16 (NMNZ M.154911) Brook, 2002a: 24; Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.179665 and paratypes M.137045 (4), AIM AK 73289 (1): North Island, SE of Cape Reinga, Tapotupotu Bush (NZMS 260 M02/840510), G.R. Parrish, 19 Mar. 1988.

MATERIAL EXAMINED (12 lots): Type material (see above), M.38225 (9), M.124329 (3), M.137042 (30), M.137043 (1), M.137044 (1), M.154911 (2), M.156627 (many), M.156629 (1), M.177684 (2).

DESCRIPTION: Shell up to 5.60 mm high, about as high as wide or slightly higher than wide (height/width ratio 1.14–1.25), broadly conical (spire angle 61–69°), spire 1.27–1.73 times as high as aperture, rather widely umbilicate. Protoconch and teleoconch reddish brown, some specimens uniformly darkly pigmented, others with variable number and pattern of narrow white spiral bands on spire and base of last one or two whorls in adults. Periostracum smooth.

Protoconch of 1.70–1.80 convex whorls, 790–900 µm wide, first whorl smooth and glossy, last part traversed by fine, rounded, collabral riblets that are more closely spaced and slightly more strongly prosocline than those on immediately succeeding teleoconch.

Teleoconch of up to 4.20 convex whorls; periphery rounded throughout; whorls expanding at about same rate as protoconch, or more rapidly than protoconch (early spire outline evenly conical or coeloconoid), evenly expanding until last adult whorl, which is very slightly constricted, its insertion point gently descending behind outer lip; suture well defined. Base broadly rounded, smoothly curving into umbilicus. Sculpture of weak, weakly sigmoidal, widely spaced, strongly prosocline, collabral riblets, and fine collabral growth lines. Aperture subcircular, mature peristome rim thin and weakly flared, rapidly and weakly to moderately thickened within.

Radula (Fig. 1E) with characteristics of the genus.

ETYMOLOGY: In honour of Fred J. Brook of Whangarei, in appreciation for his outstanding contributions to biogeography and systematics of terrestrial pulmonates in the New Zealand region.

DISTRIBUTION: North Island: northwestern tip of Aupouri Peninsula (Fig. 5D). Known also from fossils in Holocene dunes at Te Werahi (M.180342) (Brook 1999d).

BIOLOGY: Litter-dwelling detritivore of coastal shrublands and forests, to about 250 m elevation.

CONSERVATION STATUS: Ranked as 'data deficient' by McGuinness (2001). Listed as 'range restricted (data poor)' by Brook (2002a) and Hitchmough (2002). Brook (2002a: 24) remarked 'Fossil evidence suggests this species was formerly more widely distributed on northwestern Aupouri Peninsula. The present fragmented, relict distribution presumably resulted from extensive habitat destruction caused by anthropic land clearance for gum-digging, pastoral farming and exotic forestry. The total population is possibly still declining as a consequence of continued modification and loss of habitat, and there is a risk that some local populations could become extinct if historical trends continue.' Our assessment is that this range-restricted species continues to be of immediate conservation concern, and should be ranked 'nationally vulnerable' according to the criteria of Molloy *et al.* (2002).

REMARKS: Compared with *Cytora lignaria*, which has restricted distribution centred further eastwards on the tip of the Aupouri Peninsula, *C. brooki* differs in being smaller relative to the number of whorls, in attaining smaller size, and in tending to be more narrowly conical. The two species do, however, occur sympatrically at Tapotupotu (e.g. M.88410 and M.137042) and as a Holocene fossil in dunes (F.J. Brook, pers. comm., 2006).

***Cytora calva* (Hutton, 1882)**

(Figs 4C, 6G,H, 8A)

*Leptopoma calva* Hutton, 1882: 282; Hutton, 1883b: 140; Hutton, 1884a: 174; Hutton, 1884b: 209.

*Lagocheilus calvum*.- Hedley & Suter, 1893: 621.

*Lagochilus calvum*.- Suter, 1894b: 140.

*Lagochilus calvus*.- Suter, 1894d: 224.

*Lagochilus* (*Cytora*) *calvum*.- Kobelt & Möllendorff, 1897: 85; Suter, 1913: 179, pl. 35, fig. 1.

*Japonia* (*Cytora*) *calva*.- Kobelt, 1902: 65.

*Murdochia calva*.- Powell, 1937: 67.

*Cytora calva*.- Powell, 1957: 90; Powell, 1979: 85.

TYPE MATERIAL: Neotype (here selected) NMNZ M.174790: South Island, N of Arthur's Pass, Jacksons, near roadside on Otira–Kumara highway, 200 m (NZMS 260, K33/870283), F.M. Climo, 9 Aug. 1982.

MATERIAL EXAMINED (22 lots): Type material (see above), M.29700 (2), M.73144 (4), M.79237 (1), M.82795 (1), M.89712 (1), M.96792 (1), M.101036 (3), M.107770 (1), M.115059 (4), M.120730 (1), M.120852 (1), M.122483 (1), M.124802 (1), M.124815 (1), M.124817 (1), M.124968 (4), M.126655 (1), M.126659 (2), M.129089 (1), M.159987 (11), M.159995 (1).

REDESCRIPTION: Shell up to 3.45 mm high, higher than wide (height/width ratio 1.30–1.64), narrowly conical (spire angle 50–60°), spire 1.65–1.69 times as high as aperture, umbilicus narrow. Irregular reddish-brown collabral maculations on spire and base, or base uniformly pigmented, colourless submedian band bounded abapically by thin reddish-brown line; ground translucent pale buff or whitish. Periostracum on teleoconch produced at summits of collabral riblets as low, thin lamellae on spire and base, numbering about 20 per mm at end of third whorl, locally two or three lamellae periodically coalesce adapically to form subsutural row of higher, broadly rounded lamellae.

Protoconch of 1.70–1.80 convex whorls, 600–710 µm wide, smooth and glassy, last half-whorl traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 3.50 broadly convex whorls; periphery rounded at all stages of growth; spire whorls regularly expanding, last adult whorl distinctly constricted; suture well defined. Base broadly convex, evenly curving into umbilicus. Sculpture of very weak, weakly sigmoidal, prosocline, collabral riblets that are surmounted by periostracal lamellae; additionally with fine collabral growth lines and obscure spiral lines. Aperture subcircular, rim thin, gently thickened within at maturity.

DISTRIBUTION: Western South Island, from vicinity of Granity to Lake Kanieri (Fig. 8A).

BIOLOGY: Litter-dwelling detritivore of mixed broadleaved-conifer forests and *Nothofagus* forests, from near sea-level to over 1000 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: The type specimen of *Leptopoma calva*, last recorded by Suter (1913) as the only specimen he had seen, appears to be no longer extant (e.g. Freeman *et al.* 1996). After the briefest original description (Hutton 1882), Hutton (1883b) described *L. calva* thus: 'Shell conical, reddish brown with a thin spiral band below the periphery; spire acutely conical; whorls 6.5, rather flattened, the last convex below and rounded: epidermis smooth, forming numerous oblique growth-lines; suture impressed: umbilicus very narrow, but open: aperture, peristome, operculum and dentition like the last species. height 0.13, diameter 0.08 inch. [3.30 x 2.03 mm]', with 'Greymouth' as type locality (presumably Greymouth district). The specimen we have selected as neotype represents the only *Cytora* species occurring in the vicinity of Greymouth that is accordant with Hutton's descriptions and Suter's (1913) crude illustration of the holotype. Unfortunately, we have not seen any reliably localised specimens from Greymouth or the immediate vicinity of that town, so we have chosen the neotype from one of the nearest localities where the species is definitely known to occur.

*Cytora calva* is extremely distinctive in having a maculate colour pattern, the only other species with a similar pattern being *C. kakano* n.sp. (see below), which is larger relative to the number of whorls and more broadly conical.

***Cytora chiltoni* (Suter, 1896)**

(Figs 4D, 6I,J, 8B)

*Leptopoma pannosa*.- Hutton, 1882: 282 (in part + *C. mayhillae*).

*Lagochilus chiltoni* Suter, 1896: 33, pl. 4, fig. 1.

*Lagochilus* (*Cytora*) *chiltoni*.- Kobelt & Möllendorff, 1897: 85; Suter, 1913: 179, pl. 10, fig. 1 – in part (Waikato record = *C. maui* (M.170200)).

*Japonia* (*Cytora*) *chiltoni*.- Kobelt, 1902: 65, fig. 11.

*Cytora chiltoni*.- Powell, 1957: 90; Gardner, 1977: 38; Powell, 1979: 85; Gardner, 1994: 14 (in part = *C. tuarua* + *C. maui*).

*Cytora pannosa*.- Gardner, 1994: left text fig. (only) (not Hutton, 1882).

NOT *Murdochia chiltoni*.- Dell, 1954: 138 (= *C. tuarua*); Dell, 1955: 1136 (= *C. tuarua*).

NOT *Cytora chiltoni*.- Gardner, 1975: 119 (= *C. maui*); Goulstone, 1990: 21, text fig. (= *C. maui*); Mason, 1988: 90 (= *C. tuarua*).

NOT *Cytora* cf. *chiltoni*.- Mayhill, 1994: 35, text figs (= *C. maui*).

TYPE MATERIAL: Holotype NMNZ M.125086: South Island, WNW of Murchison, Buller River valley, Fern Flat, C. Chilton.

MATERIAL EXAMINED (154 lots): Type material (see above), M.13401 (4), M.14260 (2), M.20479 (2), M.22289 (1), M.37090 (4), M.38851 (2), M.47181 (2), M.56448 (2), M.57105 (1), M.61875 (3), M.62968 (6), M.69051 (4), M.72987 (2), M.73132 (4), M.74006 (7), M.76318 (1), M.76472 (1), M.77323 (2), M.77709 (4), M.77753 (7), M.77871 (3), M.77885 (2), M.78422 (8), M.78701 (1), M.79260 (2), M.79717 (1), M.79867 (1), M.79875 (1), M.81937 (1), M.82523 (1), M.86428 (1), M.86535 (8), M.86628 (1), M.88900 (1), M.89094 (2), M.89735 (1), M.96749 (11), M.97347 (2), M.97383 (2), M.97402 (30), M.98846 (1), M.98942 (3), M.100721 (15), M.101213 (3), M.101231 (13), M.101741 (3), M.101940 (1), M.102735 (9), M.103194 (8), M.103347 (1), M.103369 (1), M.103390 (7), M.104760 (2), M.105297 (15), M.105342 (1), M.105560 (5), M.105862 (2), M.106099 (3), M.106103 (1), M.106271 (6), M.106522 (1), M.107091 (4), M.107131 (3), M.107244 (2), M.107272 (2), M.107360 (6), M.108393 (1), M.108415 (4), M.108482 (1), M.108530 (7), M.108542 (1), M.108712 (2), M.108760 (1), M.109646 (2), M.114004 (5), M.115077 (15), M.115092 (4), M.115216 (many), M.116352 (3), M.116422 (4), M.120261 (2), M.120457 (9), M.120480 (6), M.120601 (3), M.120729 (1), M.122446 (1), M.123469 (3), M.123552 (4), M.123578 (2), M.123641 (1), M.123757 (2), M.123785 (2), M.124034 (1), M.124216 (1), M.124662 (1), M.124677 (1), M.124705 (2), M.124707 (1), M.124810 (1), M.124819 (2), M.124821 (1), M.124841 (1), M.124843 (1), M.124847 (7), M.124864 (3), M.124866 (10), M.124867 (13), M.124869 (22), M.124870 (1), M.124878 (1), M.124882 (8), M.124888 (1), M.124894 (1), M.124897 (1), M.124898 (1), M.124899 (1), M.124906 (1), M.124910 (1), M.124917 (5), M.124919 (7), M.124922 (1), M.124925 (1), M.124942 (1), M.124944 (3), M.124945 (2), M.124960 (3), M.124998 (1), M.125086 (1), M.125928 (1), M.126234 (1), M.126258 (2), M.126390 (2), M.126426 (many), M.126656 (1), M.127942 (3), M.129238 (1), M.159016 (1), M.159032 (1), M.159384 (2), M.159426 (1), M.159436 (1), M.159480 (1), M.159503 (1), M.159565 (1), M.161290 (1), M.161389 (1), M.162373 (1), M.164378 (1), M.164411 (1), M.166373 (1), M.169215 (2), M.174815 (1), M.174816 (1).

REDESCRIPTION: Shell 2.35–3.40 mm high at maturity, higher than wide (height/width ratio 1.35–1.52), narrowly conical (spire angle 47–58°), spire 1.52–1.83 times as high as aperture, narrowly umbilicate. Translucent uniform yellowish to deep reddish brown; some specimens reddish brown with whitish or pale yellowish-brown broad median spiral band on spire whorls and on outer base. Periostracum on teleoconch produced at summits of widely spaced collabral riblets as thin lamellae on spire and base, higher, broadly rounded blades on periphery that number five to eight per mm at end of third whorl.

Protoconch of 1.70–1.80 convex whorls, 560–580 µm wide, fine, crisp spiral lirae throughout, first whorl additionally very finely malleate; spirals most prominent, widely spaced and numbering about eight on first 1.2 whorls, weaker on last half-whorl where intersecting rounded, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 3.10–4.70 convex whorls; spire whorls rather evenly expanding, last adult whorl modestly constricted and gently descending; broadly and rather evenly curving from periphery into umbilicus; suture well defined. Sculpture of weak, weakly sigmoidal, widely spaced, prosocline, collabral riblets that are surmounted by periostracal lamellae; additionally with numerous weak, crowded, spiral threads and fine collabral growth lines. Aperture subcircular, rim thin and simple, gently thickened within.

DISTRIBUTION: Western South Island, from Cape Farewell to Breaksea Sound (also Dusky Sound), including western Marlborough and inland North Canterbury (Fig. 8B).

BIOLOGY: Litter-dwelling detritivore of coastal shrubland, mixed broadleaved-conifer shrublands and forests, and *Nothofagus* forests, from near sea-level to about 1500 m elevation. Frequently collected from limestone outcrops.

CONSERVATION STATUS: Widely distributed. Not of immediate conservation concern.

REMARKS: Compared with *Cytora pannosa*, with which it is

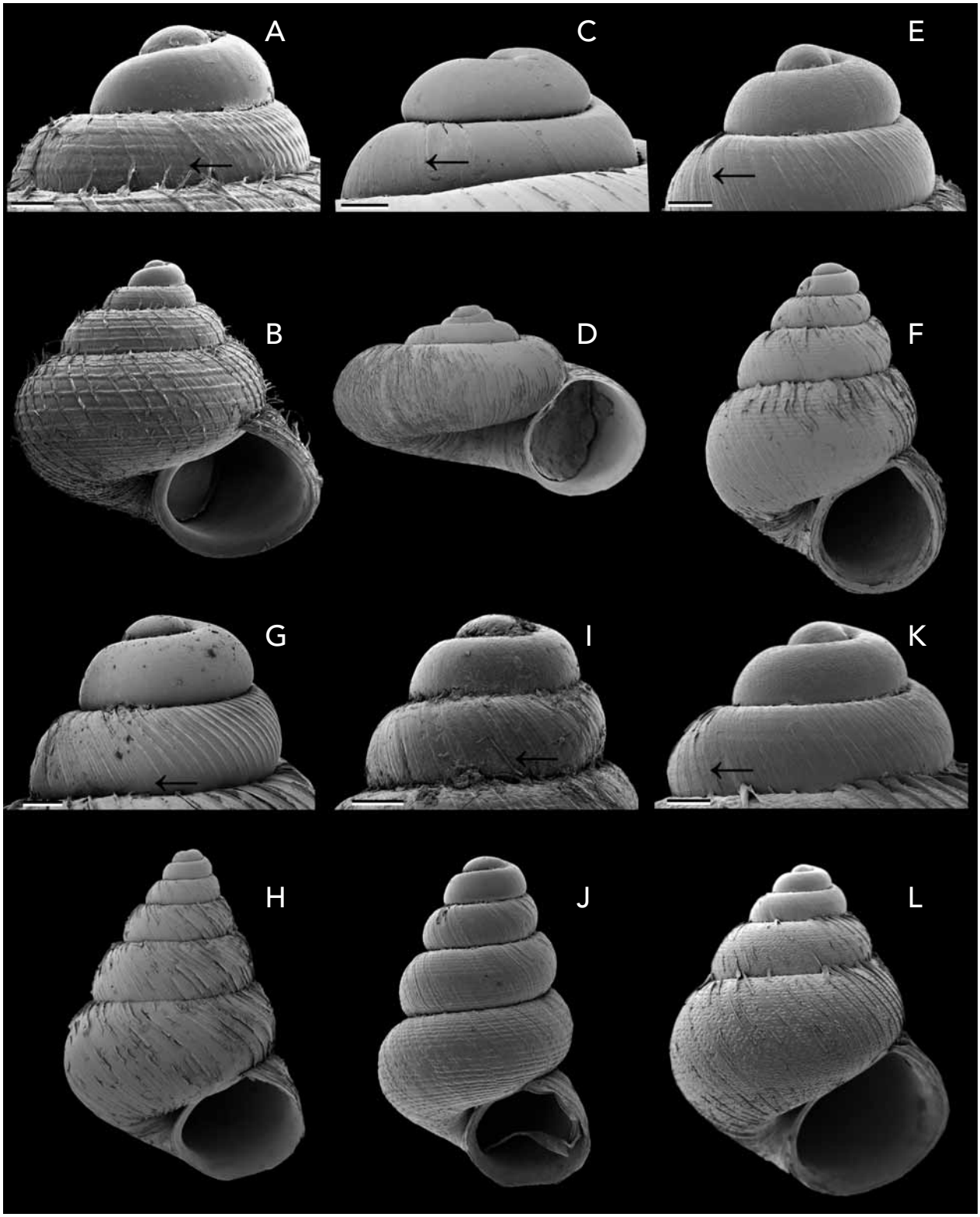


Fig. 7 Lateral views of whole shells and protoconchs (protoconch–teleoconch boundary arrowed) of *Cytora* species (SEM). A, B, *Cytora cytora* (Gray, 1850), Lake Waikaremoana, S side, M.93067 (B, 2.40 x 2.35 mm); C, D, *Cytora depressa* N. Gardner, 1968, ENE of Upper Takaka, M.88889 (D, 2.50 x 3.85 mm); E, F, *Cytora fasciata* (Suter, 1894), S of New Plymouth, Meeting of the Waters Reserve, M.166124 (E), and Stratford Reserve, M.97872 (F, 2.60 x 1.90 mm); G, H, *Cytora filicosta* (Powell, 1948), Three Kings Islands, South West Island, M.36432 (H, 3.95 x 2.75 mm); I, J, *Cytora gardneri* n.sp., SW of North Cape, holotype,

frequently sympatric, *C. chiltoni* differs in being smaller relative to the number of whorls, in having broadly rounded rather than sharply angular periostracal blades at the periphery, and in having a broader protoconch. Although the two species overlap in shape, *C. chiltoni* is typically more narrowly conical than *C. pannosa*. *Cytora chiltoni* is not to be confused with the similar species *C. kahurangi*, *C. tuarua* and *C. maui*, which are described below.

***Cytora climoi* new species**

(Figs 4F, 5E, 6K,L)

*Cytora* sp. 9 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.179666 and paratype M.124940: South Island, NW of Collingwood, roadside NE of Knuckle Hill (NZMS 260 M25/716650), F.M. Climo, 13 Apr. 1994. Additional paratypes: M.110016 (1), South Island, WSW of Collingwood, Kaituna Gorge, summit ridge above The Forks, F.M. Climo & K. Mahlfeld, 21 Apr. 1992; M.124953 (1), South Island, N of Collingwood, Pakawau Gorge, F.M. Climo & K. Mahlfeld, 1 Sep. 1993.

MATERIAL EXAMINED (five lots): Type material (see above), M.116338 (1).

DESCRIPTION: Shell up to 2.65 mm high at maturity, higher than wide (height/width ratio 1.10–1.23), broadly conical (spire angle 67–78°); 1.09–1.30 times as high as aperture, umbilicus moderately wide. Reddish brown with narrow, pale buff submedian spiral band. Periostracum on teleoconch produced at summits of collabral riblets as thin, delicate, widely spaced lamellae on spire and base.

Protoconch of about 1.60 convex whorls, 440–600 µm wide, first 1.2 whorls with fine, crisp, open, mesh sculpture, last 0.4 whorl traversed by crisp collabral riblets.

Teleoconch of up to 2.80 broadly convex whorls; whorls rather evenly expanding, last adult whorl gently constricted: suture deeply impressed. Base more broadly rounded than periphery, smoothly curving into umbilicus. Sculptured throughout with weak, weakly sigmoidal, widely spaced, prosocline, collabral riblets; and fine, crisp, densely crowded, anastomosing and dendritic threads that are more or less aligned with generating curve; additionally with fine collabral growth lines. Aperture subcircular, rim thin and simple, gently thickened within at maturity.

ETYMOLOGY: After Frank M. Climo, who collected the type material, and in appreciation of his work on New Zealand terrestrial Mollusca.

DISTRIBUTION: Northwestern South Island (Fig. 5E).

BIOLOGY: Little is known of this species. Collected from litter in forests, at 20–440 m elevation.

CONSERVATION STATUS: Presently known from only five specimens. Our assessment is that this range-restricted, rare species should be ranked 'sparse' according to the criteria of Molloy *et al.* (2002).

REMARKS: *Cytora climoi* is strongly characterised by the combination of small size, short and broadly conical spire, pale peripheral band, and particularly the unusual teleoconch sculpture of crisp anastomosing and dendritic threads.

***Cytora cytora* (Gray, 1850)**

(Figs 1F, 4G, 7A,B, 8C)

*Cyclophorus cytora* Gray, 1850: 167; Martens, 1873: 23; Hector, 1873: 23; Hutton, 1880: 37; Hutton, 1884b: 210; Cheeseman, 1886: 165.

*Cyclophorus*? *cytora*.- Pfeiffer, 1852: 86.

*Lagocheilus cytora*.- Hedley & Suter, 1893: 621.

*Lagochilus cytora*.- Suter, 1893: 149, 151; Suter, 1894b: 140; Suter, 1894d: 223.

*Lagochilus* (*Cytora*) *cytora*.- Kobelt & Möllendorff, 1897: 85; Suter, 1913: 180, pl. 35, fig. 2.

*Japonia* (*Cytora*) *cytora*.- Kobelt, 1902: 65.

*Murdochia cytora*.- Iredale, 1915: 446; Powell, 1937: 67.

*Cytora cytora*.- Powell, 1957: 90; Whitten, 1957: 2; Rees, 1959: 21; Climo, 1975: fig. 6c; Powell, 1979: 84, fig. 12/3; Solem *et al.*, 1981: 476; Ballance, 1982: 30; Goulstone, 1990: 20, text fig.; Gardner, 1994: 5, text fig.; Brook & Goulstone, 1995: 9; Barker & Mayhill, 1999: 237; Barker, 2006: 134.

TYPE MATERIAL: Holotype BMNH 49.12.3.43: North Island, 'Auckland, Major Greenwood'.

MATERIAL EXAMINED (341 lots): Holotype (see above), M.14448 (3), M.22229 (7), M.25427 (2), M.25440 (1), M.29030 (25), M.29044 (6), M.29092 (3), M.37074 (1), M.37904 (2), M.37984 (2), M.38154 (2), M.39254 (1), M.45781 (1), M.47021 (2), M.47022 (2), M.48530 (2), M.48554 (1), M.51803 (1), M.51907 (2), M.55214 (3), M.55333 (20), M.56609 (12), M.57217 (1), M.57653

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M.179667 (J, 1.50 x 0.90 mm); K, L, *Cytora goulstonei* n.sp., NNW of Kaikohe, Puketi Forest, paratype, M.97198 (L, 2.60 x 2.20 mm). Scale bars 100 µm.

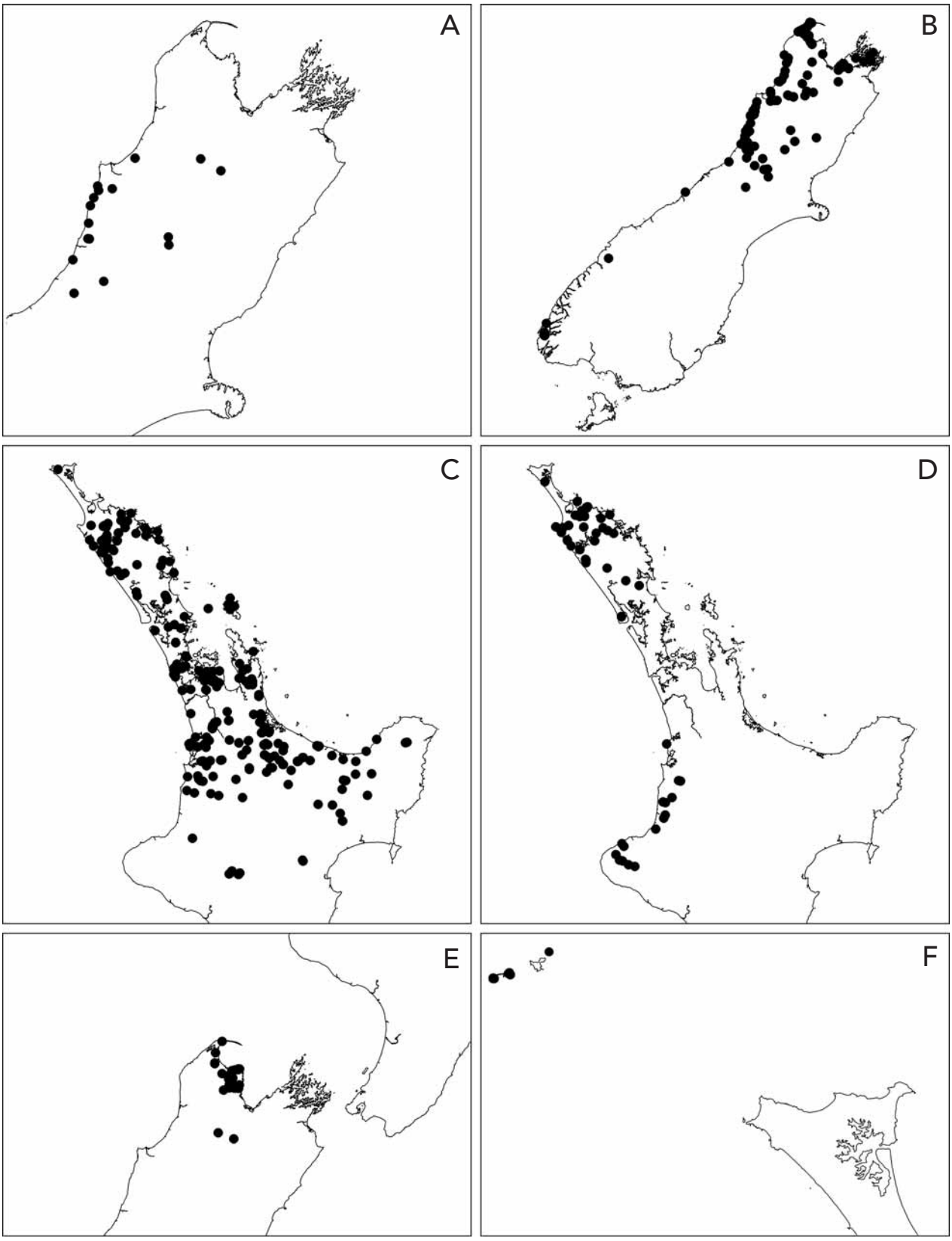


Fig. 8 Distributions of *Cytora* species within New Zealand. A, *Cytora calva* (Hutton, 1882); B, *Cytora chiltoni* (Suter, 1896); C, *Cytora cytora* (Gray, 1850); D, *Cytora fasciata* (Suter, 1894); E, *Cytora depressa* N. Gardner, 1968; F, *Cytora filicosta* (Powell, 1948).

(1), M.57892 (5), M.58139 (1), M.61785 (1), M.61798 (3), M.62502 (1), M.62647 (1), M.62714 (1), M.63517 (30), M.63544 (5), M.68482 (1), M.68525 (1), M.68676 (1), M.68859 (1), M.68941 (12), M.69071 (1), M.69822 (20), M.70482 (1), M.70630 (5), M.70781 (1), M.70791 (1), M.72285 (1), M.72320 (2), M.72391 (1), M.73944 (3), M.73970 (1), M.75591 (1), M.75737 (2), M.77418 (1), M.77455 (1), M.77782 (10), M.78100 (2), M.78261 (1), M.78490 (2), M.78556 (1), M.78636 (2), M.78756 (2), M.78888 (1), M.78937 (1), M.79334 (1), M.81770 (1), M.82111 (1), M.82143 (1), M.82862 (2), M.83024 (1), M.83069 (1), M.83145 (2), M.84770 (3), M.88453 (6), M.89343 (1), M.89354 (1), M.89585 (2), M.93067 (13), M.93082 (2), M.96502 (2), M.96603 (1), M.97055 (2), M.97284 (1), M.97513 (1), M.97925 (5), M.97955 (3), M.97996 (2), M.99873 (1), M.101585 (12), M.101693 (11), M.102798 (1), M.103670 (1), M.104258 (5), M.104523 (1), M.104615 (2), M.113646 (1), M.113673 (1), M.116751 (2), M.124265 (4), M.124267 (2), M.124268 (4), M.124269 (1), M.124270 (1), M.124271 (1), M.124293 (1), M.124334 (1), M.124344 (7), M.124347 (2), M.124353 (11), M.124360 (3), M.124361 (1), M.124371 (2), M.124529 (1), M.124530 (7), M.124579 (1), M.124679 (2), M.124680 (4), M.124782 (1), M.124787 (1), M.126451 (1), M.127503 (1), M.127528 (1), M.156249 (1), M.156268 (5), M.156411 (5), M.156412 (2), M.156413 (1), M.156414 (3), M.156415 (8), M.156416 (10), M.156417 (many), M.156418 (2), M.156419 (3), M.156420 (1), M.156421 (1), M.156422 (1), M.156423 (2), M.156424 (1), M.156425 (16), M.156426 (12), M.156429 (9), M.156430 (1), M.156431 (4), M.156432 (14), M.156433 (1), M.156434 (2), M.156435 (3), M.156436 (4), M.156437 (12), M.156438 (2), M.156571 (1), M.156577 (5), M.156578 (1), M.156579 (2), M.156607 (1), M.156608 (5), M.156609 (2), M.156947 (2), M.156948 (4), M.156949 (2), M.156950 (5), M.156951 (1), M.156952 (5), M.156953 (3), M.156954 (5), M.156955 (1), M.156956 (3), M.156957 (2), M.156958 (8), M.156993 (2), M.161207 (1), M.163258 (3), M.163444 (3), M.163524 (2), M.163542 (3), M.163600 (2), M.163636 (3), M.163657 (1), M.163978 (2), M.164243 (1), M.164260 (1), M.164754 (1), M.164767 (9), M.164820 (6), M.164835 (2), M.164880 (2), M.164915 (3), M.164966 (4), M.165028 (2), M.165119 (1), M.165174 (4), M.165276 (3), M.165725 (1), M.165830 (1), M.165877 (1), M.166965 (1), M.167021 (1), M.167054 (2), M.167141 (1), M.167183 (30), M.167602 (2), M.167670 (5), M.167680 (1), M.168389 (1), M.168550 (6), M.168599 (many), M.168672 (many), M.168758 (20), M.168812 (11), M.168843 (many), M.168929 (many), M.169125 (5), M.169126 (1), M.169127 (1), M.169128 (1), M.169129 (3), M.169130 (1), M.169131 (1), M.169132 (1), M.169133 (3), M.169134 (2), M.169135 (8), M.169136 (2), M.169137 (1), M.169138 (3), M.169139 (3), M.169140 (1), M.169141 (3), M.169142 (1), M.169143 (4), M.169144 (1), M.169145 (1), M.169146 (2), M.169147 (1), M.169148 (3), M.169149 (6), M.169150 (1), M.169151 (2), M.169152 (2), M.169153 (2), M.169154 (3), M.169155 (2), M.169156 (1), M.169157 (3), M.169158 (3), M.169159 (8), M.169160 (1), M.169161 (1), M.169162 (4), M.169163 (2), M.169164 (1), M.169165 (2), M.169166 (2), M.169167 (7), M.169168 (2), M.169169 (2), M.169170 (2), M.169171 (2), M.169172 (1), M.169173 (2), M.169174 (1), M.169175 (1), M.169176 (1), M.169177 (3), M.169178 (1), M.169179 (1), M.169180 (4), M.169181 (9), M.169182 (3), M.169183 (1), M.169184 (2), M.169185 (1), M.169186 (2), M.169187 (6), M.169188 (7), M.169189 (2), M.169190 (1), M.169191 (30), M.169192 (1), M.169193 (3), M.169194 (3), M.169195 (6), M.169196 (1), M.169197 (1), M.169198 (2), M.169199 (2), M.169200 (1), M.169201 (1), M.169202 (2), M.169203 (2), M.169204 (2), M.169262 (2), M.169263 (1), M.169264 (1), M.169265 (6), M.169266 (2), M.169267 (4), M.169268 (6), M.169269 (1), M.169270 (1), M.169271 (1), M.169272 (1), M.169273 (1), M.169274 (16), M.169499 (1), M.169461 (1), M.169511 (1), M.169607 (1), M.169643 (1), M.169823 (1), M.169855 (1), M.169918 (1), M.169919 (1), M.170170 (9), M.170171 (5), M.170172 (6), M.170173 (4), M.170174 (5), M.170206 (5), M.174326 (15), M.174330 (8), M.174818 (8), M.175033 (30), M.175050 (2), M.175089 (12), M.175139 (3), M.175162 (1), M.175221 (8), M.175244 (1), M.175263 (9), M.176018 (1), M.176038 (3), M.176055 (1). M.176088 (1), M.176104 (1), M.176111 (2), M.176130 (1), M.177695 (2), M.177725 (7), M.177731 (2), M.178060 (4), M.178066 (4).

REDESCRIPTION: Shell 2.40–3.05 mm high at maturity, slightly higher than wide (height/width ratio 1.06–1.19), broadly conical (spire angle 64–78°), spire 1.18–1.68 times as high as aperture, rather widely umbilicate. Translucent, periostracum yellowish to reddish brown, produced as

prominent hairs at intersections of spiral and axial riblets, and as weak lamellae at summits of axial riblets that number five to six per mm at end of third whorl.

Protoconch of 1.70–1.80 convex whorls, 560–600 µm wide, first whorl smooth, remainder traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 3.60 broadly convex whorls; periphery broadly rounded at all stages of growth; spire whorls rather evenly expanding, at maturity last whorl distinctly constricted before distinctly expanded as a low convex varix behind outer lip, insertion point gently descending immediately behind adult outer lip; suture well defined. Base evenly rounded from periphery into umbilicus. Sculpture of crisp, widely spaced spiral threads that multiply by intercalation, numbering six to eight at end of penultimate whorl, and 10–13 over base and outer part of umbilicus; weaker, widely spaced, prosocline, collabral riblets that are enlarged by periostracal lamellae; and fine collabral growth lines. Aperture subcircular, rim thin, rapidly thickened within at maturity.

Radula: (Fig. 1F) with characteristics of the genus.

DISTRIBUTION: North Island, north of a line between Mt Taranaki and Cape Kidnappers (Fig. 8C).

BIOLOGY: Primarily litter-dwelling, but also known from low vegetation such as fern fronds. Habitats include shrublands and broadleaved, mixed broadleaved-conifer and *Nothofagus* forests, from near sea-level to *c.* 870 m elevation.

CONSERVATION STATUS: Widely distributed and common. Not of immediate conservation concern.

REMARKS: *Cytora cytora* is extremely distinctive in the combination of small shell size, broadly conical spire, wide umbilicus, and teleoconch sculpture of crisp spiral threads with periostracal spines at their intersections with collabral riblets. A sinistral specimen is known (M.25427). Shell morphology is rather homogeneous throughout the range of the species, with the notable exception of two specimens from Radar Bush, southeast of Cape Reinga (M.79334 and M.161207), which are unusually high and narrow (height/width ratio 0.84–0.88) but otherwise similar.

### *Cytora depressa* N. Gardner, 1968

(Figs 1G, 4J, 7C,D, 8E)

*Cytora depressa* Gardner, 1968: 159, fig. 1; Climo, 1975: 468; Powell, 1979: 84; Gardner, 1994: 18, text fig.

TYPE MATERIAL: Holotype AIM AK 71315 and paratypes NMNZ M.31962 (3): South Island, NW of Nelson, W side of Takaka Hill, leaf mould amongst rocky outcrops, N.W. Gardner, Jan. 1967.

MATERIAL EXAMINED (50 lots): Type material (see above), M.23170 (4), M.36422 (2), M.48397 (1), M.55509 (1), M.56110 (1), M.56878 (1), M.56961 (1), M.62934 (1), M.71622 (1), M.72946 (6), M.73168 (1), M.86346 (2), M.88889 (22), M.89025 (15), M.89043 (12), M.101833 (2), M.103268 (1), M.104749 (8), M.105580 (3), M.105916 (4), M.105998 (3), M.106922 (3), M.108335 (6), M.109760 (3), M.109926 (1), M.120375 (6), M.120950 (1), M.121265 (2), M.122512 (5), M.122568 (22), M.122604 (24), M.122606 (2), M.122624 (26), M.124001 (8), M.124331 (3), M.124873 (many), M.125893 (1), M.125901 (2), M.125916 (2), M.125938 (2), M.126066 (1), M.126697 (1), M.129227 (1), M.156442 (3), M.156443 (1), M.162440 (2), M.162468 (1), M.162583 (3).

REDESCRIPTION: Shell 3.60–4.10 mm wide at maturity, markedly wider than high (height/width ratio 0.66–0.69), broadly conical (spire angle 135–177°), spire weakly coeloconoid and 0.68–0.86 times as high as aperture, very widely umbilicate. Shell of juveniles pale, translucent buff; that of adults uniformly dark, translucent, reddish brown. Periostracum on teleoconch produced at summits of collabral riblets as weak lamellae that number 15–24 per mm at end of second whorl.

Protoconch of about 1.40–1.60 convex whorls, 700–890 µm wide, first whorl smooth, last half-whorl smooth apart from weak collabral growth lines.

Teleoconch of up to 2.20 whorls, strongly and evenly convex at all stages of growth; expanding more rapidly than protoconch whorls (weakly coeloconoid), last adult whorl slightly contracted, end of last adult whorl disjunct and descending; suture well defined. Base broadly and evenly rounded from periphery into umbilicus. Sculpture of weak, weakly prosocline collabral riblets that are surmounted by periostracal lamellae, and with fine collabral growth lines. Aperture at maturity subcircular, rim thin and simple, slightly thickened within.

Radula (Fig. 1G) with characteristics of the genus.

DISTRIBUTION: Northwestern South Island (Fig. 8E). Well known also as fossils and subfossils in caves of limestone karst within the species' extant range.

BIOLOGY: Litter-dwelling detritivore of broadleaved shrublands, mixed broadleaved-conifer forests and *Nothofagus*

forests, from near sea-level to 900 m elevation. Species has been frequently collected from habitats on limestone outcrops.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora depressa* is distinctive in the combination of very broadly conical spire, very wide umbilicus, uniformly pigmented shell, lack of axial riblets on the last half-whorl of the protoconch, and detachment and descent of the last part of the last adult whorl. It is locally sympatric with the superficially similar species *C. kamura* n.sp., described below.

***Cytora fasciata* (Suter, 1894)**

(Figs 1H, 4H, 7E,F, 8D)

*Lagochilus fasciatum* Suter, 1894a: 132, pl. 19, figs 30, 31; Suter, 1894b: 140.

*Lagochilus fasciatus*.- Suter, 1894d: 225.

*Murdochia fasciatum*.- Powell, 1937: 67.

*Lagochilus* (*Cytora*) *fasciatum*.- Kobelt & Möllendorff, 1897: 85; Suter, 1913: 180, pl. 35, fig. 3.

*Japonia* (*Cytora*) *fasciata*.- Kobelt, 1902: 65.

*Cytora fasciata*.- Powell, 1957: 90; Powell, 1979: 84; Gardner, 1994: 11, text fig. (in part = *C. houhora* n.sp.).

*Cytora* cf. *fasciata*.- Goulstone *et al*., 1993: 6, text fig.

*Cytora* sp. aff. *fasciata*.- Brook, 1999e: 404.

TYPE MATERIAL: Syntype AIM AK 73001: North Island, NW of Wanganui, near Manaia, Waimate Plains, R. Murdoch. A second syntype, originally in the Suter Collection (NMNZ) is no longer extant (Marshall 1996).

MATERIAL EXAMINED (65 lots): Syntype (see above), M.37721 (2), M.48669 (2), M.48695 (3), M.55213 (1), M.55842 (2), M.55876 (5), M.56022 (3), M.57294 (6), M.58185 (2), M.58195 (4), M.58317 (1), M.62552 (1), M.68725 (3), M.69821 (2), M.72412 (1), M.77297 (2), M.78589 (1), M.87631 (2), M.88395 (1), M.96676 (5), M.97739 (1), M.97872 (7), M.97962 (1), M.102799 (3), M.104547 (20), M.124292 (1), M.124298 (3), M.124317 (4), M.124335 (14), M.124340 (1), M.124549 (1), M.124587 (2), M.124745 (3), M.124756 (many), M.127984 (6), M.127988 (3), M.148351 (1), M.156803 (1), M.162328 (1), M.163095 (1), M.163324 (1), M.163368 (2), M.163442 (3), M.163604 (3), M.163656 (1), M.164728 (1), M.164881 (1), M.164995 (2), M.165007 (1), M.165183 (1), M.165505 (1), M.165923 (2), M.165949 (2), M.166124 (10), M.169041 (2), M.169042 (9), M.169043 (1), M.169944 (1), M.169952 (1), M.169966 (1), M.177692 (1), M.177702 (many), M.177734 (10), M.178044 (9).

REDESCRIPTION: Shell up to 3.50 mm high, higher than wide (height/width ratio 1.22–1.47), narrowly conical (spire angle 52–63°), spire 1.44–1.57 times as high as aperture, umbilicus narrow. Protoconch and teleoconch yellowish to reddish brown; colourless or white peripheral to submedian spiral band commencing on second teleoconch whorl. Periostracum on teleoconch produced at summits of collabral riblets as prominent thin lamellae on spire and base, numbering about 13 per mm at end of third whorl, most prominent over adapical third of each spire whorl after first whorl.

Protoconch of 1.50–1.60 convex whorls, 510–600 µm wide, first whorl smooth and glossy, remainder traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 3.50 broadly convex whorls; periphery broadly rounded at all stages of growth; spire whorls rather evenly expanding, last adult whorl distinctly constricted and insertion point gently descending; suture deeply impressed. Base broadly rounded, smoothly and tightly rounded into narrow umbilicus. Sculptured throughout with very weak, widely spaced, prosocline, collabral riblets; numerous fine, crisp, spiral threads; and fine collabral growth lines. Aperture roundly D-shaped.

Radula (Fig. 1H) with characteristics of the genus.

DISTRIBUTION: North Island, from Northland and west coast between Raglan and Mt Taranaki (Fig. 8D). Also known as fossils from Holocene dunes on Tauroa Peninsula (M.148351) (Brook 1999e).

BIOLOGY: Litter-dwelling detritivore occurring from near sea-level to over 1000 m. Known from coastal shrublands, *Leptospermum*/*Kunzea* shrublands/forests, mixed broadleaved-conifer forests, *Agathis* forests and *Nothofagus* forests.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora fasciata* is distinctive in the combination of small size (height to 3.50 mm), well-developed spiral sculpture throughout the teleoconch, pale peripheral spiral band, and strong axial lamellae, which are enlarged in a broad subsutural zone. We are unable to detect any differences between specimens from the strongly disjunct northern and southern clusters of populations (Fig. 8D).

***Cytora filicosta* (Powell, 1948)**

(Figs 4L, 7G,H, 8F)

*Murdochia filicosta* Powell, 1948: 274, pl. 53, fig. 4.

*Cytora filicosta*.- Powell, 1957: 90, pl. 27, fig. 1; Climo, 1975: 468; Powell, 1979: 86, pl. 23, fig. 2; Gardner, 1994: 21, text fig.; Brook, 1999a: 1; McGuinness, 2001: 576; Brook, 2002a: 16; Brook, 2002b: 71; Hitchmough, 2002: 115.

TYPE MATERIAL: Holotype AIM AK 71047 and paratypes NMNZ M.5261 (11), M.156575 (4): Three Kings Islands, Northeast Island, leaf mould, G.A. Buddle, Jan. 1948.

MATERIAL EXAMINED (60 lots): Type material (see above), M.24360 (many), M.29242 (30), M.36432 (many), M.36439 (many), M.37070 (16), M.38722 (20), M.38733 (8), M.47233 (many), M.47260 (many), M.47265 (many), M.88688 (many), M.156576 (11), M.174430 (many), M.174437 (30), M.174443 (15), M.174449 (15), M.174455 (many), M.174462 (many), M.174468 (20), M.174473 (20), M.174478 (2), M.174482 (6), M.174487 (15), M.174493 (1), M.174496 (20), M.174501 (6), M.174505 (30), M.174510 (30), M.174515 (15), M.174521 (11), M.174531 (20), M.174537 (12), M.174542 (many), M.174551 (many), M.174563 (many), M.174572 (10), M.174578 (many), M.174587 (16), M.174596 (20), M.174603 (20), M.174610 (20), M.174620 (many), M.174632 (6), M.174637 (7), M.174654 (30), M.174664 (20), M.174675 (30), M.174685 (30), M.174697 (20), M.174707 (20), M.174718 (many), M.174731 (20), M.174740 (many), M.174750 (many), M.174756 (17), M.174763 (20), M.174771 (many).

REDESCRIPTION: Shell up to 4.65 mm high, higher than wide (height/width ratio 1.33–1.59), narrowly conical (spire angle 47–58°), spire 1.58–1.93 times as high as aperture, umbilicus narrow. Protoconch yellowish brown; teleoconch translucent, medium to dark reddish brown; pattern either pale yellowish brown to whitish with dark reddish-brown line bordering suture adapically, submedian band, outer basal band and umbilical area, or (less frequently) same except that adapical area between peripheral band and suture solid reddish brown. Periostracum on teleoconch produced at summits of collabral riblets as low, thin lamellae on spire and base, numbering typically 11 or 12 per mm at end of third whorl, summits very finely crenulate (visible by refraction on live-collected, permanently wet specimens – largely destroyed in dry specimens).

Protoconch of 1.60–1.70 convex whorls, 590–670 µm wide, most of first whorl smooth and glossy, remainder traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 4.80 broadly convex whorls; first three whorls with peripheral angulation that is obscured by succeeding whorls, periphery becoming rounded on fourth whorl, thereafter broadly rounded; spire whorls rather evenly expanding, last adult whorl slightly constricted and insertion point gently descending; suture well defined. Base more broadly rounded than periphery, tightly rounded to subangulate at umbilical rim; umbilicus funnel-shaped. Sculpture of weak, weakly sigmoidal, widely spaced, prosocline, collabral riblets that are surmounted by periostracal lamellae; additionally with fine collabral and more or less obscure spiral growth lines. Aperture roundly D-shaped.

DISTRIBUTION: Three Kings Islands, North East, South West and West islands (Fig. 8F).

BIOLOGY: Detritivore, living in litter on the ground, under stones and among ground-layer plants (Brook 2002a). Occurs in shrublands, and in *Kunzea* and broadleaved forests.

CONSERVATION STATUS: Listing as 'range restricted' by McGuinness (2001), Brook (2002a) and Hitchmough (2002). Our assessment is that this range-restricted species is not of immediate conservation concern, and should be ranked 'range restricted' according to the criteria of Molloy *et al.* (2002).

REMARKS: Compared to *Cytora annectens*, which it most closely resembles, *C. filicosta* differs in attaining smaller size (height up to 4.65 mm, versus 6.20 mm), in being smaller relative to the number of whorls, in having more crowded periostracal lamellae, and in lacking inconspicuous secondary series of crenulations on the lamellae. Both species are endemic to the Three Kings Islands, but are allopatric, *C. annectens* being restricted to Great Island.

***Cytora gardneri* new species**

(Figs 4K, 7I,J, 11A)

*Cytora* sp. 'Kohuronaki' McGuinness, 2001: 566.

*Cytora* sp. 2 (NMNZ M.87893) Hitchmough, 2002: 31.

*Cytora* sp. 11 (NMNZ M.87893) Brook, 2002a: 22; Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.179667 and paratypes M.87893 (10), AIM AK 73290 (1): North Island, SW of North Cape, NE of Waitiki Landing, 40 m (NZMS 260 N02/966448), C.C. Ogle *et al.*, Nov. 1986.

Additional paratypes: M.72442 (1), North Island, SW of North Cape, B.F. Hazelwood, 7 Oct. 1976; M.178055 (2), M.161105 (1), North Island, SE of Cape Reinga, Radar Bush, P.C. Mayhill, May 1982 and Apr. 1983 respectively.

MATERIAL EXAMINED (six lots): Type material (see above).

DESCRIPTION: Shell 1.50–2.00 mm high at maturity, higher than wide (height/width ratio 1.43–1.78), narrowly conical (spire angle 34–46°), weakly cyrtoconoid, spire 1.50–2.06 times as high as aperture, umbilicus a very narrow chink. Translucent yellowish to light reddish brown, with weak submedian and outer basal bands in some specimens. Periostracum smooth.

Protoconch of 1.70–1.90 convex whorls, 410–500 µm wide, first whorl smooth and glossy, remainder traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 4.00 strongly convex whorls; periphery broadly rounded at all stages of growth; rate of whorl expansion gradually slowing (weakly cyrtoconoid), last adult whorl strongly constricted and insertion point typically slightly descending immediately behind outer lip; suture deeply impressed. Base broadly rounded, smoothly and tightly rounded into narrow umbilical chink. Sculptured throughout with numerous, fine, crisp, crowded, slightly wavy, spiral threads; weak, widely spaced, prosocline, collabral riblets; and fine collabral growth lines. Aperture subcircular.

ETYMOLOGY: After the outstanding collector, Norman Gardner, late of Auckland.

DISTRIBUTION: North Island, far north of Aupouri Peninsula (Fig. 11A).

BIOLOGY: Litter-dwelling detritivore of *Kunzea* and broadleaved forests.

CONSERVATION STATUS: *Cytora gardneri* was listed by McGuinness (2001) as of conservation concern owing to modification or destruction of its habitat. It was listed as 'nationally critical (one location; human induced)' by Brook (2002a) and Hitchmough (2002). Brook (2002a) noted that the species is known only from a single population in a small forest remnant. Our assessment is that this range-restricted species continues to be of immediate conservation concern, and should be ranked 'nationally critical' according to the criteria of Molloy *et al.* (2002).

REMARKS: *Cytora gardneri* is extremely distinctive in the combination of a minute, narrowly conical, weakly cyrtoconoid shell, teleoconch sculpture of crowded spiral threads, and smooth periostracum.

***Cytora goulstonei* new species**

(Figs 4O, 7K,L, 11C)

*Cytora* sp. 8 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.164803: North Island, E of Kaitaia, SE of Kaeo, beside Waiare Road, 20 m (NZMS 260 P04/839748), P.C. Mayhill, Nov. 1987. Paratypes: M.124323 (2), North Island, NW of Kaeo, B.F. Hazelwood & O.J. Marston, 8 Jun. 1996; M.97198 (1), M.164950 (1), North Island, NNW of Kaikohe, Puketi Forest, P.C. Mayhill, Oct. 1986; M.101625 (1), North Island, NNW of Kaikohe, Puketi Forest, P.C. Mayhill, Dec. 1989; M.166792 (2), AIM (1), Bay of Islands, Moturoa Island, P.C. Mayhill, Apr. 1981.

MATERIAL EXAMINED (39 lots): Type material (see above), M.36944 (2), M.37575 (1), M.46969 (3), M.55401 (3), M.55825 (4), M.58138 (2), M.61922 (1), M.72411 (1), M.78588 (1), M.87655 (4), M.96616 (1), M.97237 (2), M.99072 (3), M.99414 (4), M.114409 (2), M.116101 (1), M.124321 (2), M.124322 (3), M.124324 (1), M.127983 (8), M.156645 (5), M.163096 (1), M.163224 (1), M.163325 (2), M.163364 (1), M.163481 (2), M.163973 (1), M.164036 (2), M.164694 (1), M.164811 (1), M.177703 (many), M.177735 (6).

DESCRIPTION: Shell up to 3.70 mm high at maturity, higher than wide (height/width ratio 1.22–1.39), pupoid (spire angle 54–66°), spire 1.06–1.21 times as high as aperture, narrowly umbilicate. Protoconch and teleoconch reddish brown, teleoconch with narrow, submedian, colourless spiral band. Periostracum on teleoconch produced at summits of collabral riblets as thin lamellae on spire and base, numbering about 15 per mm at end of third whorl; after first whorl about a third of lamellae strongly elevated in adapical quarter to form a narrow subsutural zone, few other lamellae extending as far as suture adapically.

Protoconch of 1.50–1.70 convex whorls, 530–600 µm wide, first whorl very finely malleate, remainder traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 3.00 broadly convex whorls at maturity; first 1.5 whorls with rounded peripheral angulation that is obscured by succeeding whorls, periphery becoming rounded on next half-whorl, then broadly rounded; spire whorls rather evenly expanding, last adult

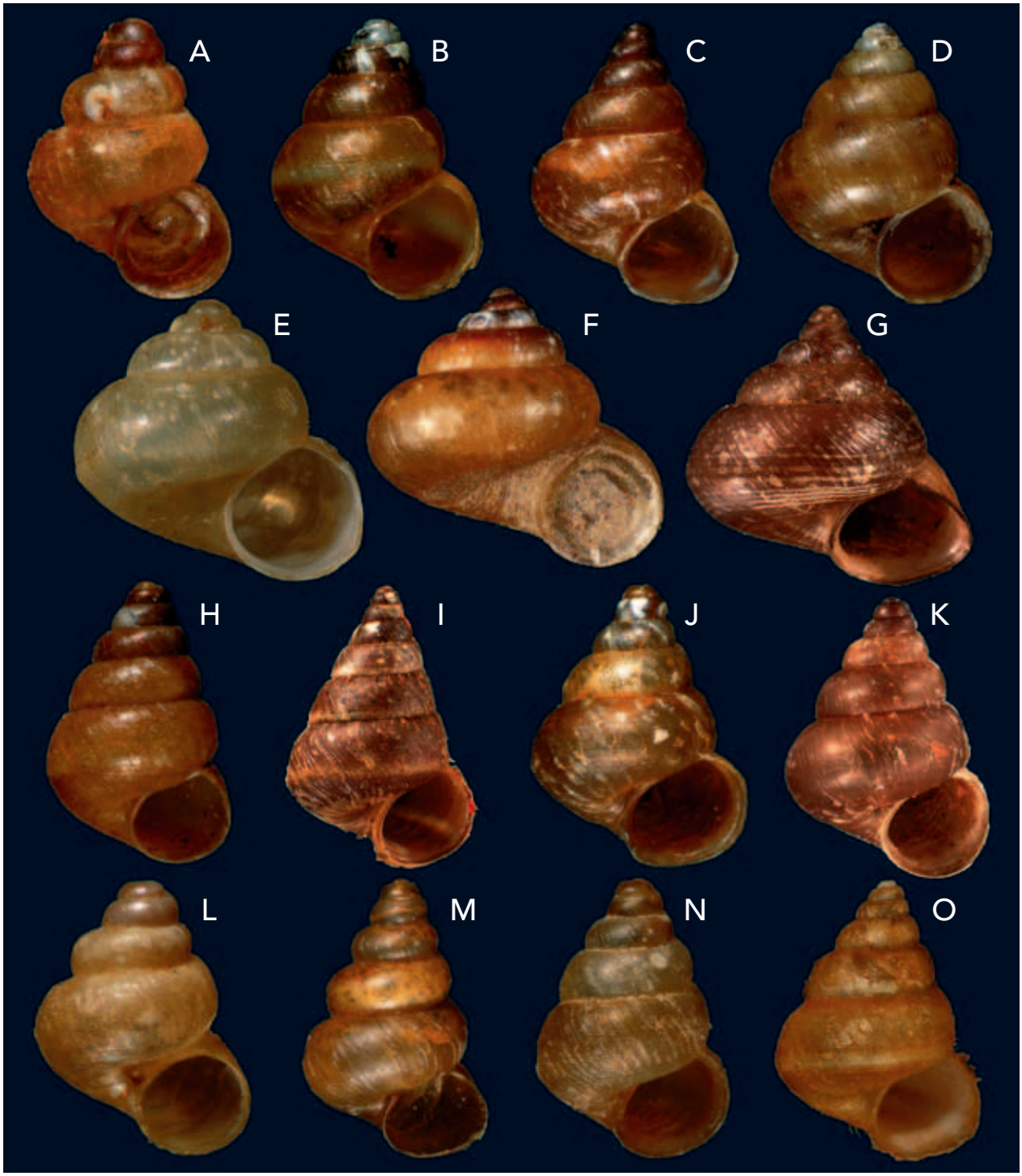


Fig. 9 Shells of *Cytora* species. A, *Cytora hazelwoodi* n.sp., SW of Whitianga, beside Tapu Coroglen Road, paratype, M.76267 (1.75 x 1.25 mm); B, *Cytora houhora* n.sp., Mt Camel, holotype, M.179669 (3.20 x 2.40 mm); C, *Cytora kahurangi* n.sp., N of Collingwood, Fossil Point, holotype, M.179671 (3.70 x 2.75 mm); D, *Cytora kakano* n.sp., S of Seddonville, Charming Creek Road, holotype, M.96727 (3.50 x 2.80 mm); E, *Cytora jamiesoni* n.sp., N of Karamea, Heaphy Track, Swan Burn, paratype, M.89091 (3.10 x 3.15 mm); F, *Cytora kamura* n.sp., Queen Charlotte Sound, Motuara Island, holotype, M.179672 (3.60 x 3.70 mm); G, *Cytora lignaria* (L. Pfeiffer, 1857), SW of North Cape, NE of Waitiki Landing, M.79645 (5.70 x 5.75 mm); H, *Cytora kerrana* N. Gardner, 1968, W of North Cape, Kerr Point, paratype, M.31959 (3.45 x 2.30 mm); I, *Cytora malleata* n.sp., NW of Whangaruru, Ngaitonga, Te Ringa Track, holotype, M.179673 (6.50 x 4.20 mm); J, *Cytora maui* n.sp., E of Turangi, Otuhoe, paratype, M.124800 (2.33 x 1.80 mm); K, *Cytora mayhillae* n.sp., Doubtful Sound, Secretary Island, above

whorl slightly constricted and insertion point gently descending; suture well defined. Base more broadly rounded than periphery, smoothly and tightly curving into narrow umbilicus. Sculptured throughout with fine, densely crowded malleations and very weak, prosocline, collabral riblets, few of which entirely traverse spire whorls; additionally with fine collabral growth lines. Aperture roundly D-shaped, rim thin.

ETYMOLOGY: After the outstanding collector Jim Goulstone, late of Auckland.

DISTRIBUTION: North Island, Northland from vicinity of Mangonui to Waipoua Forest (Fig. 11C).

BIOLOGY: Litter-dwelling detritivore of lowland (up to *c.* 330 m elevation) mixed shrublands, mixed broadleaved-conifer forests and *Agathis* forests.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora goulstonei* is distinctive in the combination of broadly pupoid shell shape, small size, short spire, extensive malleate sculpture, elevated subsutural periostracal zone, and reddish coloration with colourless peripheral band.

***Cytora hazelwoodi* new species**

(Figs 9A, 10C,D, 11D)

*Cytora* sp. 12 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.179668 and paratypes M.169121 (5), AIM AK 73291 (1): North Island, S of Whitianga, SW of Coroglen, 60 m (NZMS 260 T11/468687), P.C. Mayhill, Aug. 1980. Additional paratypes: M.76267 (1), M.169206 (1), North Island, SW of Whitianga, Crosbies Clearing, off Tapu Coroglen Road, P.C. Mayhill, Apr. 1982; M.76290 (2), M.169122 (2), North Island, SW of Whitianga, Maumaupaki Track, off Tapu Coroglen Road, P.C. Mayhill, Sep. 1982.

MATERIAL EXAMINED (13 lots): Type material (see above), M.124563 (1), M.169086 (1), M.169120 (4), M.169207 (1), M.169208 (1), M.169900 (1).

DESCRIPTION: Shell up to 2.03 mm high, higher than wide (height/width ratio 1.32–1.45), narrowly conical (spire angle 50–61°), spire 1.51–1.60 times as high as aperture, very narrowly umbilicate. Translucent, yellowish brown, apical area paler or darker than subsequent whorls. Periostracum produced as low lamellae at summits of axial riblets that number about 21 per mm at end of third whorl.

Protoconch of about 1.60–1.70 convex whorls, 460–500 µm wide, sculptured throughout with numerous fine, crisp, wavy, spiral threads, forming reticulate pattern on last half-whorl by intersecting rounded, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 3.00 strongly convex whorls; periphery rounded at all stages of growth; last adult whorl distinctly contracted and insertion point slightly descending at maturity; suture well defined. Base broadly rounded, evenly rounded into umbilical chink. Sculpture of fine, crisp, crowded, spiral threads; weak, prosocline, collabral riblets; and fine collabral growth lines. Aperture subcircular, rim thin and rapidly thickened within at maturity.

ETYMOLOGY: After the outstanding collector Bruce Hazelwood, late of Auckland, who collected much of the material upon which this revision is based.

DISTRIBUTION: Northeastern North Island: Coromandel Range and Kaimai Mamaku Forest Park (Fig. 11D).

BIOLOGY: A detritivore of litter in coastal broadleaved forest, and mixed broadleaved-conifer forests, from near sea-level to about 710 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: Compared with *Cytora torquillum*, which has similar gross facies, *C. hazelwoodi* differs in being more broadly conical at maturity, in being larger relative to the number of whorls, and in having a wider umbilicus.

***Cytora hedleyi* (Suter, 1894)**

(Figs 2A, 4M, 10A,B, 11E)

*Lagochilus hedleyi* Suter, 1893: 151 (*nude name*).

*Lagocheilus hedleyi*.- Hedley & Suter, 1893: 621 (*nude name*).

*Lagochilus hedleyi*.- Suter, 1894b: 140 (*nude name*); Suter, 1894c: 484, pl. 22, figs 1, 1a–d; Suter, 1894d: 225.

*Lagochilus* (*Cytora*) *hedleyi*.- Kobelt & Möllendorff, 1897: 85; Suter, 1913: 181, pl. 35, fig. 4.

*Japonia* (*Cytora*) *hedleyi*.- Kobelt, 1902: 66.

*Murdochia hedleyi*.- Powell, 1937: 67.

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Blanket Bay, holotype, M.146093 (4.35 x 3.15 mm); L, *Cytora minor* n.sp., NW of Te Kuiti, Tawarau Forest, holotype, M.82612 (1.25 x 0.98 mm); M, *Cytora motu* n.sp., Poor Knights Islands, Aorangi Island, Puweto Valley, holotype, M.179674 (2.40 x 1.60 mm); N, *Cytora pakotai* n.sp., N of Dargaville, Pakotai Reserve, holotype, M.98334 (2.20 x 1.50 mm); O, *Cytora pallida* (Hutton, 1883), Auckland, Cornwallis, neotype, M.174819 (4.40 x 3.20 mm).

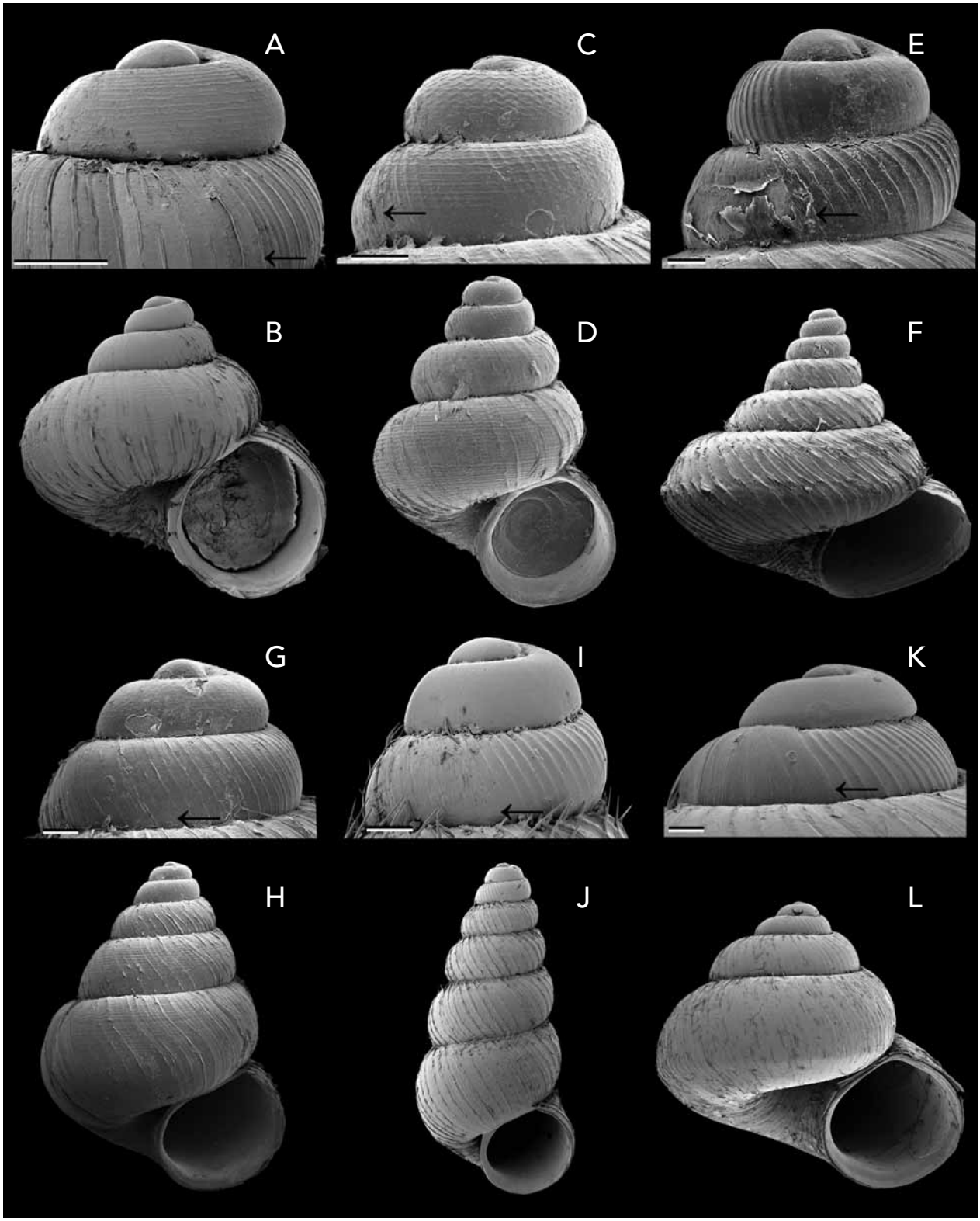


Fig. 10 Lateral views of whole shells and protoconchs (protoconch–teleoconch boundary arrowed) of *Cytora* species (SEM). A, B, *Cytora hedleyi* (Suter, 1894), NW of Hamilton, Hakirimata Track, M.168754 (B, 1.95 x 2.00 mm); C, D, *Cytora hazelwoodi* n.sp., S of Whitianga, SW of Coroglen, holotype, M.179668 (D, 1.90 x 1.43 mm); E, F, *Cytora hirsutissima* (Powell, 1951), Three Kings Islands, Great Island, M.155506 (E, 4.30 x 4.50 mm); G, H, *Cytora houhora* n.sp., holotype, Houhora, Mt Camel, M.177691 (H, 3.20 x 2.40 mm); I, J, *Cytora hispida* Gardner, 1967, Spirits Bay, Waterfall Gully, M.161848 (J, 3.60 x 1.70 mm);

*Cytora hedleyi*.- Powell, 1957: 91; Whitten, 1957: 2; Rees, 1959: 21; Rees, 1961: 16; Powell, 1979: 84, fig. 12/5; Solem *et al*., 1981: 476; Goulstone, 1990: 20, text fig.; Gardner, 1994: 13, text fig.; Barker, 2006: 135, text fig. 3Q.

TYPE MATERIAL: Syntypes NMNZ M.125114 (2): North Island, 'Hunua Range, T. Broun' (from original label).

MATERIAL EXAMINED (196 lots): Syntypes (see above), M.25208 (3), M.29091 (2), M.29097 (1), M.37077 (1), M.37093 (3), M.37519 (7), M.38137 (1), M.38501 (1), M.45947 (2), M.47018 (2), M.47020 (1), M.47752 (2), M.47776 (1), M.48531 (2), M.57563 (3), M.58160 (20), M.61970 (2), M.63516 (many), M.63541 (4), M.68068 (1), M.68135 (8), M.68860 (8), M.69234 (5), M.69938 (9), M.71628 (4), M.75321 (1), M.75873 (1), M.77783 (5), M.77841 (1), M.78984 (4), M.80412 (2), M.81615 (3), M.81755 (1), M.82140 (1), M.82194 (3), M.82426 (2), M.82550 (2), M.82815 (3), M.82952 (1), M.84576 (10), M.84900 (3), M.89355 (1), M.96589 (1), M.97094 (2), M.97517 (1), M.97596 (1), M.97672 (4), M.97761 (2), M.98286 (3), M.99331 (1), M.99504 (1), M.107729 (3), M.116705 (2), M.116750 (4), M.124272 (4), M.124273 (1), M.124274 (17), M.124303 (23), M.124304 (1), M.124342 (17), M.124343 (6), M.124348 (7), M.124355 (1), M.124357 (4), M.124365 (2), M.124528 (3), M.124770 (many), M.124772 (3), M.124789 (1), M.125114 (1), M.127841 (8), M.127845 (30), M.127846 (4), M.129430 (3), M.156389 (3), M.156390 (4), M.156391 (4), M.156392 (many), M.156393 (9), M.156394 (7), M.156395 (many), M.156396 (2), M.156397 (4), M.156398 (5), M.156399 (25), M.156400 (5), M.156401 (11), M.156402 (5), M.156403 (22), M.156404 (11), M.156405 (1), M.156406 (13), M.156407 (5), M.156408 (2), M.156409 (1), M.156410 (3), M.156427 (16), M.156428 (4), M.156582 (1), M.156592 (6), M.156600 (17), M.156959 (1), M.156960 (2), M.156961 (6), M.156962 (11), M.156964 (9), M.156965 (9), M.156966 (4), M.156967 (1), M.156968 (5), M.156969 (6), M.156970 (3), M.156971 (1), M.156972 (30), M.156973 (1), M.168196 (10), M.168327 (1), M.168353 (1), M.168483 (3), M.168643 (3), M.168707 (14), M.168754 (many), M.168850 (30), M.168967 (2), M.169097 (2), M.169098 (2), M.169099 (1), M.169100 (1), M.169101 (2), M.169102 (1), M.169103 (1), M.169104 (2), M.169105 (2), M.169106 (3), M.169107 (1), M.169108 (13), M.169109 (7), M.169110 (12), M.169111 (1), M.169112 (7), M.169113 (1), M.169114 (1), M.169115 (2), M.169116 (5), M.169117 (2), M.169118 (2), M.169119 (1), M.169275 (3), M.169276 (3), M.169277 (2), M.169278 (1), M.169279 (1), M.169280 (2), M.169281 (1), M.169282 (1), M.169283 (2), M.169284 (30), M.169285 (8), M.169286 (3), M.169287 (1), M.169288 (3), M.169289 (1), M.169290 (1), M.169291 (2), M.169292 (5), M.169293 (6), M.169348 (1), M.169432 (1), M.169451 (5), M.169485 (1), M.169488 (1), M.169576 (1), M.169644 (3), M.170162 (7), M.170163 (3), M.170164 (3), M.174785 (7), M.175057 (1), M.175062 (20), M.175110 (6), M.175145 (4), M.175148 (2), M.175186 (2), M.175202 (8), M.175215 (1), M.175222 (20), M.175236 (20), M.175250 (3), M.175271 (1), M.176085 (1), M.176096 (1), M.176112 (1), M.177723 (20), M.177726 (4), M.177729 (15).

REDESCRIPTION: Shell 2.05–3.0 mm high at maturity, typically slightly higher than wide (height/width ratio 1.04–1.12), broadly conical (spire angle 65–85°), spire 1.00–1.33 times as high as aperture, widely umbilicate. Translucent, periostracum yellowish to reddish brown, produced as prominent lamellae at summits of axial riblets that number four to eight per mm at start of third whorl.

Protoconch of 1.50–1.70 convex whorls, 530–580 µm wide, first whorl sculptured with very fine, slightly wavy, spiral threads, last whorl traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 2.30–3.10 broadly convex whorls at maturity, periphery broadly rounded at all stages of growth; spire whorls evenly expanding; at maturity last whorl slightly constricted, last part detached and gently descending; suture well defined. Base evenly rounded from periphery into umbilicus. Sculpture of numerous fine, rather weak, crowded, slightly wavy, spiral threads; widely spaced, prosocline, collabral riblets that are surmounted by periostracal lamellae; and fine collabral growth lines. Aperture subcircular, peristome dissolute at maturity, rim thin, weakly thickened within.

Radula (Fig. 2A) with characteristics of the genus.

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K, L, *Cytora jamiesoni* n.sp., N of Karamea, Heaphy Track, Swan Burn, paratype, M.89091 (K), and holotype, M.179670 (L, 3.45 x 3.60 mm). Scale bars 100 µm.

DISTRIBUTION: Northern North Island, from vicinity of Wellsford in Northland south to the Waikato and Bay of Plenty (Fig. 11E).

BIOLOGY: A detritivore common in leaf litter and under rotting logs. Found in coastal and inland shrublands and broadleaved-conifer forests to about 730 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora hedleyi* is distinctive in the combination of small shell size, broadly conical spire, wide umbilicus, finely lirate first protoconch whorl, finely spirally lirate teleoconch, prominent periostracal blades, and the disjunct nature of the last whorl in mature shells. It is locally common, and frequently occurs sympatrically with *C. cytora*.

### *Cytora hirsutissima* (Powell, 1951)

(Figs 2C, 4N, 10E,F, 11B)

*Murdochia hirsutissima* Powell, 1951: 132, pl. 27, fig. 6.

*Cytora hirsutissima*.- Powell, 1957: 91; Climo, 1973: 572, figs 9A, 19A, B, G, 20C–E; Climo, 1975: 467; Powell, 1979: 86, pl. 23, fig. 4; Gardner, 1980: 88, text fig.; Gardner, 1994: 24, text fig.; McGuinness, 2001: 73, pl. 3, fig. 20, text figs; Brook, 2002a: 17; Brook, 2002b: 71; Hitchmough, 2002: 115.

TYPE MATERIAL: Holotype AIM AK 71170 and paratype NMNZ M.156574: Three Kings Islands, Great Island, SW coast, 700 feet [213 m], site of *Placostylus bollonsi arbutus* colony, in leaf mould amongst large boulders, under *Streblus* (formerly *Paratrophis*) and *Brachyglottis*, A.W.B. Powell, 6 Oct. 1948.

MATERIAL EXAMINED (three lots): Paratype (see above), M.29266 (11), M.155506 (5).

REDESCRIPTION: Shell up to 6.40 mm high, about as high as wide (height/width ratio 0.94–1.01), broadly and markedly coeloconoid (spire angle 75–80°), spire 2.09–2.17 times as high as aperture, broadly umbilicate at maturity. Uniform yellowish to reddish brown. Periostracum on teleoconch produced as increasingly prominent, subsutural and peripheral rows of very long, slender hair-like spines that arise from axially elongate trigonal bases on summits of collabral riblets, the peripheral row exposed on spire; collabral riblets on base and within umbilicus with many short, fine, slender hairs; lamellae numbering about seven per mm at end of third whorl.

Protoconch of 1.75–2.00 convex whorls, 700–800 µm wide, first three-quarter whorl smooth, last whorl-and-a-quarter traversed by weak, rounded, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 5.00 strongly convex whorls; last two adult spire whorls slightly but distinctly flattened between spine rows, periphery rounded or roundly angulate; spire whorls expanding increasingly rapidly (coeloconoid spire), rate of expansion of last adult whorl slowing and insertion point descending markedly near apertural rim; suture strongly impressed. Base very broadly rounded, smoothly and tightly curved into umbilicus. Sculpture of rather strong, weakly sigmoidal, strongly prosocline, widely spaced, collabral riblets; and fine collabral and spiral growth lines. Aperture subcircular and with thickened peristome at maturity.

Radula (Fig. 2C) with characteristics of the genus.

DISTRIBUTION: Three Kings Islands, restricted to Great Island (Fig. 11B).

BIOLOGY: Detritivore, living under rocks and rotting logs and branches (Climo 1973, 1975; Brook 2002a,b). The animal is blind as it lacks eyes (Climo 1973, 1975).

CONSERVATION STATUS: Great Island was extensively modified by human occupation and feral animal introductions (see Brook 2002b). The goats were eradicated in 1946 (Turbott 1948). *Cytora hirsutissima* was discovered in 1948, with specimens collected only at the type locality. From a survey in 1970, Climo (1973, 1975) assessed the status of the species as 'restricted to an area of about 2 $m^2$, of rock and rubble under a milk tree (*Streblus* sp.) living under a few large rocks covered by the joined fern (*Arthopteris tenella*), but not under bare rocks in close proximity'. By 1996, *Cytora hirsutissima* was described as occupying an area of *c.* 200 $m^2$, at the foot of a boulder scree and extending onto an adjoining rocky terrace (Brook 2002a,b). It was identified as of high conservation concern by McGuinness (2001). We concur with Brook (2002a) and Hitchmough (2002) in listing the species as 'nationally critical (one location, recovering)'.

REMARKS: *Cytora hirsutissima* is the most distinctive of all *Cytora* species in the combination of large size, short spire, coeloconoid contour, and strongly developed periostracal spines and hairs.

### *Cytora hispida* N. Gardner, 1967

(Figs 4I, 10I,J, 13A)

*Cytora hispida* Gardner, 1967: 215, fig. 1; Climo, 1975: 467, fig. 6d; Powell, 1979: 86; Goulstone *et al.*, 1993: 5, text fig.; Parrish & Sherley, 1993: 48; Gardner, 1994:

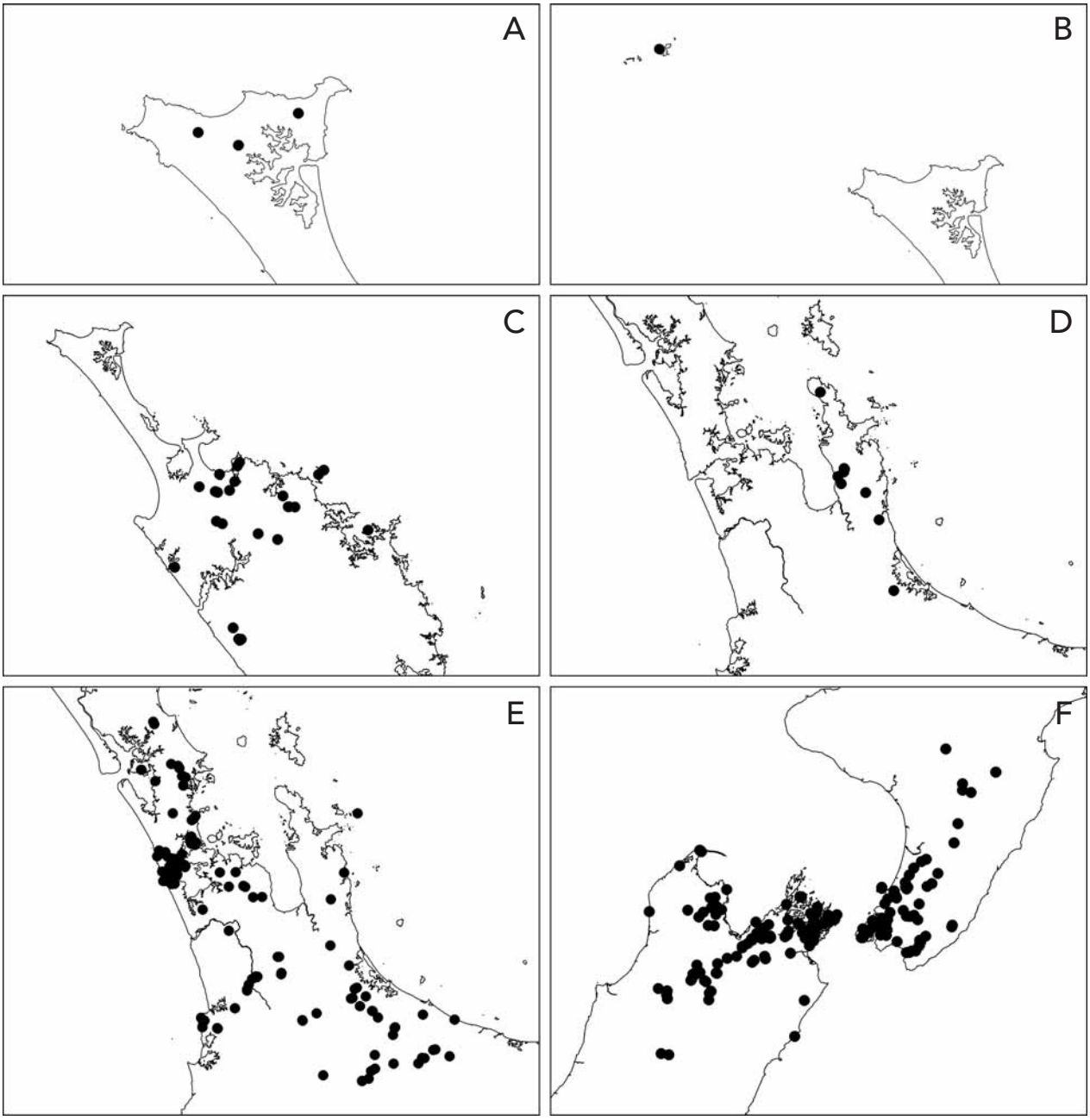


Fig. 11 Distributions of *Cytora* species within New Zealand. A, *Cytora gardneri* n.sp.; B, *Cytora hirsutissima* (Powell, 1951); C, *Cytora goulstonei* n.sp., D, *Cytora hazelwoodi* n.sp.; E, *Cytora hedleyi* (Suter, 1894); F, *Cytora kamura* n.sp.

5, text fig.; Brook, 1999d: 389; Brook, 2002a: 18; Hitchmough, 2002: 115.

*Cytora hipsida* [*sic*].- McGuinness, 2001: 566.

TYPE MATERIAL: Holotype AIM AK 71293 and paratypes NMNZ M.31966 (7): North Island, near Cape Reinga, Taputaputa Bay, in small bush remnant, N.W. Gardner, Apr. 1965.

MATERIAL EXAMINED (29 lots): Paratypes (see above), M.15140 (2), M.21971 (1), M.29693 (20), M.37223 (2), M.38239 (4), M.56343 (8), M.56345 (3), M.70076 (1), M.76595 (many), M.77033 (12), M.77112 (1), M.87754 (2), M.87787 (9), M.87794 (14), M.87825 (2), M.87876 (2), M.87909 (20), M.87949 (9), M.88397 (5), M.88695 (3), M.96561 (1), M.99143 (5), M.104007 (6), M.156448

(20), M.161848 (4), M.161903 (4), M.161954 (1), M.162028 (5).

REDESCRIPTION: Shell up to 3.60 mm high, higher than wide (height/width ratio 2.04–2.13), narrowly and weakly cyrtoconoid (spire angle 25–32°), spire 2.25–2.40 times as high as aperture, very narrow umbilical chink. Pale translucent buff, last few whorls with reddish-brown subsutural band and base. Periostracum on teleoconch produced at summits of collabral riblets as low, thin lamellae, summits weakly crenulated, bearing long, slender, hair-like spines on spire and base; lamellae numbering about 11 per mm at end of third whorl, spines rather regularly spaced to form six spiral rows on spire, and similar number on base.

Protoconch of 1.70–1.75 convex whorls, 530–550 µm wide, last half-whorl traversed by weak, rounded, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch; elsewhere smooth.

Teleoconch of up to 4.50 convex whorls; periphery broadly rounded at all stages of growth; spire whorls rather evenly expanding at first, then expansion rate slowing so that adult spire weakly cyrtoconoid; suture strongly impressed. Base smoothly and tightly curved into umbilical chink. Sculpture of weak, more or less straight, widely spaced, prosocline, collabral riblets that are surmounted by periostracal lamellae; weak spiral grooves that coincide with periostracal spines; and fine collabral growth lines. Aperture roundly ovate, thin inner lip rim gently flared.

DISTRIBUTION: North Island, northern Aupouri Peninsula (Fig. 13A). Known also from fossils in Holocene dunes at Te Werahi (M.180322, M.180341, M.180357) (Brook 1999d).

BIOLOGY: Litter-dwelling detritivore that occurs in shrublands, and in broadleaved-conifer and *Agathis* forests. Gardner (1967) remarks that *Cytora hispida* 'shows a decided preference for scrub on bush fringes where it occurs in considerable numbers under low fern and grasses'.

CONSERVATION STATUS: Ranked as 'declining' by McGuinness (2001). Listed as 'range restricted' by Brook (2002a) and Hitchmough (2002). Brook (2002a) remarked, 'This species has a fragmented, relict distribution as a result of extensive habitat destruction caused by anthropic land clearance for gum-digging, pastoral farming and exotic forestry. The total population is probably still declining as a consequence of continued modification and loss of habitat, and there is a risk that some local populations could become extinct if historical trends continue.' Our assessment is that this range-restricted species continues to be of immediate conservation concern, and should be ranked 'nationally vulnerable' according to the criteria of Molloy *et al.* (2002).

REMARKS: *Cytora hispida* is characterised by the combination of tall, narrow, weakly cyrtoconoid shell shape, and weak spiral grooves that coincide with hair-like periostracal spines. The allopatric (more southerly) species *C. aranea* is similar in shape and size, but differs in that the teleoconch is sculptured with crowded spiral threads and in that it lacks periostracal hairs.

***Cytora houhora* new species**

(Figs 9B, 10G,H, 13B)

*Lagochilus chiltoni septentrionalis*.- Suter, 1907: 238 (in part) (not Suter, 1907).

*Lagochilus* (*Cytora*) *chiltoni septentrionale*.- Suter, 1913: 180 (in part).

*Cytora septentrionale*.- Powell, 1979: 85 (in part).

TYPE MATERIAL: Holotype NMNZ M.179669 and paratypes M.47295 (2), AIM AK 73292 (1): North Island, Houhora, Mt Camel, 236 m, B.F. Hazelwood, 4 Jan. 1976. Additional paratype: M.177691, North Island, Houhora, gully SE side Mt Camel, 160 m (N03/257089), F.J. Brook, 12 Dec. 2003.

MATERIAL EXAMINED (six lots): Type material (see above), M.88456 (2), M.170223 (3).

DESCRIPTION: Shell up to 3.88 mm high, higher than wide (height/width ratio 1.43–1.49), narrowly conical (spire angle 50–61°), spire 1.08–1.11 times as high as aperture, narrowly umbilicate. Protoconch and start of first teleoconch whorl dark reddish brown; subsequent teleoconch whorls light reddish brown, with pale yellowish-brown peripheral spiral band that commences on second teleoconch whorl. Periostracum on teleoconch produced at summits of collabral riblets as low, thin lamellae on spire and base, numbering about 10 per mm at end of third whorl.

Protoconch of 1.60–1.80 convex whorls, 660–670 µm wide, first whorl smooth and glossy, remainder traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 3.75 broadly convex whorls; periphery broadly rounded at all stages of growth; spire whorls evenly expanding, last adult whorl distinctly constricted

and insertion point gently descending; suture deeply impressed. Base broadly rounded, smoothly and tightly rounded into narrow umbilicus. Sculptured throughout with very weak, widely spaced, prosocline, collabral riblets; numerous fine, crisp, spiral threads; and fine collabral growth lines. Aperture roundly D-shaped.

ETYMOLOGY: After the harbour and township near the type locality (noun in apposition).

DISTRIBUTION: Northern North Island, Mt Camel (Fig. 13B).

BIOLOGY: Litter-dwelling detritivore, known only from remnant coastal shrubland and forest ranging from near sea-level to *c.* 240 m elevation.

CONSERVATION STATUS: Species comprising a single relict population of very narrow range in a highly degraded habitat. Our assessment is that this species is of immediate conservation concern and should be ranked 'nationally critical' according to the criteria of Molloy *et al.* (2002).

REMARKS: Specimens (M.170223) of *Cytora houhora* were recorded as *Largochilus chiltoni septentrionalis* but contrasted by Suter (1907). Suter did not, however, include them in the original description and there is no indication on the original label that he intended them to have type status. Compared with *C. septentrionalis*, *C. houhora* differs in being more narrowly conical, attaining smaller size (height to 3.88 mm versus 6.25 mm), in being considerably smaller relative to the number of whorls, and in having weaker periostracal lamellae (not enlarged in a subsutural zone). Compared with *C. fasciata*, a large form of which (height to 3.50 mm) also occurs on Mt Camel (sympatric), *C. houhora* differs in attaining larger size and in being somewhat larger relative to the number of whorls, and in having weaker periostracal lamellae, again especially subsuturally. This or a similar species, also sympatric with *C. fasciata*, occurs in the Warawara Forest, west of Rawene, about 68 km south of Mt Camel on the west coast (e.g. M.63045, M.101652, M.163714, M.177689).

***Cytora jamiesoni* new species**

(Figs 9E, 10K,L, 13C)

*Cytora* sp. 15 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.179670 and paratypes M.89091 (11), AIM AK 73293 (2): South Island, N of Karamea, S end of Heaphy Track, mouth of Swan Burn Creek (NZMS 260 L26/347145), P.R. Jamieson, 8 Mar. 1976. Additional paratypes: M.91835 (1), M.61876 (4), South Island, N of Karamea, Heaphy Track, Swan Burn Creek, D.J. Roscoe, 8 Mar. 1976; M.91839 (4), South Island, N of Karamea, S of Kohaihai River mouth, Lookout Ridge, F.M. Climo & K. Mahlfeld, 16 Dec. 1994.

MATERIAL EXAMINED (24 lots): Type material (see above), M.29662 (1), M.47560 (1), M.57722 (6), M.62983 (6), M.86400 (3), M.89112 (1), M.91829 (4), M.91831 (2), M.91832 (1), M.91836 (10), M.91837 (1), M.105970 (2), M.107956 (1), M.109528 (3), M.116574 (2), M.123487 (2), M.123553 (1), M.126377 (1).

DESCRIPTION: Shell 2.95–3.75 mm wide at maturity, about as wide as high (height/width ratio 0.95–1.00), broadly conical (spire angle 84–94°), spire 1.11–1.26 times as high as aperture, widely umbilicate. Translucent white beneath colourless to deep reddish-brown periostracum. Periostracum on teleoconch produced at summits of collabral riblets as delicate, thin, low but distinct lamellae numbering 10–16 per mm at end of second whorl.

Protoconch of 1.60–1.75 convex whorls, 730–830 µm wide, first whorl smooth, last half-whorl traversed by rounded collabral riblets that are stronger and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 2.40–2.75 whorls at maturity: periphery narrowly and roundly angulate, angulation becoming slightly but distinctly elevated in some specimens, spire whorls strongly convex, base broadly rounded from periphery into umbilicus; spire outline typically weakly cyrtoconoid: last adult whorl strongly contracted, end of last adult whorl disjunct and descending; suture well defined. Sculpture of very weak, prosocline collabral riblets that are surmounted by periostracal lamellae; and fine collabral growth lines. Aperture at maturity subcircular, rim thin, rapidly and moderately thickened within.

ETYMOLOGY: After Peter Jamieson, late of Wellington, who collected the sample that yielded the holotype, and much additional material besides.

DISTRIBUTION: Northwestern South Island, from Cape Farewell to Karamea (Fig. 13C).

BIOLOGY: Litter-dwelling detritivore, most frequently collected from coastal and other lowland broadleaved shrublands and forests. Less commonly collected from montane broadleaved forests, up to *c.* 950 m level.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora jamiesoni* is distinctive in combining axial riblets on the last half-whorl of the protoconch, a broadly

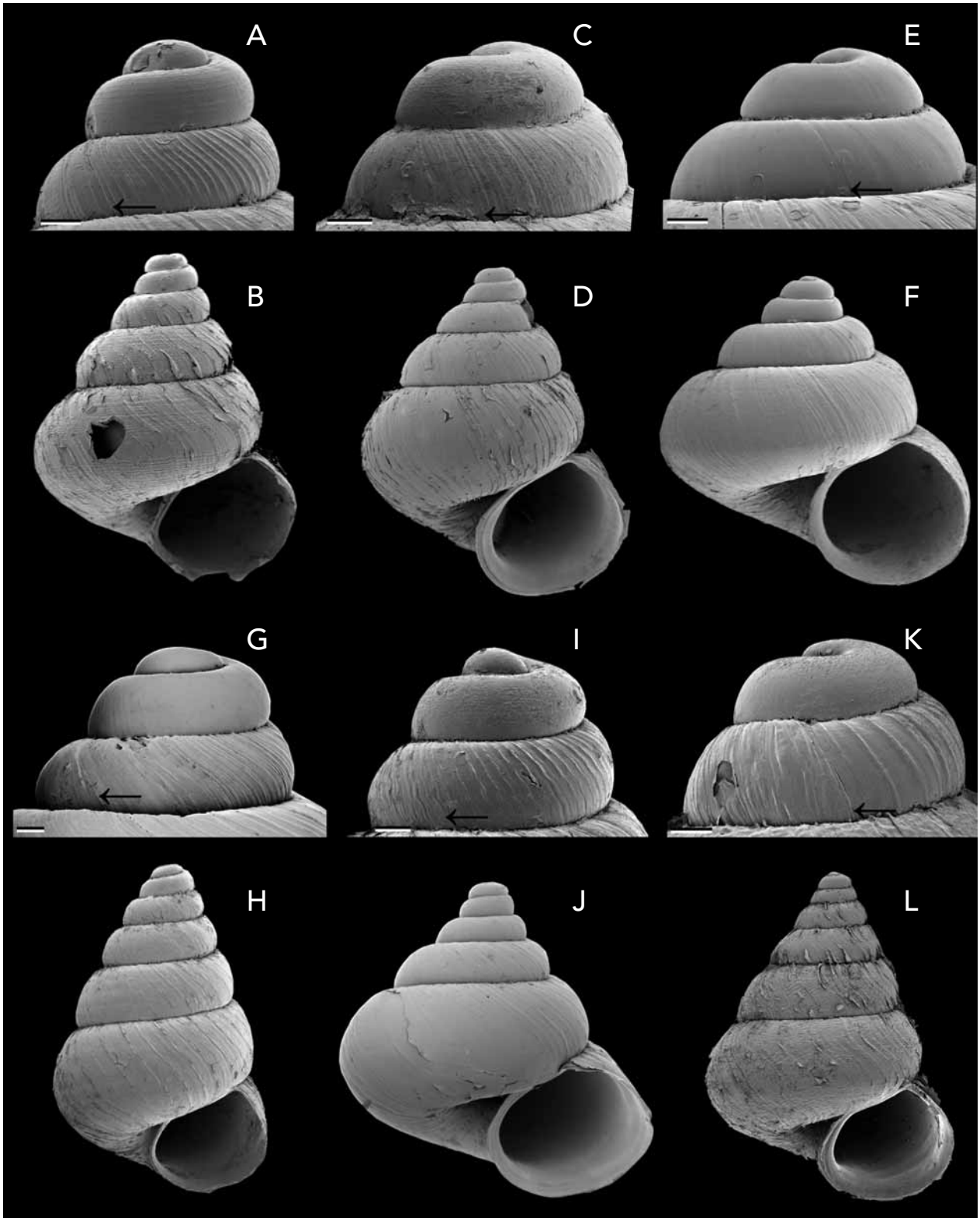


Fig. 12 Lateral views of whole shells and protoconchs (protoconch–teleoconch boundary arrowed) of *Cytora* species (SEM). A, B, *Cytora kahurangi* n.sp., N of Collingwood, Fossil Point, paratypes, M.123861 (B, 3.70 x 2.82 mm); C, D, *Cytora kakano* n.sp., S of Seddonville, Charming Creek Road, paratype, M.183080 (C), and W of Moria Gate, NE of Karamea, paratype, M.96803 (D, 3.35 x 2.65 mm); E, F, *Cytora kamura* n.sp., Queen Charlotte Sound, Curious Cove, paratypes, M.166310 (F, 3.05 x 3.05 mm); G, H, *Cytora kerrana* N. Gardner, 1968, W of North Cape, Kerr Point, paratypes, M.31959

conical spire, a uniform white or brown shell, an angulate periphery, a broad umbilicus, and an axially lamellate periostracum. Two allopatric species with similar shell facies, *C. kamarua* and *C. paparoa*, are described below.

***Cytora kahurangi* new species**

(Figs 9C, 12A,B, 13D)

TYPE MATERIAL: Holotype NMNZ M.179671 and paratypes M.123861 (20), AIM AK 73294 (2): South Island, N of Collingwood, Fossil Point, gully at end of beach (NZMS 260 M24/874774), D.J. Roscoe, 16 Dec. 1993. Additional paratypes: M.122589 (15), South Island, Puponga, near abandoned coal mine, D.J. Roscoe, 2 Feb. 1992; M.124948 (3), South Island, NE of Mangarakau, NW of Collingwood, D.J. Roscoe, 19 May 1985.

MATERIAL EXAMINED (80 lots): Type material (see above), M.24623 (1), M.24624 (2), M.37164 (3), M.37891 (3), M.37926 (1), M.38176 (1), M.38189 (3), M.38196 (1), M.55508 (1), M.56887 (1), M.57721 (40), M.57941 (7), M.58002 (4), M.61634 (1), M.61852 (1), M.63012 (3), M.63023 (2), M.71378 (5), M.71429 (1), M.73403 (1), M.75756 (10), M.76682 (7), M.80887 (6), M.80946 (1), M.80994 (2), M.86348 (1), M.86394 (3), M.86516 (1), M.86602 (1), M.88835 (1), M.89270 (1), M.103286 (1), M.105644 (1), M.105989 (2), M.106101 (1), M.106220 (1), M.107027 (5), M.107660 (1), M.108255 (4), M.108706 (2), M.108764 (2), M.109508 (3), M.109623 (1), M.109831 (4), M.109989 (2), M.115131 (2), M.115132 (1), M.115191 (4), M.116300 (3), M.116327 (5), M.116330 (1), M.116367 (5), M.116419 (1), M.116423 (1), M.120663 (1), M.121058 (1), M.121754 (2), M.122821 (4), M.124892 (1), M.124939 (1), M.124943 (1), M.124946 (2), M.124947 (2), M.124949 (11), M.124962 (1), M.124963 (3), M.126673 (2), M.129637 (1), M.161223 (1), M.161238 (1), M.162391 (1), M.162418 (1), M.174274 (5), M.174813 (2), M.174814 (5).

DESCRIPTION: Shell 3.30–4.10 mm high at maturity, higher than wide (height/width ratio 1.35–1.47), narrowly conical (spire angle 49–60°), spire 1.48–1.73 times as high as aperture, narrowly umbilicate. Translucent uniform reddish brown. Periostracum on teleoconch produced at summits of widely spaced collabral riblets as low, thin lamellae on spire and base, slightly higher on periphery, numbering 9–11 per mm at end of third whorl.

Protoconch of 1.60–1.80 convex whorls, 570–600 µm wide, fine, crisp spiral lirae throughout, spirals most prominent on first 1.2 whorls, weaker on last half-whorl where intersecting rounded, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 3.50–4.10 convex whorls; spire whorls rather evenly expanding, last adult whorl weakly constricted and gently descending; broadly and rather evenly curving from periphery into umbilicus; suture well defined. Sculpture of weak, weakly sigmoidal, widely spaced, prosocline, collabral riblets that are surmounted by periostracal lamellae; additionally with numerous weak, crowded, spiral threads and fine collabral growth lines. Aperture subcircular, rim thin and simple, gently thickened within and weakly flared at maturity.

ETYMOLOGY: After Kahurangi National Park, at the northern end of which is the type locality (noun in apposition).

DISTRIBUTION: Northwestern South Island (Fig. 13D).

BIOLOGY: Litter-dwelling detritivore of shrublands, and mixed broadleaved-conifer and *Nothofagus* forests, from near sea-level to *c.* 575 m elevation. Not uncommonly associated with limestone outcrops and is known as a fossil in karst caves (e.g. M.80946).

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: Compared with *Cytora chiltoni*, which it most closely resembles, *C. kahurangi* differs principally in attaining a larger size, and in being larger relative to the number of whorls. The two species are locally sympatric (e.g. M.174813 and M.86428, M.75756 and M.103369, M.124946 and M.106103, M.116423 and M.116422, M.174814 and M.125928, M.124949 and M.103369, and M.108764 and M.108760).

***Cytora kakano* new species**

(Figs 9D, 12C,D, 13E)

*Cytora* sp. 3 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.96727 and paratype M.183080: South Island, S of Seddonville, Charming Creek Road, 200 m (NZMS 260 L28/259579), P.C.

(H, 3.47 x 2.20 mm); I, J, *Cytora lignaria* (L. Pfeiffer, 1857), SW of North Cape, NE of Waitiki Landing, M.79645 (J, 5.15 x 5.20 mm); K, L, *Cytora malleata* n.sp., NW of Whangaruru, Ngaitonga, Te Ringa Track, paratypes, M.167134 (L, 5.50 x 4.10 mm). Scale bars 100 µm.

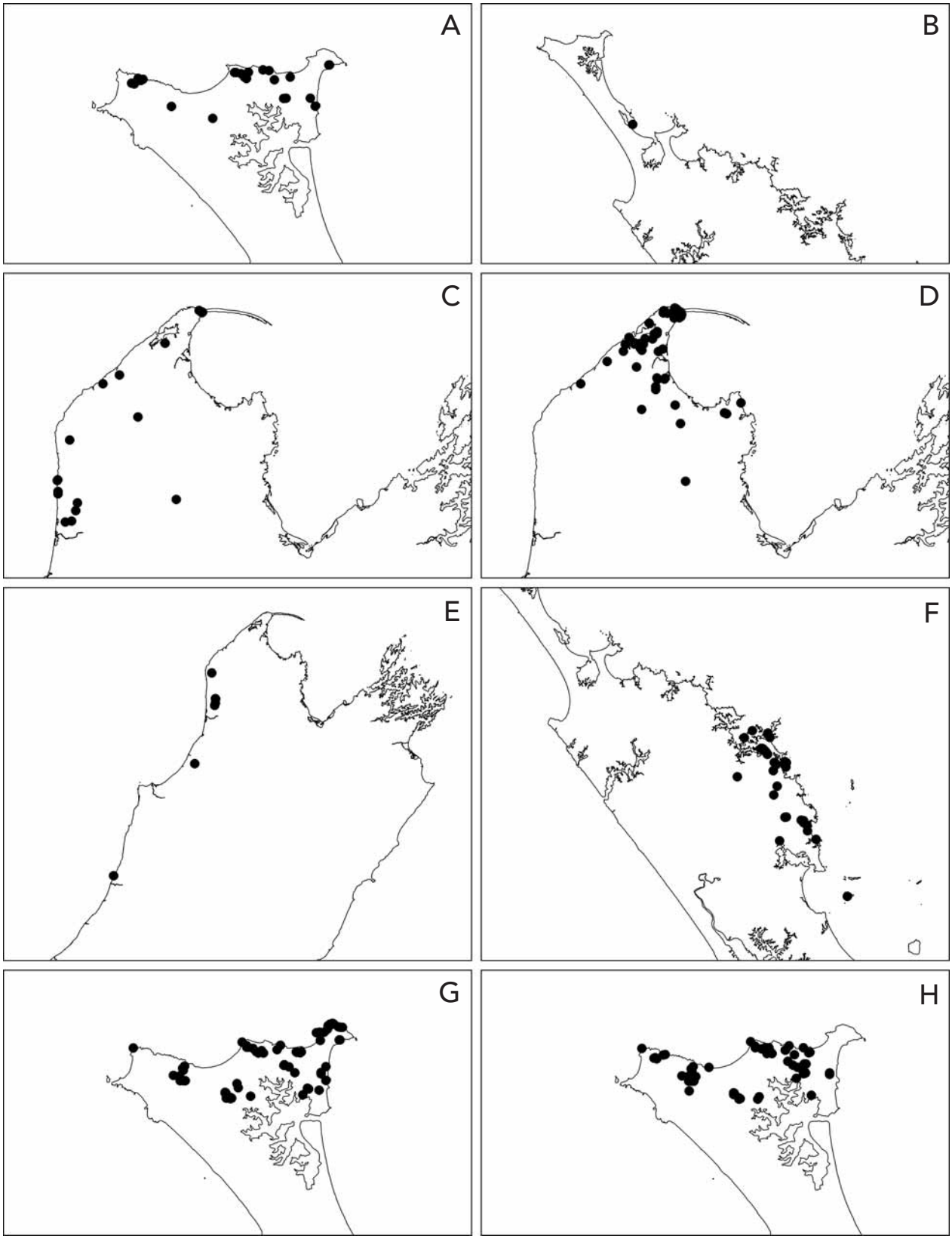


Fig. 13 Distributions of *Cytora* species within New Zealand. A, *Cytora hispida* Gardner, 1967; B, *Cytora houhora* n.sp.; C, *Cytora jamiesoni* n.sp.; D, *Cytora kahurangi* n.sp.; E, *Cytora kakano* n.sp., F, *Cytora malleata* n.sp.; G, *Cytora kerrana* Gardner, 1968; H, *Cytora lignaria* (L. Pfeiffer, 1857).

Mayhill, Jan. 1987. Paratypes: M.96803 (1), M.159887, South Island, NE of Karamea, Oparara, campsite W of Moria Gate, P.C. Mayhill, Jan. 1987; M.38848 (1), South Island, N of Karamea, Lewis Saddle, O.J. Marston, Dec. 1966; M.121201 (1), South Island, NE of Karamea, McCallums Mill Road, D.J. Roscoe, 26 Dec. 1980; M.127851 (1), South Island, NW of Runanga, Elizabeth Walkway, F.M. Climo & K. Mahlfeld, 13 Dec 1994.

MATERIAL EXAMINED (nine lots): Type material (see above), M.77754 (1), M.127852 (2).

DESCRIPTION: Shell up to 3.95 mm high, higher than wide (height/width ratio 1.26–1.30), narrowly conical (spire angle 55–70°), spire 1.29–1.60 times as high as aperture, narrowly umbilicate. Reddish brown, with rather ill-defined maculate pattern of irregular, paler, collabral bands, some specimens with narrow, pale, spiral band at periphery, one specimen with another spiral band on inner base. Periostracum on teleoconch produced at summits of collabral riblets as low, thin lamellae on spire and base, numbering 13–16 per mm at end of third whorl, in some specimens lamellae on last adult whorl coalesce in groups of two or three adapically to form subsutural row of higher, broadly rounded lamellae that number four or five per mm.

Protoconch of 1.60–1.75 convex whorls, 700–750 µm wide, first whorl smooth and glossy, remainder traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 3.50 broadly convex whorls; periphery rounded at all stages of growth, spire outline weakly cyrtoconoid, last adult whorl distinctly constricted and insertion point gently descending; suture well defined. Base broadly convex, evenly curving into umbilicus. Sculpture of weak, weakly sigmoidal, prosocline, collabral riblets that are surmounted by periostracal lamellae; additionally with fine collabral growth lines and few obscure spiral lines. Aperture subcircular, rim thin, gradually and gently thickened within, inner lip gently flared into umbilicus.

ETYMOLOGY: Seed (Māori) (noun in apposition).

DISTRIBUTION: Northwestern South Island (Fig. 13E).

BIOLOGY: Litter-dwelling detritivore, known from forests at 100–*c.* 420 m elevation.

CONSERVATION STATUS: The species is of some conservation concern owing to its evidently sparse populations.

REMARKS: Compared with *Cytora calva*, the only other known *Cytora* species with an axially maculate colour pattern, *C. kakano* differs in attaining larger size, in being larger relative to the number of whorls, and in being more broadly conical. *Cytora kakano* and *C. calva*, possibly phylogenetic sister species, have predominantly northern and southern distributions respectively (allopatric), and are closely adjacent in the vicinity of Runanga and Blackball.

***Cytora kamura* new species**

(Figs 2B, 9F, 11F, 12E,F)

*Cyclophorus lignarius.*- Suter, 1892: 275 (not Pfeiffer, 1857).

*Lagocheilus lignarium.*- Hedley & Suter, 1893: 621 (not Pfeiffer, 1857).

*Lagochilus lignarius.*- Suter, 1894d: 224 (not Pfeiffer, 1857).

*Lagochilus lignarium.*- Suter, 1894b: 140 (not Pfeiffer, 1857).

*Lagochilus* (*Cytora*) *lignarium.*- Suter, 1913: 182, pl. 35, fig. 5 (not Pfeiffer, 1857).

*Murdochia lignaria.*- Powell, 1937: 67 (not Pfeiffer, 1857).

*Cytora lignaria.*- Powell, 1957: 91 (not Pfeiffer, 1857); Climo, 1975: fig. 6d; Powell, 1979: 84, fig. 12/6 (not Pfeiffer, 1857); Gardner, 1994: 17, text fig. (not Pfeiffer, 1857).

*Cytora* sp. 1 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.179672 and paratype M.37573: South Island, Queen Charlotte Sound, Motuara Island (NZMS 260 Q26/170115), B.A. Holloway, 11 Nov. 1961. Additional paratypes: M.20445 (1), South Island, N of Picton, Kenepuru Sound, reserve W of Hopewell, W.F. Ponder, Jan. 1958; M.105565 (4), South Island, NE of Picton, Kenepuru Sound, Roadside W of Kenepuru Head, D.J. Roscoe, 6 Feb. 1982; M.106508 (2), South Island, NW of Picton, Kenepuru Sound, hill track above Hopewell, D.J. Roscoe, 6 Feb. 1982; M.20446 (6), South Island, N of Picton, NE of Manaroa, Mt Kiwi, W.F. Ponder, 26 Dec. 1958; M.30871 (2), Blumine Island, B.A. Holloway, 11 Nov. 1961; M.55692 (3), M.69050 (3), South Island, N of Picton, Melville Cove, off Titirangi Road, B.F. Hazelwood, Jan. 1977; M.170168 (2), South Island, N of Picton, Kenepuru, J. McMahon; M.72817 (1), Long Island, K. Browne, 1982; M.122964 (1), South Island, E of French Pass, Turner Peak, D.J. Roscoe, 11 Dec. 1993; M.126059 (4), South Island, SE of Picton, Whites Bay, near Pukatea Stream, D.J. Roscoe, 9 Jul. 1988; M.166310 (7), AIM AK 73295 (1), South Island, Queen Charlotte Sound, Curious Cove, P.C. Mayhill, Feb. 1981.

MATERIAL EXAMINED (277 lots): Type material (see above), M.2513 (2), M.5387 (2), M.14153 (5), M.14522 (1), M.20444 (6), M.22328 (2), M.23169 (10), M.25413 (1), M.25486 (2), M.25535 (3), M.29732 (4), M.30997 (2), M.31019 (1), M.31080 (1), M.32037 (1), M.32051 (1), M.32052 (2), M.32053 (1), M.32054 (2), M.32055 (1), M.32103 (1), M.32125 (2), M.32767 (1), M.36360 (1), M.36648 (2), M.37033 (1), M.37510 (1), M.37574 (1), M.37890 (1), M.38519 (4), M.38969 (1), M.38975 (1), M.46856 (2), M.47010 (2), M.47011 (3), M.47012 (2), M.47013 (2), M.47019 (1), M.47244 (1), M.47804 (2), M.47884 (3), M.47918 (1), M.47942 (1), M.51832 (1), M.52363 (2), M.55248 (2), M.55347 (1), M.55595 (2), M.55935 (1), M.56125 (1), M.56317 (1), M.56497 (1), M.56530 (2), M.56942 (3), M.56994 (1), M.57003 (1), M.57098 (1), M.57104 (3), M.57137 (2), M.58018 (1), M.68044 (1), M.69507 (2), M.69832 (2), M.70005 (1), M.70379 (2), M.72237 (6), M.72266 (1), M.72836 (2), M.72945 (1), M.73242 (1), M.73351 (2), M.73409 (4), M.75635 (1), M.76113 (4), M.76353 (4), M.76848 (2), M.78828 (1), M.79461 (2), M.79724 (1), M.79782 (7), M.79846 (7), M.80092 (4), M.80155 (2), M.80172 (3), M.81938 (2), M.82035 (2), M.88479 (1), M.89045 (8), M.89434 (2), M.89458 (1), M.91828 (5), M.91840 (2), M.91841 (4), M.92611 (1), M.92860 (2), M.98585 (1), M.98691 (1), M.100774 (1), M.101300 (1), M.101302 (2), M.101315 (3), M.101346 (3), M.101470 (1), M.101891 (3), M.101910 (1), M.101930 (11), M.101942 (1), M.102775 (1), M.103248 (1), M.104566 (5), M.104641 (1), M.104657 (1), M.104685 (3), M.104783 (9), M.104804 (1), M.104842 (6), M.104968 (1), M.104991 (1), M.105124 (3), M.105202 (2), M.105221 (10), M.105239 (2), M.105258 (10), M.105273 (2), M.105380 (1), M.105699 (1), M.105877 (2), M.105962 (1), M.106352 (8), M.106550 (2), M.106578 (2), M.106841 (1), M.106875 (2), M.106908 (1), M.107109 (1), M.107231 (2), M.107333 (6), M.107357 (8), M.107382 (1), M.107453 (3), M.107684 (1), M.107820 (2), M.107871 (1), M.108032 (1), M.108083 (1), M.108199 (2), M.108502 (3), M.108583 (1), M.108733 (7), M.109595 (2), M.109680 (3), M.109731 (6), M.109845 (9), M.109888 (1), M.109954 (1), M.113766 (2), M.113953 (1), M.114114 (1), M.115330 (1), M.115679 (4), M.115703 (15), M.115742 (1), M.115752 (1), M.115828 (4), M.115850 (1), M.115888 (2), M.116133 (4), M.116238 (5), M.116511 (4), M.116537 (1), M.120501 (1), M.120535 (11), M.120726 (7), M.121349 (6), M.121420 (1), M.121446 (1), M.121515 (3), M.121557 (1), M.121589 (6), M.121609 (7), M.121621 (2), M.121808 (1), M.121931 (11), M.122086 (3), M.122159 (1), M.122176 (3), M.122221 (1), M.122255 (2), M.122289 (1), M.122558 (2), M.122656 (4), M.122720 (1), M.122746 (1), M.122940 (2), M.122945 (1), M.123060 (1), M.123124 (1), M.123387 (7), M.123661 (4), M.123734 (2), M.123756 (3), M.123956 (6), M.124146 (4), M.124182 (1), M.124319 (1), M.124332 (1), M.124885 (1), M.124921 (1), M.124961 (1), M.125865 (2), M.125873 (10), M.125952 (1), M.126069 (1), M.126177 (6), M.126246 (2), M.126310 (1), M.126384 (8), M.126410 (1), M.126664 (30), M.175047 (3), M.175091 (1), M.156611 (2), M.156612 (7), M.156613 (1), M.156614 (1), M.156615 (2), M.156616 (2), M.156617 (1), M.156618 (9), M.156619 (3), M.156620 (1), M.156621 (4), M.156622 (1), M.156623 (2), M.156811 (8), M.156974 (1), M.156975 (1), M.156976 (6), M.161362 (1), M.161482 (2), M.161511 (8), M.161643 (3), M.162745 (1), M.166338 (3), M.166353 (3), M.166395 (1), M.166981 (15), M.168988 (1), M.168989 (2), M.168990 (8), M.168991 (1), M.168992 (1), M.169123 (1), M.169124 (6), M.169379 (2), M.169987 (1), M.170166 (1), M.170167 (1), M.170169 (2), M.170205 (2), M.175047 (3), M.175091 (1).

DESCRIPTION: Shell 3.50–3.85 mm wide at maturity, slightly wider than high (height/width ratio 0.78–0.97), broadly conical (spire angle 84–115°), spire 1.00–1.46 times as high as aperture, rather widely umbilicate. Translucent white beneath uniformly reddish-brown periostracum. Periostracum on teleoconch produced at summits of collabral riblets as delicate, thin, low but distinct lamellae with finely and irregularly serrated edge on spire and base, numbering 7–11 per mm at end of second whorl.

Protoconch of about 1.75–1.80 convex whorls, 730–820 µm wide, first whorl smooth, last half-whorl smooth apart from weak collabral growth lines.

Teleoconch of 2.70–3.00 whorls at maturity, broadly convex above and tightly rounded below periphery; spire whorls rather evenly expanding, last adult whorl slightly contracted, end of last adult whorl disjunct and descending; suture well defined. Base broadly and evenly rounded from periphery into umbilicus. Sculpture of very weak, prosocline, collabral riblets that are surmounted by periostracal lamellae; fine collabral growth lines; with or without more or less obscure spiral lines on spire or both spire and

base. Aperture at maturity subcircular, rim thin, rapidly and moderately thickened within.

Radula (Fig. 2B) with characteristics of the genus.

ETYMOLOGY: Carpenter (Māori), alluding to the former misidentification as *Cytora lignaria* (*lignarius* being Latin for a carpenter).

DISTRIBUTION: Southern North Island and northern South Island (Fig. 11F). Within this range, also known as subfossil in karst caves (e.g. M.102775, M.116133).

BIOLOGY: Detritivore in litter and in rotting wood. Occurs in mixed broadleaved-conifer and *Nothofagus* forests, from near sea-level to *c.* 1060 m elevation. Habitat includes those forests on limestone outcrops.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora kamura* has long been misidentified as *C. lignaria*, the type material of which is in fact the species from northern Aupouri Peninsula, long known as *C. ampla* (Powell, 1941) (see below).

*Cytora kamura* is distinctive in the combination of low-spired, broad umbilicus, lack of axial riblets on the last half-whorl of the protoconch, and detachment and descent of the last part of the last whorl at maturity. Compared with the superficially similar, allopatric (western) species *C. jamiesoni*, *C. kamura* is readily separable by the lack of axial riblets on the last half protoconch whorl and the lack of a peripheral angulation on the teleoconch. It differs from the superficially similar, locally sympatric species *C. depressa* in having a more narrowly conical spire, a narrower umbilicus and a more tightly coiled teleoconch. See below for comparison with another superficially similar species, *C. paparoa* n.sp. A sinistral specimen was obtained by D.J. Roscoe beside the Nydia Walkway, Havelock (M.126177).

We are unable to detect any differences in shell morphology between specimens from the North and South islands, and assume that the two populations have been isolated since formation of Cook Strait during the middle Pleistocene (Lewis *et al.* 1994).

### *Cytora kerrana* N. Gardner, 1968

(Figs 9H, 12G,H, 13G)

*Cytora kerrana* Gardner, 1968: 160, figs 2, 3; Gardner, 1994: 10, text fig.; Goulstone *et al.*, 1993: 6, 29, text fig.; McGuinness, 2001: 566; Brook, 2002a: 19; Hitchmough, 2002: 115.

*Cytora pallida*.- Powell, 1979: 84 (in part) (not Hutton, 1883a); Goulstone *et al.*, 1993: 6, 29 (not Hutton, 1883a).

*Cytora* sp. 5 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype AIM AK 71316: North Island, near North Cape, Kerr Point, under stunted scrub on coastal cliff face, N.W. Gardner, Jan. 1966.

MATERIAL EXAMINED (90 lots): Holotype (see above), M.31959 (12), M.32768 (6), M.37776 (3), M.38232 (12), M.38601 (2), M.47952 (7), M.56326 (15), M.56331 (9), M.56337 (3), M.56362 (10), M.62749 (14), M.70053 (8), M.70075 (many), M.72406 (1), M.76984 (2), M.76993 (many), M.77020 (3), M.77048 (9), M.77057 (10), M.77084 (20), M.77092 (2), M.77115 (2), M.77130 (4), M.77146 (30), M.79333 (2), M.79357 (1), M.79363 (1), M.79614 (6), M.79653 (1), M.81773 (2), M.82058 (2), M.82067 (10), M.82076 (2), M.87755 (1), M.87841 (2), M.87872 (2), M.87904 (1), M.87940 (3), M.88418 (3), M.88470 (10), M.88675 (many), M.88709 (1), M.99460 (15), M.103942 (30), M.104006 (many), M.104026 (1), M.107739 (30), M.116617 (1), M.124330 (10), M.156630 (many), M.156632 (many), M.156633 (3), M.156634 (1), M.156635 (4), M.156636 (3), M.161073 (2), M.161103 (1), M.161104 (3), M.161106 (2), M.161128 (3), M.161129 (1), M.161169 (16), M.161177 (2), M.161198 (4), M.161204 (8), M.161214 (2), M.161215 (3), M.161828 (4), M.161849 (14), M.161856 (30), M.161904 (5), M.161932 (1), M.161975 (many), M.161982 (1), M.161990 (1), M.162055 (5), M.162068 (5), M.162082 (2), M.162101 (3), M.162107 (20), M.162112 (1), M.162157 (4), M.162173 (4), M.162195 (3), M.162203 (2), M.162234 (6), M.162278 (1), M.177682 (6), M.177683 (15).

REDESCRIPTION: Shell up to 4.20 mm high, higher than wide (height/width ratio 1.33–1.49), narrowly conical (spire angle 42–52°), spire 1.75–1.77 times as high as aperture, very narrowly umbilicate. Protoconch yellowish to dark reddish brown; teleoconch reddish brown with broad to narrow yellowish-brown or whitish peripheral to submedian spiral band. Periostracum on teleoconch thin, weakly lamellate at summits of larger axial riblets on spire and base (seven to nine per mm at end of third whorl), and produced as slender hair-like spines that form about six spiral rows on spire whorls, and about eight additional rows on base.

Protoconch of 1.60–1.80 convex whorls, 650–730 µm wide, first whorl smooth, thereafter traversed by rounded, prosocline, collabral riblets.

Teleoconch of up to 4.1 broadly convex whorls; first three whorls with peripheral angulation that is obscured by succeeding whorls, periphery becoming broadly rounded on fourth whorl; spire whorls rather evenly expanding, last adult whorl slightly but distinctly constricted, insertion point of last part weakly descending in some specimens; suture well defined. Base broadly and rather evenly rounded from periphery to tightly rounded rim of deep, narrow, steep-sided umbilicus. Sculpture of very weak, prosocline, collabral riblets, and weak spiral threads and grooves; fine prosocline collabral growth lines throughout. Aperture roundly D-shaped, lip rim thin.

DISTRIBUTION: North Island, northern Aupouri Peninsula (Fig. 13G). Known also as a fossil in Holocene dunes at Whareana Bay (e.g. M.180532, M.180567, M.180581).

BIOLOGY: Litter-dwelling detritivore. Occurs in shrublands and broadleaved forests.

CONSERVATION STATUS: *Cytora kerrana* was ranked as 'declining' by McGuinness (2001), and listed as 'range restricted' by Brook (2002a) and Hitchmough (2002). Brook (2002a) remarked that *C. kerrana* 'has a fragmented, relict distribution as a result of extensive habitat destruction caused by anthropic land clearance for gum-digging, pastoral farming and exotic forestry. The total population is probably still declining as a consequence of continued modification and loss of habitat, and there is a risk that some local populations could become extinct if historical trends continue.' Our assessment is that this locally abundant species continues to be of immediate conservation concern simply because the habitat is vulnerable to disturbance, and should be ranked 'range restricted' according to the criteria of Molloy *et al.* (2002).

REMARKS: *Cytora kerrana* was synonymised with *C. pallida* by Powell (1979), reputedly on N.W. Gardner's advice (Goulstone *et al.* 1993). However, we concur with Goulstone *et al.* (1993) in recognising that *C. kerrana* is a distinct species, differing from *C. pallida* in lacking spiral threads on the protoconch, in lacking a pale spiral band on the base, in lacking any trace of malleate sculpture, in having more numerous primary axial riblets/periostracal laminae at equivalent stages of growth, in attaining a smaller size (maximum height 4.20 mm versus 6.00 mm), and in typically having a more narrowly conical spire (spire angle 42–52° versus 51–65°). *Cytora kerrana* differs further from *C. pallida* in having a periostracum that is more finely hirsute and that lacks the row of prominent subsutural lamellae on the adapical third of each whorl.

Specimens from stunted scrub on serpentinite rocks between Kerr Point and North Cape, including the type material, attain smaller size and are smaller relative to the number of whorls than specimens from elsewhere (height up to 3.60 mm versus 4.20 mm). All material is tentatively treated as conspecific awaiting comparison of gene sequences.

***Cytora lignaria* (L. Pfeiffer, 1857)**

(Figs 2D, 9G, 12I,J, 13H)

*Cyclostoma* (*Cyclophorus*?) *lignarium* Pfeiffer, 1857: 112.

*Cyclophorus*? *lignarius*.- Pfeiffer, 1858: 44.

*Cyclophorus lignarius*.- Reeve, 1861: pl. 19, fig. 94; Hector, 1873: 23; Hutton, 1880: 37; Hutton, 1884b: 210.

*Cyclostoma lignarium*.- Martens, 1873: 23.

*Lagochilus* (*Cytora*) *lignarium*.- Kobelt & Möllendorff, 1897: 86.

*Japonia* (*Cytora*) *lignaria*.- Kobelt, 1902: 66 (in part = *Cytora kamura*)

*Murdochia lignaria*.- Iredale, 1915: 446.

*Murdochia ampla* Powell, 1941: 260, pl. 51, fig. 10; Powell, 1946: 69, pl. 26, fig. 10. New synonymy.

*Cytora ampla*.- Powell, 1957: 90; Rees, 1961: 15; Climo, 1970: fig. 1B, C, F, K; Powell, 1979: 86, pl. 23, fig. 5; Gardner, 1994: 6, text fig.; Brook, 1999d: 389; McGuinness, 2001: 566; Brook, 2002a: 14; Hitchmough, 2002: 115.

NOT *Cyclophorus lignarius*.- Suter, 1892: 275 (= *Cytora kamura*).

NOT *Lagocheilus lignarium*.- Hedley & Suter, 1893: 621 (= *C. kamura*).

NOT *Lagochilus lignarium*.- Suter, 1894b: 140 (= *C. kamura*).

NOT *Lagochilus lignarius*.- Suter, 1894d: 224 (= *C. kamura*).

NOT *Lagochilus* (*Cytora*) *lignarium*.- Suter, 1913: 182, pl. 35, fig. 5 (= *C. kamura*).

NOT *Murdochia lignaria*.- Powell, 1937: 67 (= *C. kamura*).

NOT *Cytora lignaria*.- Powell, 1957: 91; Powell, 1979: 84, fig. 12/6; Gardner, 1994: 17, text fig. (all = *C. kamura*).

TYPE MATERIAL: *Cyclostoma lignaria* – lectotype (here selected) BMNH 198851/1 and two paralectotypes BMNH 198851/2-3: 'New Zealand', H. Cuming colln. Type locality here restricted to North Island, northern Aupouri Peninsula, beside junction of Te Hapua and Spirits Bay roads.

*Murdochia ampla* – holotype AIM AK 70497: North Island, between Spirits Bay and Tom Bowling Bay,

Unuwhao 800–900 feet [243–275 m], under decaying leaves in coastal forest, A.W.B. Powell, 1 Feb. 1932.

MATERIAL EXAMINED (79 lots): Type material (see above), M.4127 (11), M.5476 (14), M.22243 (2), M.37103 (1), M.37576 (2), M.37580 (1), M.37781 (30), M.38233 (4), M.38452 (1), M.38600 (2), M.54252 (2), M.55467 (8), M.62654 (2), M.70052 (1), M.76587 (2), M.77008 (2), M.77019 (2), M.77072 (6), M.77120 (3), M.77144 (1), M.79025 (1), M.79332 (4), M.79356 (3), M.79362 (2), M.79645 (7), M.79657 (3), M.81790 (20), M.82059 (5), M.82061 (1), M.82084 (6), M.87747 (many), M.87778 (2), M.87827 (1), M.87875 (3), M.87905 (1), M.88410 (many), M.88469 (5), M.88664 (5), M.88702 (1), M.88711 (8), M.96564 (2), M.97254 (5), M.99139 (2), M.103943 (9), M.104032 (1), M.107743 (2), M.116612 (1), M.124328 (6), M.129292 (3), M.129381 (3), M.137046 (10), M.156625 (25), M.156626 (5), M.161072 (7), M.161102 (4), M.161127 (5), M.161165 (5), M.161181 (2), M.161203 (8), M.161830 (5), M.161875 (3), M.161902 (9), M.161939 (23), M.161949 (4), M.161966 (2), M.162007 (9), M.162041 (13), M.162091 (5), M.162111 (1), M.162164 (1), M.162223 (1), M.162249 (6), M.162256 (2), M.175373 (5), M.177681 (3), M.177684 (1).

REDESCRIPTION: Shell up to 6.5 mm high, about as high as wide or slightly higher than wide (height/width ratio 0.93–1.06), broadly conical (spire angle 72–89°), spire 1.26–1.72 times as high as aperture, rather widely umbilicate. Protoconch and teleoconch reddish brown, some specimens uniformly darkly pigmented, others with variable number and pattern of narrow white spiral bands on spire and base of last one or two whorls in adults. Periostracum smooth.

Protoconch of 1.75–1.80 convex whorls, 910–930 µm wide, first whorl smooth and glossy, remainder traversed by fine, rounded, collabral riblets that are more closely spaced and slightly more strongly prosocline than those on immediately succeeding teleoconch.

Teleoconch of up to 4.00 convex whorls; periphery rounded throughout; whorls expanding more rapidly than protoconch (early spire outline coeloconoid), evenly until last adult whorl, which is very slightly constricted, its insertion point gently descending behind outer lip; suture well defined. Base broadly rounded, smoothly curving into umbilicus. Sculpture of weak, weakly sigmoidal, widely spaced, strongly prosocline, collabral riblets, and fine collabral growth lines. Aperture subcircular, mature peristome rim thin and weakly flared, rapidly and markedly thickened within.

Radula (Fig. 2D) with characteristics of the genus.

DISTRIBUTION: North Island, northern Aupouri Peninsula (Fig. 13H). Known also from fossils in Holocene dunes at Te Werahi (Brook 1999d).

BIOLOGY: Litter-dwelling detritivore. Habitat comprises shrubland, *Kunzea* forest, and broadleaved and conifer-broadleaved forests, from near sea-level to *c.* 300 m elevation.

CONSERVATION STATUS: McGuinness (2001) did not rank *Cytora lignaria* as of conservation concern. However, *C. ampla* was ranked as 'declining'. Brook (2002a) and Hitchmough (2002) listed *C. ampla* as 'range restricted'. Our assessment is that this species, as recognised here (i.e. with synonymy of *lignaria* and *ampla*), continues to be of immediate conservation concern because the habitat is vulnerable to disturbance. Accordingly, a rank of 'range restricted' on the Molloy *et al.* (2002) criteria is appropriate.

REMARKS: The type material of *Cyclostoma lignaria* represents a species that is restricted to the far north of Aupouri Peninsula, which until now has been identified as *Cytora ampla* (Powell, 1941). The common, widespread southern species hitherto identified as *C. lignaria* (see synonymy) is herein named *C. kamura* (see above). In the absence of type material, previous workers associated Pfeiffer's name with the southern form largely by elimination, using the description and accordant proportions derived from the given dimensions ('diam. maj. 5, min. 4 2/3, alt. 4 mill.'). As indicated by Suter (1892), however, none of the southern specimens attains this size, but in fact Pfeiffer's given height dimension is erroneous (lectotype 4.80 x 4.62 mm, paralectotypes 4.69 x 4.90 mm and 4.61 x 4.26 mm). We have selected the junction of Te Hapua and Spirits Bay roads as type locality, because specimens from there most closely match the lectotype (e.g. M.162007).

### *Cytora malleata* new species

(Figs 9I, 12K,L, 13F)

TYPE MATERIAL: Holotype NMNZ M.179673 and paratypes M.167134 (33), AIM AK 73296 (2): North Island, NW of Whangaruru, Te Ringa Track, Ngaitonga (NZMS 260 Q05/256520), P.C. Mayhill, Nov. 1988. Additional paratypes: M.124398 (19), North Island, Whangaruru, A.C. O'Connor, Feb. 1948.

MATERIAL EXAMINED (48 lots): Type material (see above), M.37577 (2), M.48174 (30), M.58116 (1), M.58121 (2),

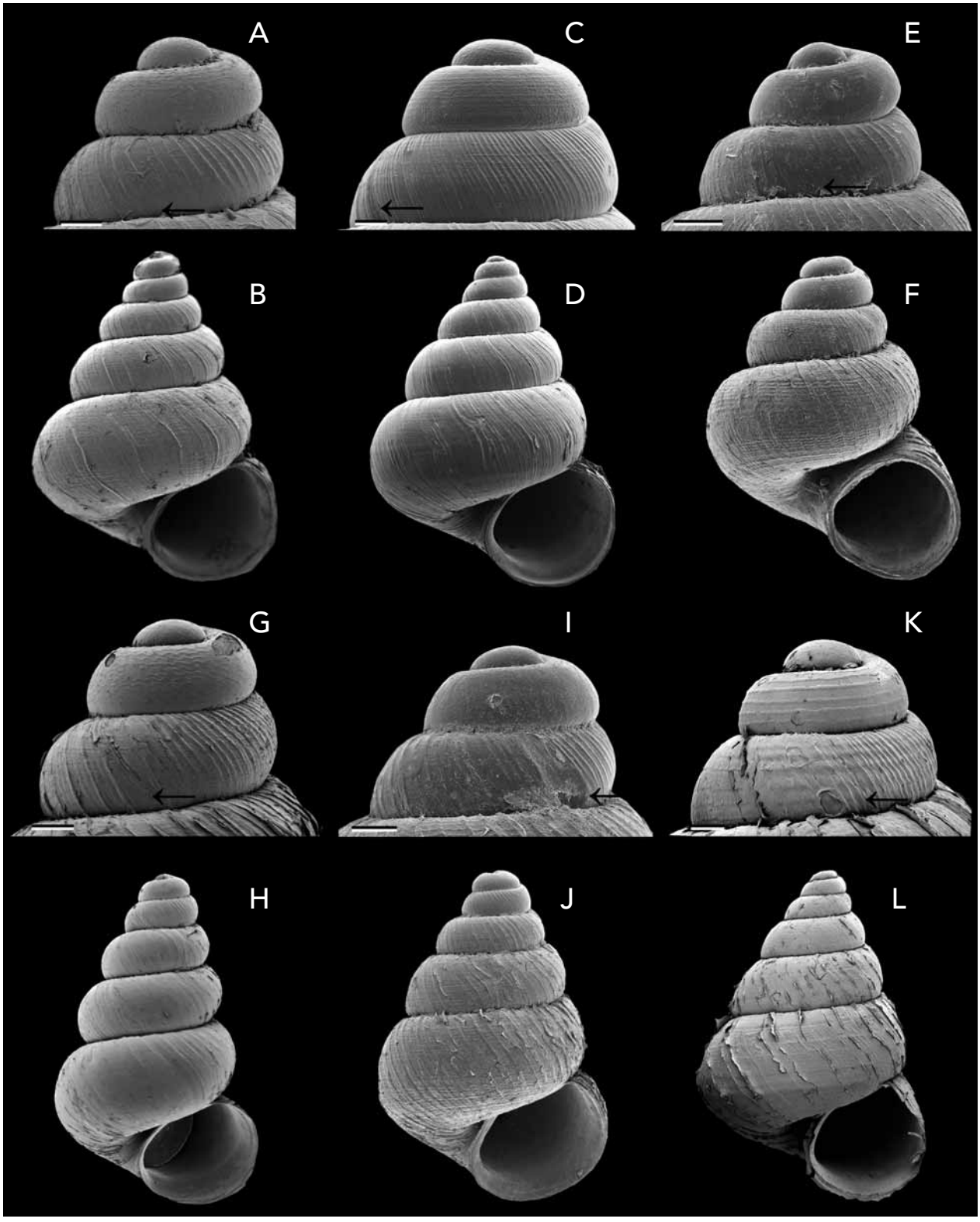


Fig. 14 Lateral views of whole shells and protoconchs (protoconch–teleoconch boundary arrowed) of *Cytora* species (SEM). A, B, *Cytora maui* n.sp., NW of Turangi, Pureora Forest, Waituhi Kuratau Reserve, paratype, M.62067 (A), and holotype, M.183065 (B, 2.50 x 1.80 mm); C, D, *Cytora mayhillae* n.sp., Doubtful Sound, Secretary Island, above Blanket Bay, holotype, M.146093 (D, 4.35 x 3.15 mm); E, F, *Cytora minor* n.sp., NW of Te Kuiti, Tawarau Forest, holotype, M.82612 (F, 1.25 x 0.98 mm); G, H, *Cytora motu* n.sp., Poor Knights Islands, Aorangi Island, Puweto Valley, paratypes, M.57625 (H,

M.82458 (1), M.82980 (4), M.83072 (14), M.83099 (1), M.83167 (1), M.83219 (5), M.99242 (1), M.99397 (5), M.124580 (2), M.124773 (2), M.127833 (3), M.166715 (4), M.166727 (17), M.166728 (2), M.166758 (1), M.166796 (20), M.166857 (many), M.166879 (2), M.166891 (6), M.166926 (1), M.166945 (1), M.166985 (many), M.167017 (8), M.167022 (6), M.167045 (2), M.167055 (3), M.167074 (11), M.167113 (1), M.167226 (2), M.167244 (2), M.167313 (6), M.167331 (2), M.167512 (1), M.167537 (3), M.167594 (3), M.167603 (1), M.167693 (3), M.169040 (2), M.177687 (3), M.178084 (3).

DESCRIPTION: Shell up to 6.45 mm high, higher than wide (height/width ratio 1.30–1.39), narrowly conical (spire angle 49–59°), spire 1.43–1.69 times as high as aperture, narrowly umbilicate. Protoconch dark reddish brown; teleoconch dull yellowish brown to dark reddish brown, additionally with pale yellowish-brown or whitish peripheral spiral band that is almost entirely exposed suprasuturally on spire, and a more or less median basal spiral band. Periostracum thin, produced on both spire and base as prominent, irregular, thin, irregularly spaced, sigmoidal, prosocline collabral lamellae that number about eight per mm at end of third whorl; most prominent in broad subsutural and peripheral zones, prominent lamellae alternating with several weaker ones.

Protoconch of about 1.75–2.00 convex whorls, 770–850 µm wide, summit of first three-quarter whorl very finely malleate, elsewhere smooth; last whorl traversed by rounded, prosocline, collabral riblets.

Teleoconch of up to 5.10 broadly convex whorls; periphery roundly angulate at all stages of growth, sides and base broadly rounded, base smoothly curving into steep-walled, narrow umbilicus. All whorls rather evenly expanding; suture well defined. Sculpture of very weak, irregularly spaced, prosocline, sigmoidal, collabral riblets; and strong, dense malleations throughout that form a diagonally reticulate pattern with collabral sculpture. Aperture roundly D-shaped; peristome thin, weakly but distinctly flared (especially at columella).

ETYMOLOGY: Hammered (Latin), alluding to the distinctive teleoconch sculpture.

DISTRIBUTION: North Island, eastern Northland, from Bay of Islands south to Whangarei, and Taranga Island and Hen and Chickens Islands (Fig. 13F).

BIOLOGY: Litter-dwelling detritivore of shrublands and forests, from near sea-level to about 350 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora malleata* is highly distinctive in the combination of very large size (height up to 6.40 mm), tall spire, angulate periphery at all stages of growth, strongly developed periostracum, and strong and extensive malleate sculpture. The superficially similar, locally sympatric species *C. pallida* has a strongly spirally sculptured protoconch and much more weakly developed periostracum and malleate sculpture.

***Cytora maui* new species**

(Figs 9J, 14A,B, 15A)

*Lagochilus* (*Cytora*) *chiltoni*.- Suter, 1913: 179 (in part not Suter, 1896).

*Cytora chiltoni*.- Gardner, 1975: 119 (not Suter, 1896); Goulstone, 1990: 21, text fig. (not Suter, 1896); Gardner, 1994: 14 (in part + *C. tuarua*).

*Cytora pallida*.- Ballance, 1982: 34 (not Hutton, 1883a).

*Cytora* cf. *chiltoni*.- Mayhill, 1994: 35, text fig. (not Suter, 1896).

*Cytora* sp. 10 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.183065 and paratypes M.62067 (23), AIM AK 73297 (2): North Island, NW of Turangi, Pureora Forest, Waituhi Kuratau Scenic Reserve (NZMS 260 T18/316557), C. Broomfield, 1979. Additional paratypes: M.124800 (6), North Island, E of Turangi, Otuhoe, A.C. O'Connor, 1951; M.72149 (1), North Island, SW of Turangi, N of Lake Rotoaira, P.C. Mayhill, Jul. 1979; M.70209 (6), North Island, SW of Turangi, Hinemihi Track, B.F. Hazelwood, 22 Sep 1981.

MATERIAL EXAMINED (211 lots): Type material (see above), M.14037 (1), M.15135 (9), M.15814 (1), M.28918 (1), M.30008 (1), M.31002 (3), M.36378 (many), M.37081 (2), M.37939 (1), M.39088 (3), M.39153 (1), M.39227 (6), M.45754 (4), M.45833 (1), M.47014 (30), M.47016 (1), M.47017 (2), M.47206 (2), M.47595 (2), M.48025 (4), M.48055 (30), M.51909 (2), M.51952 (2), M.55673 (12), M.57054 (1), M.57216 (1), M.57280 (2), M.57293 (1), M.57674 (1), M.57728 (1), M.57885 (1), M.61772 (1), M.61823 (1), M.62043 (1), M.63411 (12), M.63548 (6), M.68137 (1), M.68151 (1), M.68172 (3), M.68705

2.30 x 1.55 mm); I, J, *Cytora pakotai* n.sp., N of Dargaville, Pakotai Reserve, holotype, M.98334 (J, 2.20 x 1.50 mm); K, L, *Cytora pallida* (Hutton, 1883), Auckland, Cornwallis, M.124310 (L, 4.45 x 3.15 mm). Scale bars 100 µm.

(1), M.68942 (4), 69875 (1), M.69895 (4), M.70028 (4), M.70741 (4), M.71483 (2), M.72096 (3), M.72108 (2), M.72126 (3), M.72152 (3), M.73945 (1), M.75656 (1), M.75944 (3), M.76133 (1), M.76212 (1), M.80181 (4), M.81636 (1), M.81682 (1), M.82586 (1), M.82982 (1), M.88584 (5), M.89344 (1), M.93070 (3), M.93100 (3), M.93130 (3), M.97130 (1), M.98293 (3), M.101692 (8), M.102690 (13), M.103133 (4), M.103882 (1), M.104294 (6), M.104484 (2), M.104624 (10), M.107734 (1), M.124280 (1), M.124317 (2), M.124558 (5), M.124564 (2), M.124566 (2), M.124567 (1), M.124575 (3), M.124584 (6), M.124585 (4), M.124588 (1), M.124591 (1), M.124592 (1), M.124593 (1), M.124594 (1), M.124595 (4), M.124597 (4), M.124598 (2), M.124599 (4), M.124727 (1), M.124777 (3), M.124778 (1), M.124779 (1), M.124799 (3), M.124822 (2), M.124862 (2), M.125600 (8), M.126524 (1), M.127494 (2), M.127504 (1), M.127948 (1), M.129995 (5), M.156585 (27), M.156649 (1), M.166140 (2), M.166150 (2), M.166160 (1), M.166759 (1), M.166806 (1), M.166847 (3), M.166892 (1), M.168117 (2), M.168251 (1), M.168580 (1), M.168640 (3), M.168727 (4), M.168731 (1), M.168993 (1), M.168994 (1), M.168995 (1), M.168996 (1), M.168997 (1), M.168998 (1), M.168999 (1), M.169000 (5), M.169001 (5), M.169002 (3), M.169003 (7), M.169004 (4), M.169005 (1), M.169006 (1), M.169007 (1), M.169008 (2), M.169009 (1), M.169010 (3), M.169011 (2), M.169012 (1), M.169013 (2), M.169014 (1), M.169015 (1), M.169016 (4), M.169017 (2), M.169018 (1), M.169019 (1), M.169020 (7), M.169021 (2), M.169022 (1), M.169023 (2), M.169024 (1), M.169025 (2), M.169026 (1), M.169027 (2), M.169028 (3), M.169029 (2), M.169030 (3), M.169031 (1), M.169032 (1), M.169033 (1), M.169034 (1), M.169035 (1), M.169036 (1), M.169037 (1), M.169038 (2), M.169219 (many), M.169220 (4), M.169221 (2), M.169222 (2), M.169223 (1), M.169224 (1), M.169225 (1), M.169226 (1), M.169227 (2), M.169228 (2), M.169229 (1), M.169230 (1), M.169231 (1), M.169232 (12), M.169233 (3), M.169234 (2), M.169235 (3), M.169236 (2), M.169237 (20), M.169238 (2), M.169239 (1), M.169240 (4), M.169241 (3), M.169242 (2), M.169243 (10), M.169244 (3), M.169720 (3), M.169788 (1), M.169871 (2), M.169933 (1), M.170200 (1), M.174331 (11), M.175044 (2), M.177728 (6), M.178065 (6), M.178072 (1), M.178081 (9), M.178082 (4), M.181306 (6).

DESCRIPTION: Shell 1.75–2.90 mm high at maturity, higher than wide (height/width ratio 1.20–1.47), broadly to narrowly conical (spire angle 52–62°), spire 1.21–1.78 times as high as aperture, narrowly umbilicate. Translucent, reddish (fading to yellowish) brown. Periostracum produced as thin lamellae at summits of axial riblets, including peripheral row of prominent, broadly rounded projections, numbering six to eight per mm at end of third whorl.

Protoconch of 1.70–1.80 convex whorls, 500–570 µm wide, sculptured with fine, crisp, spiral threads, markedly wavy on first whorl, forming reticulate pattern on last half-whorl where intersecting fine, crisp, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 3.00–4.00 strongly convex whorls at maturity; periphery rounded at all stages of growth, most broadly and evenly rounded on last adult whorl; spire whorls evenly expanding; last adult whorl typically weakly contracted at maturity; suture well defined. Base broadly rounded, evenly rounded into umbilicus. Sculpture of fine, crowded, spiral threads; weak, weakly sigmoidal, prosocline, collabral riblets; and fine collabral and spiral growth lines. Aperture subcircular, rim thin and rapidly thickened within at maturity.

ETYMOLOGY: After the fisherman of Māori legend, who fished up the North Island.

DISTRIBUTION: North Island, from Northland in vicinity of Mangamuka southwards to Wanganui and Eketahuna (Fig. 15A). Known also as fossils from karst caves in western Waikato–northwestern Taranaki (e.g. M.36378, M.39227, M.47595, M.82586).

BIOLOGY: Ground-dwelling detritivore of broadleaved-conifer and *Nothofagus* forests, from near sea-level to about 1200 m elevation. Often found under leaves in very wet litter.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora maui*, the so-called 'North Island *chiltoni*', is distinctive in the combination of uniformly reddish to yellowish-brown coloration, wavy spiral lirae on protoconch, reticulate sculpture on the last protoconch whorl, spirally lirate teleoconch, narrowly to broadly conical spire, and the presence of a broad row of broadly rounded periostracal laminae at the periphery. It differs markedly from *C. chiltoni* in having close, wavy, spiral threads on the first

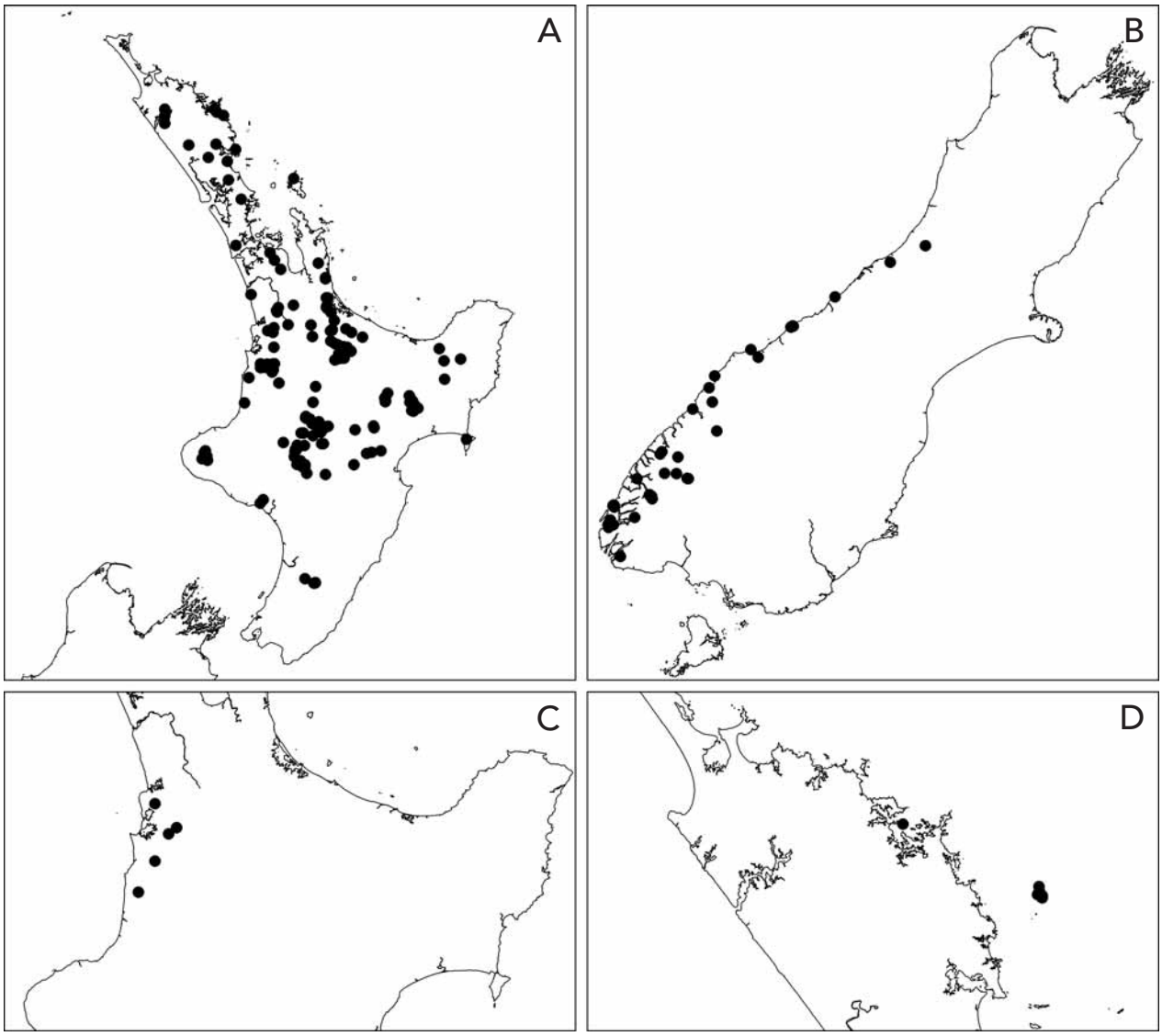


Fig. 15 Distributions of *Cytora* species within New Zealand. A, *Cytora maui* n.sp.; B, *Cytora mayhillae* n.sp.; C, *Cytora minor* n.sp.; D, *Cytora motu* n.sp.

whorl of the protoconch, the South Island species having stronger, more widely spaced, straight, spiral threads on the first whorl, which are more readily apparent under moderate magnification.

***Cytora mayhillae* new species**

(Figs 9K, 14C,D, 15B)

*Leptopoma pannosa*.- Hutton, 1882: 282 (in part + *C. chiltoni*).

*Murdochia* cf. *calvum*.- Dell, 1955: 1136.

TYPE MATERIAL: Holotype NMNZ M.146093: South Island, Doubtful Sound, Secretary Island, above Blanket Bay, 60 m (NZMS 260 B43/378284), P.C. Mayhill, Feb. 1985. Paratypes: M.82736 (2), South Island, Doubtful Sound, Deep Cove, Brasell Point, P.C. Mayhill, Feb. 1985; M.146264 (3), AIM AK 73298 (1), South Island, Doubtful Sound, Deep Cove, WNW of Manapouri, Old Doubtful Sound Track, P.C. Mayhill, Feb. 1985; M.82783 (1), South Island, Doubtful Sound, SE of Deep Cove, Stella Falls, P.C. Mayhill, Feb. 1985.

MATERIAL EXAMINED (63 lots): Type material (see above), CM M18078 (paralectotype of *C. pannosa* CM M18078, 'Greymouth, R. Helms'), M.28811 (4), M.29905 (1), M.29913 (1), M.30486 (1), M.38119 (1), M.75423 (1),

M.79565 (2), M.85689 (1), M.89760 (2), M.99980 (1), M.100311 (1), M.100047 (1), M.124630 (1), M.124631 (2), M.124633 (5), M.124637 (1), M.124638 (1), M.124639 (3), M.124650 (5), M.124652 (2), M.124653 (1), M.124654 (2), M.124655 (1), M.124656 (1), M.124657 (1), M.124687 (1), M.124688 (1), M.124689 (2), M.124690 (2), M.124691 (2), M.124693 (1), M.124694 (2), M.124696 (3), M.124697 (1), M.124698 (1), M.124699 (2), M.124700 (4), M.124701 (1), M.124702 (3), M.124846 (5), M.124890 (7), M.125658 (1), M.127943 (1), M.146111 (1), M.146122 (2), M.146135 (1), M.146136 (1), M.146144 (1), M.146176 (1), M.146198 (2), M.146256 (1), M.146625 (1), M.146816 (2), M.157311 (15), M.157764 (1), M.174275 (1), M.174314 (1).

DESCRIPTION: Shell up to 4.35 mm high, higher than wide (height/width ratio 1.15–1.41), narrowly conical (spire angle 53–66°), spire 1.28–1.71 times as high as aperture, narrowly umbilicate. Reddish brown, some specimens with pale submedian and outer basal spiral bands. Periostracum on teleoconch produced at summits of collabral riblets as thin lamellae on spire and base, including peripheral row of prominent, broadly rounded projections, numbering about four per mm at end of third whorl

Protoconch of 1.65–1.85 convex whorls, 730–770 µm wide, first 1.2 whorls finely and closely spirally lirate, remainder traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 3.80 broadly convex whorls; spire whorls rather evenly expanding, last adult whorl slightly constricted and insertion point gently descending; base more broadly rounded than periphery, evenly curving into umbilicus; suture well defined. Sculpture of weak, weakly sigmoidal, widely spaced, prosocline, collabral riblets that are surmounted by periostracal lamellae; additionally with fine collabral and more or less obscure spiral growth lines. Aperture subcircular, rim thin and simple, gently thickened within at maturity.

ETYMOLOGY: After the outstanding collector Pauline Mayhill, late of Tauranga, who collected much of the material upon which this revision is based.

DISTRIBUTION: Southwestern South Island, from vicinity of Lake Ianthe south to Preservation Inlet (Fig. 15B).

BIOLOGY: Litter-dwelling detritivore of broadleaved-conifer and *Nothofagus* forests, from near sea-level to *c.* 1000 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: Dell (1955) thought Fiordland material was possibly referable to *Leptopoma calva* Hutton, 1882, described from Greymouth, but was unable to make a definitive taxonomic statement in the absence of type material, inadequate original descriptions and lack of topotype specimens. We recognise the Fiordland material as distinct from *Cytora calva* as typified by the neotype selected here, and accordingly erect a new taxon, *C. mayhillae*. The species resembles the South Island species *C. chiltoni*, *C. kahurangi* and *C. tuarua* n.sp. in colour and in having periostracal lamellae enlarged at the periphery of the teleoconch. *Cytora mayhillae* differs from *C. chiltoni* in attaining larger size (height up to 4.70 mm (non-type material) versus 3.40 mm), and in having a larger protoconch (width 730–770 µm versus 560–580 µm). *Cytora mayhillae* approaches *C. kahurangi* in size, but differs from that and further from *C. chiltoni* in having much finer and closer spiral threads on the first whorl of the protoconch. *Cytora mayhillae* and *C. chiltoni* are locally sympatric (syntopic?), but *C. mayhillae* and *C. kahurangi* are allopatric. *Cytora tuarua* (see below) is smaller and has a smooth first protoconch whorl.

***Cytora minor* new species**

(Figs 9L, 14E,F, 15C)

TYPE MATERIAL: Holotype NMNZ M.82612: North Island, NW of Te Kuiti, Tawarau Forest Ecological Reserve, 240 m (NZMS 260 R16/765203), P.C. Mayhill, Feb. 1984. Paratypes: M.113707 (1), AIM AK 73299 (1), North Island, NE of Awakino, Herangi Range, Department of Conservation, 21 Nov. 1991; M.177663 (1), North Island, ESE of Kawhia, SE of Te Kihi Trig, P.C. Mayhill, Sep. 1983; M.169320 (1), North Island, SW of Te Awamutu, Walter Scott Reserve, P.C. Mayhill, Aug. 1980; M.177732 (2), North Island, S of Raglan, S-facing slope beside Bridal Veil Falls track, 200 m, B.A. Marshall & P. Poortman, 19 Oct. 2004.

MATERIAL EXAMINED (six lots): Type material (see above).

DESCRIPTION: Shell 1.26–1.53 mm high at maturity, higher than wide (height/width ratio 1.28–1.40), narrowly conical (spire angle 48–59°), spire 1.41–1.55 times as high as aperture, narrowly umbilicate. Translucent, pale yellowish to reddish brown. Periostracum produced as weak lamellae at summits of axial riblets that number about 20 per mm at end of third whorl.

Protoconch of 1.60–1.75 convex whorls, 410–450 µm wide, sculptured throughout with numerous fine spiral threads, forming reticulate pattern on last quarter-whorl by intersecting stronger, rounded, collabral riblets that are more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 2.00–2.30 whorls at maturity; periphery strongly rounded at all stages of growth; last adult whorl markedly contracted and insertion point gently descending at maturity; suture well defined. Base broadly rounded, evenly rounded into umbilicus. Sculpture of fine, crisp, crowded, spiral threads; weak, prosocline, collabral riblets; and fine collabral and spiral growth lines. Aperture subcircular, rim thin, rapidly thickened within and weakly to strongly disjunct at maturity.

ETYMOLOGY: Little (Latin).

DISTRIBUTION: Western central North Island, between Raglan and Awakino (Fig. 15C).

BIOLOGY: Litter-dwelling detritivore. Known only from broadleaved-conifer forests at elevations of 200–550 m.

CONSERVATION STATUS: Populations evidently sparse throughout the species' rather restricted range. Our assessment is that this should be ranked 'sparse' according to the criteria of Molloy *et al.* (2002).

REMARKS: *Cytora minor* resembles *C. torquillum* and especially *C. hazelwoodi* in gross facies, but differs from both in having a smaller protoconch, in attaining smaller size, in being smaller relative to the number of whorls, in having a wider umbilicus, and in that the peristome is disjunct at maturity. *Cytora minor* and *C. torquillum* are locally sympatric in the southwestern limits of the range of the latter, whereas *C. minor* and *C. hazelwoodi* are allopatric, with adjacent western and eastern distributions, respectively.

***Cytora motu* new species**

(Figs 9M, 14G,H, 15D)

*Cytora torquilla*.- Climo, 1971: 68 (not Suter, 1894c); Powell, 1979: 84 (in part); Gardner, 1994: 16 (in part).

TYPE MATERIAL: Holotype NMNZ M.179674 and paratypes M.57625 (many), AIM AK 73300 (5): North Island, Poor Knights Islands, Aorangi Island, Puweto Valley, taraire and broadleaved forest (NZMS 260 R06/687343), J.A. Bartle, 15 Jan. 1978.

MATERIAL EXAMINED (40 lots): Type material (see above), M.31032 (6), M.31039 (many), M.37961 (4), M.37969 (many), M.38457 (2), M.38617 (many), M.48568 (30), M.57488 (many), M.57500 (many), M.57613 (many), M.62907 (many), M.62920 (many), M.73476 (1), M.73481 (1), M.73485 (15), M.73490 (3), M.73492 (11), M.73495 (22), M.73499 (1), M.73500 (4), M.73503 (2), M.73505 (4), M.73511 (30), M.73512 (6), M.73513 (6), M.73514 (1), M.79989 (1), M.84637 (many), M.99785 (10), M.99792 (2), M.99810 (many), M.99819 (5), M.99821 (many), M.101606 (2), M.124368 (8), M.156675 (4), M.167188 (4).

DESCRIPTION: Shell 2.20–2.76 mm high at maturity, higher than wide (height/width ratio 1.39–1.69), narrowly conical (spire angle 39–49°), spire 1.35–1.88 times as high as aperture, narrow umbilical chink. Translucent, periostracum yellowish to reddish brown, typically produced as prominent lamellae at summits of axial riblets that number about 12 per mm at end of third whorl.

Protoconch of 1.60–1.75 convex whorls, 500–530 µm wide, first whorl sculptured with fine, wavy, spiral threads, last whorl traversed by weak, rounded, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 3.20–3.80 strongly convex whorls at maturity, periphery broadly rounded at all stages of growth; spire whorls evenly expanding, last adult whorl typically weakly expanded at maturity, weakly contracted in some specimens; suture well defined. Base broadly rounded, evenly rounded into umbilical chink. Sculpture of weak, weakly sigmoidal, prosocline, collabral riblets, with or without extremely weak spiral threads. Additionally with fine collabral and spiral growth lines. Aperture subcircular, rim thin, weakly thickened within, typically rather strongly flared at maturity.

ETYMOLOGY: Island (Māori).

DISTRIBUTION: Poor Knights Islands, and Battleship Rock, outer Bay of Islands (Fig. 15D).

BIOLOGY: Detritivore occurring in litter and woody debris in coastal forests.

CONSERVATION STATUS: Range restricted. Abundant on the Poor Knights Islands.

REMARKS: Compared with *Cytora torquillum*, which it most resembles, *C. maui* differs in attaining larger size, in being larger relative to the number of whorls, in having a larger protoconch, and in that spiral sculpture on the teleoconch is much weaker or (typically) absent. Five specimens from Battleship Rock, Moturoa Island, Bay of Islands (P.C. Mayhill, January 1980, M.101606, M.167188), are indistinguishable from Poor Knights Islands specimens.

***Cytora pakotai* new species**
(Figs 9N, 14I,J, 17C)

TYPE MATERIAL: Holotype NMNZ M.98334: North Island, N of Dargaville, Pakotai Scenic Reserve, Murray Road, 80 m (NZMS 260 P07/884093), P.C. Mayhill, Nov. 1986. Paratype: M.165636, North Island, N of Dargaville, Pakotai Scenic Reserve, Murray Road, P.C. Mayhill, Sep 1987.

MATERIAL EXAMINED (two lots): Type material (see above).

DESCRIPTION: Shell (holotype) 2.20 mm high, higher than wide (height/width ratio 1.47), narrowly conical (spire angle 50°), spire 1.40 times as high as aperture, very narrow umbilical chink. Translucent, uniform pale yellowish brown. Periostracum produced as low lamellae at summits of axial riblets that number about 15 per mm at end of third whorl.

Protoconch of 1.60 convex whorls, 470 µm wide, first 1.10 whorls essentially smooth, last half-whorl with rounded, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 3.50 convex whorls; periphery rounded at all stages of growth; last adult whorl distinctly contracted and insertion point descending at maturity; suture well defined. Base broadly rounded, evenly rounded into umbilical chink. Sculpture of fine, crisp, crowded, spiral threads; weak, prosocline, collabral riblets; and fine collabral and spiral growth lines. Aperture subcircular, rim thin and rapidly thickened within at maturity.

ETYMOLOGY: After the type locality (noun in apposition).

DISTRIBUTION: North Island, western Northland, known only from Pakotai Scenic Reserve (Fig. 17C).

BIOLOGY: Litter-dwelling detritivore of lowland mixed broadleaved-conifer forest.

CONSERVATION STATUS: The species is presently known from only one location, with the population evidently sparse. Our assessment is that *Cytora pakotai* should be afforded the rank of 'range restricted' according to the criteria of Molloy *et al.* (2002), pending further field survey to establish its conservation status properly.

REMARKS: Compared with *Cytora fasciata*, which has similar teleoconch sculpture, *C. pakotai* differs in attaining smaller size, in being smaller relative to the number of whorls, in being more narrowly conical, and in having a smaller aperture and a narrower umbilical chink. The two species are sympatric (syntopic?) at Pakotai Reserve. *Cytora pakotai* also resembles *C. hazelwoodi* and *C. minor* in having well-developed spiral sculpture on the teleoconch, but differs markedly from *C. hazelwoodi* in lacking the distinctive wavy, spiral threads on the first protoconch whorl, and from *C. minor* in being larger and in having a larger protoconch. The three taxa are allopatric.

***Cytora pallida* (Hutton, 1883)**
(Figs 2F, 9O, 14K,L, 17A)

*Leptopoma pallida* Hutton, 1883a: 477; Hutton, 1884b: 210.

*Leptopoma* (?) *pallida*.- Hutton, 1884a: 184.

*Lagocheilus pallidum*.- Hedley & Suter, 1893: 621.

*Lagochilus pallidum*.- Suter, 1894b: 140.

*Lagochilus pallidus*.- Suter, 1894d: 224.

*Lagochilus* (*Cytora*) *pallidum*.- Kobelt & Möllendorff, 1897: 86; Suter, 1913: 182, pl. 35, fig. 6 (in part: Pirongia record = juvenile *Liarea egea* (Gray, 1850)).

*Japonia* (*Cytora*) *pallida*.- Kobelt, 1902: 66.

*Murdochia pallida*.- Powell, 1937: 67.

*Murdochia pallidum*.- Morton, 1952: 69, text figs 1–3, figs 1–6.

*Cytora pallida*.- Powell, 1957: 91; Rees, 1959: 21; Rees, 1961: 15 (in part = *Cytora tokerau*); Climo, 1970: fig. 1H; Powell, 1979: 86, pl. 12, fig. 2; Solem *et al.*, 1981: 476; Gardner, 1994: 9, text fig. (in part = *C. kerrana* Gardner, 1968); Brook & Goulstone, 1995: 9; Brook, 1999b: 130; Barker, 2006: 135.

NOT *Cytora pallida*.- Suter, 1893: 151 (Pirongia record = juvenile *Liarea egea* (Gray, 1850); Ballance, 1982: 34 (= *C. maui*).

NOT *Cytora pallida*.- Goulstone *et al.*, 1993: 6, 29 (= *C. kerrana*).

TYPE MATERIAL: Neotype (here selected) NMNZ M.174819: North Island, Auckland, Cornwallis (NZMS 260 R11/530648), R.K. Dell.

MATERIAL EXAMINED (365 lots): Neotype (see above), M.784 (3), M.3993 (1), M.3999 (2), M.4011 (2), M.4038 (1), M.8827 (8), M.25442 (7), M.32177 (2), M.37075 (11), M.37079 (1), M.37095 (3), M.37224 (6), M.37518 (5), M.37578 (4), M.37977 (2), M.38127 (1), M.38162 (8), M.38170 (2), M.38220 (1), M.38798 (8), M.47753 (1), M.47772 (1), M.48075 (1), M.48668 (8), M.48694 (2), M.52467 (2), M.55329 (many), M.55403 (1), M.55417 (2), M.55439 (3), M.55477 (3), M.55826 (8), M.55836 (1), M.58137 (2), M.58159 (8), M.61932 (3), M.62516 (5), M.62540 (4), M.63239 (2), M.63458 (1), M.68400 (2), M.69202 (1), M.69233 (4), M.69805 (1),

M.69823 (20), M.69914 (2), M.73577 (2), M.75562 (4), M.75575 (1), M.76546 (2), M.76627 (2), M.78496 (3), M.78676 (2), M.78824 (2), M.78870 (2), M.80206 (1), M.80330 (1), M.80349 (4), M.81738 (1), M.82216 (4), M.82229 (1), M.82289 (4), M.82423 (5), M.82694 (1), M.82703 (2), M.82816 (4), M.82830 (3), M.82858 (8), M.82870 (5), M.83049 (5), M.83125 (5), M.83127 (3), M.83177 (1), M.83211 (1), M.84634 (7), M.84635 (2), M.84636 (1), M.84638 (20), M.84639 (8), M.84641 (2), M.84642 (1), M.88388 (1), M.88429 (1), M.88432 (1), M.88451 (many), M.88632 (1), M.88694 (11), M.88727 (1), M.93187 (3), M.97217 (1), M.97239 (1), M.97495 (1), M.97588 (2), M.97608 (1), M.97758 (1), M.97960 (3), M.97970 (1), M.98013 (1), M.98211 (3), M.98228 (5), M.98240 (1), M.98306 (6), M.98798 (2), M.99158 (4), M.99262 (1), M.101618 (1), M.101627 (1), M.101647 (4), M.101657 (1), M.102713 (13), M.104234 (5), M.104268 (2), M.104393 (10), M.104535 (1), M.114411 (4), M.114417 (4), M.114452 (3), M.114460 (2), M.114516 (20), M.115950 (1), M.116109 (2), M.116710 (2), M.124261 (1), M.124262 (8), M.124263 (3), M.124266 (22), M.124281 (4), M.124282 (2), M.124283 (3), M.124284 (1), M.124285 (1), M.124286 (3), M.124287 (3), M.124288 (5), M.124289 (12), M.124290 (3), M.124294 (13), M.124296 (3), M.124299 (2), M.124302 (1), M.124305 (1), M.124306 (1), M.124307 (6), M.124308 (17), M.124309 (1), M.124310 (22), M.124311 (3), M.124312 (3), M.124320 (1), M.124325 (1), M.124339 (9), M.124341 (3), M.124346 (2), M.124350 (1), M.124351 (2), M.124352 (7), M.124354 (3), M.124356 (3), M.124359 (1), M.124369 (1), M.124370 (6), M.124372 (2), M.124373 (6), M.124374 (1), M.124375 (1), M.124376 (1), M.124377 (1), M.124378 (1), M.124379 (3), M.124380 (10), M.124381 (5), M.124382 (2), M.124383 (5), M.124384 (8), M.124385 (1), M.124386 (1), M.124387 (many), M.124388 (30), M.124394 (9), M.124395 (7), M.124396 (2), M.124400 (5), M.124401 (2), M.124402 (11), M.124403 (29), M.124404 (15), M.124405 (9), M.124406 (2), M.124407 (24), M.124408 (2), M.124409 (2), M.124410 (1), M.124411 (1), M.124412 (1), M.124413 (2), M.124414 (2), M.124415 (5), M.124416 (5), M.124417 (6), M.124531 (4), M.124534 (1), M.124535 (2), M.124552 (12), M.124582 (3), M.124739 (11), M.124744 (6), M.124776 (9), M.124781 (1), M.124788 (6), M.124855 (16), M.124856 (6), M.124857 (14), M.124858 (1), M.124908 (1), M.124929 (6), M.124969 (4), M.124974 (6), M.124978 (1), M.124983 (10), M.127840 (4), M.127986 (30), M.129283 (5), M.156188 (1), M.156591 (1), M.156801 (1), M.156802 (1), M.156994 (2), M.156995 (1), M.156996 (3), M.156997 (5), M.156998 (9), M.156999 (4), M.161932 (1), M.162354 (1), M.162901 (1), M.163094 (1), M.163225 (1), M.163259 (1), M.163287 (1), M.163369 (3), M.163413 (26), M.163443 (7), M.163482 (2), M.163500 (14), M.163543 (5), M.163634 (3), M.163675 (6), M.163691 (7), M.163719 (6), M.163741 (2), M.163776 (many), M.163816 (1), M.163825 (7), M.163884 (many), M.163905 (7), M.163950 (16), M.163980 (18), M.164034 (1), M.164037 (4), M.164094 (3), M.164099 (4), M.164143 (8), M.164183 (20), M.164196 (5), M.164221 (1), M.164228 (14), M.164276 (3), M.164363 (5), M.164695 (2), M.164753 (1), M.164831 (1), M.164856 (5), M.164882 (18), M.164916 (3), M.164967 (6), M.165029 (1), M.165069 (1), M.165120 (6), M.165263 (1), M.165330 (1), M.165382 (1), M.165406 (5), M.165440 (2), M.165593 (3), M.165639 (2), M.165666 (1), M.165702 (1), M.165726 (3), M.165774 (3), M.165792 (1), M.165812 (2), M.165897 (4), M.166966 (1), M.167353 (1), M.167797 (2), M.167878 (1), M.167896 (1), M.167940 (3), M.168016 (5), M.168060 (4), M.168077 (1), M.168197 (6), M.168224 (1), M.168256 (2), M.168341 (5), M.168379 (18), M.168388 (1), M.168446 (2), M.169044 (2), M.169045 (1), M.169046 (3), M.169047 (2), M.169048 (1), M.169049 (5), M.169050 (1), M.169051 (4), M.169052 (6), M.169053 (2), M.169054 (3), M.169055 (3), M.169056 (1), M.169057 (5), M.169058 (1), M.169059 (1), M.169060 (2), M.169216 (4), M.169217 (8), M.169218 (1), M.169425 (1), M.169452 (1), M.169506 (1), M.170175 (1), M.170176 (2), M.170177 (1), M.170178 (2), M.170179 (1), M.170180 (3), M.170203 (2), M.170204 (2), M.174784 (8), M.175032 (4), M.175061 (20), M.175078 (2), M.175109 (8), M.175123 (1), M.175138 (3), M.175149 (4), M.175161 (4), M.175170 (3), M.175195 (1), M.175223 (20), M.175237 (10), M.175251 (1), M.175272 (1), M.175344 (5), M.177700 (5), M.177712 (7), M.178059 (many), M.178063 (many), M.178064 (5), M.178068 (7), M.178069 (5), M.178075 (10), M.178076 (many).

REDESCRIPTION: Shell 4.00–6.85 mm high at maturity, higher than wide (height/width ratio 1.28–1.54), narrowly conical (spire angle 51–65°), spire 1.27–1.68 times as high as aperture, narrowly umbilicate. Protoconch pale

yellowish brown to dark reddish brown; teleoconch pale yellowish brown to dark reddish brown, additionally with whitish peripheral spiral band that is almost entirely exposed suprasuturally on spire, most specimens with an additional whitish median basal spiral band; some specimens with an additional broad pale median band on spire whorls, others more or less uniform pale buff or white. Periostracum on teleoconch produced on summits of axial riblets as thin, rather irregularly spaced lamellae on spire and base, numbering four to five per mm at end of third teleoconch whorl, set with about seven rows of slender spines spread across spire whorls and about eight additional rows on base (spines may be indistinct or broken in adults), lamellae on last few whorls of adults frequently elevated as a broad subsutural band of ragged-edged lamellae, some very large specimens with an additional peripheral row.

Protoconch of about 1.90–2.00 convex whorls, 730–830 µm wide, sculptured with six similar, rather strong, widely spaced spiral threads, weaker on last whorl, which is additionally traversed by rounded, prosocline, collabral riblets.

Teleoconch of 3.75–5.00 broadly convex whorls; first three whorls with peripheral angulation that is obscured by succeeding whorls, periphery becoming rounded on fourth whorl, then broadly rounded; spire whorls rather evenly expanding, last adult whorl slightly but distinctly constricted, insertion point of last part weakly descending in some specimens; suture well defined. Base broadly and rather evenly rounded from periphery to tightly rounded rim of deep, narrow, steep-sided umbilicus. Sculpture of very weak, prosocline, collabral riblets, and weak spiral threads and grooves, commonly with or without areas (rarely extensive coverage) of malleations of weak to moderate strength after second whorl; fine, prosocline, collabral growth lines throughout. Aperture roundly D-shaped, lip rim thin and simple, gently thickened within.

Radula (Fig. 2F) with characteristics of the genus.

DISTRIBUTION: Northern North Island, from Doubtless Bay to vicinity of Auckland (Fig. 17A).

BIOLOGY: Detritivore, occurring predominately on the ground, but also occasionally found in suspended humus. Inhabits broadleaved shrublands, and broadleaved-conifer and *Agathis* forests, from near sea-level to *c.* 620 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora pallida* is highly distinctive in the combination of large size (height up to 6.85 mm), narrowly conical spire, and especially the presence of rather strong, widely spaced spiral threads on the first whorl of the protoconch.

Since type material appears to no longer exist (e.g. Freeman *et al.* 1996), we have selected a neotype from the vicinity of Auckland, the original type locality.

Earlier records of *Cytora pallida* south of Auckland (e.g. Rees 1961) are here interpreted as *C. tokerau.*

***Cytora pannosa* (Hutton, 1882)**

(Figs 2E, 16A, 17B, 18A,B)

*Leptopoma pannosa* Hutton, 1882: 282; Hutton, 1883b: 140; Hutton, 1884b: 209. In part = *C. chiltoni* and *C. mayhillae*.

*Lagocheilus pannosum.*- Hedley & Suter, 1893: 621.

*Lagochilus pannosum.*- Suter, 1894b: 140.

*Lagochilus pannosus.*- Suter, 1894d: 224.

*Lagochilus* (*Cytora*) *pannosum.*- Kobelt & Möllendorff, 1897: 86; Suter, 1913: 183, pl. 35, fig. 7.

*Japonia* (*Cytora*) *pannosa.*- Kobelt, 1902: 67.

*Murdochia pannosa.*- Powell, 1937: 67.

*Cytora pannosa.*- Powell, 1957: 91; Powell, 1979: 84, fig. 12/1; Gardner, 1994: 19, right text fig. only (left text fig. apparently = *C. kahurangi*).

*Cytora* sp. 6 Spencer *et al.*, in press.

TYPE MATERIAL: The original lot of three syntypes, labelled 'Greymouth, R. Helms' contains three species: the lectotype of *Leptopoma pannosa* (here selected) CM M1266, the paralectotypes being *C. chiltoni* (CM M18077) and *C. mayhillae* (CM M18078).

MATERIAL EXAMINED (139 lots): Type material (see above), M.15126 (4), M.15137 (4), M.28885 (1), M.28958 (2), M.37217 (2), M.38847 (1), M.55546 (2), M.55895 (1), M.55910 (2), M.56516 (2), M.56518 (3), M.56539 (2), M.57251 (3), M.61704 (1), M.62596 (1), M.69906 (1), M.73102 (6), M.73143 (5), M.77872 (10), M.78419 (10), M.78618 (1), M.78702 (3), M.78705 (1), M.79259 (5), M.79270 (2), M.82340 (1), M.82760 (1), M.89126 (2), M.98755 (1), M.98775 (2), M.98918 (1), M.98940 (2), M.98957 (4), M.99057 (2), M.100722 (36), M.101236 (many), M.101736 (3), M.102011 (1), M.102640 (1), M.103189 (4), M.103331 (2), M.103357 (1), M.103383 (10), M.103708 (3), M.103716 (1), M.103724 (1), M.103760 (5), M.103770 (3), M.105143 (1), M.105507 (3), M.105515 (1), M.105546 (28), M.105863 (2),

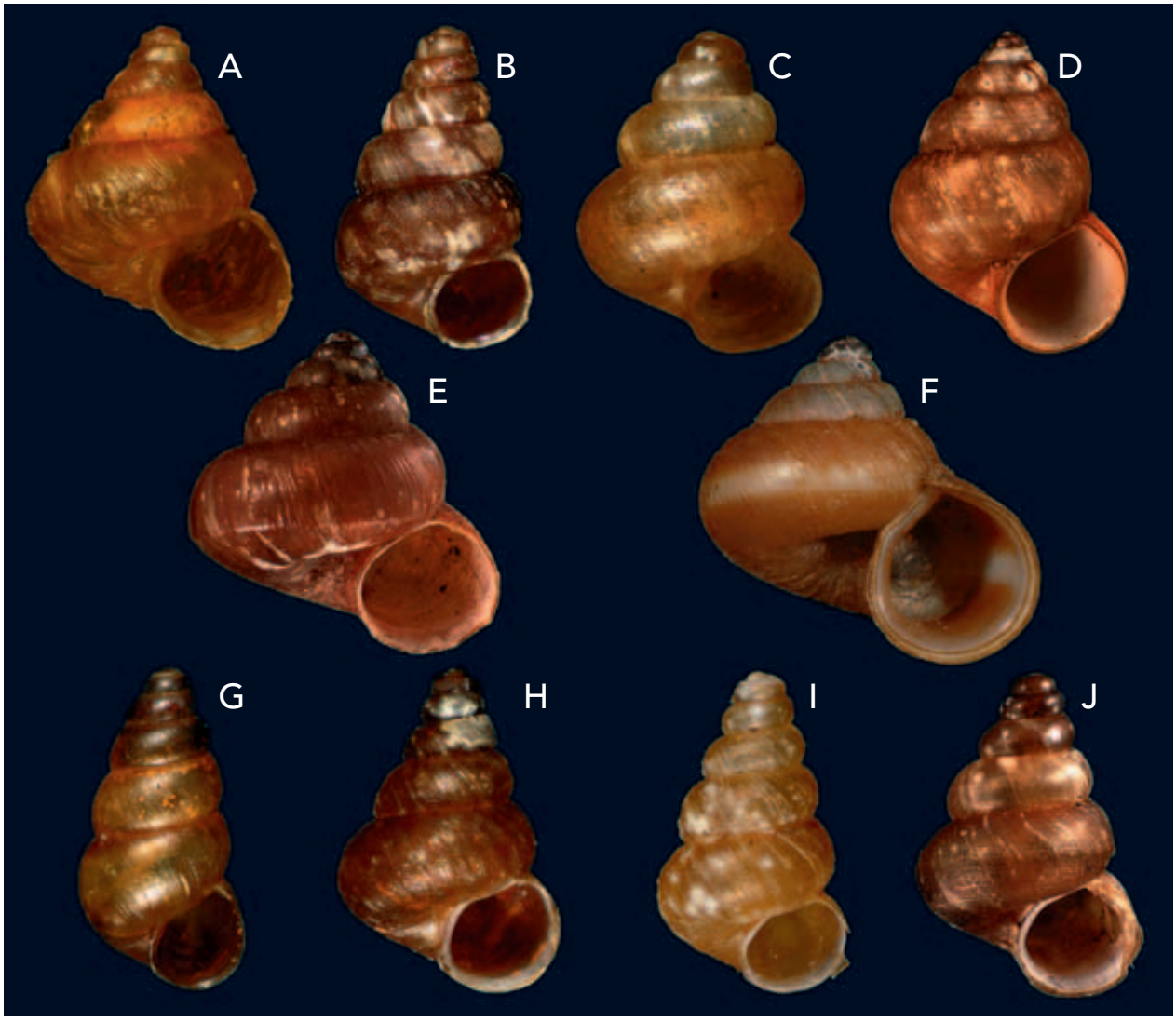


Fig. 16 Shells of *Cytora* species. A, *Cytora pannosa* (Hutton, 1882), NNE of Greymouth, N of Rapahoe, M.115215 (3.00 x 2.45 mm); B, *Cytora parrishi* n.sp., Karikari Peninsula, Whatuwhiwhi, holotype, M.179676 (2.55 x 1.60 mm); C, *Cytora rakiura* n.sp., E of Port Pegasus, island in Seal Creek, holotype, M.30684 (1.80 x 1.40 mm); D, *Cytora septentrionalis* (Suter, 1907), Waiheke Island, Cowes Bay, holotype, M.125180 (4.25 x 3.12 mm); E, *Cytora paparoa* n.sp., NE of Punakaiki, Fox River valley, paratype, M.106278 (3.30 x 3.15 mm); F, *Cytora solitaria* (Powell, 1935), Three Kings Islands, Great Island, M.29248 (3.90 x 4.10 mm); G, *Cytora tepakiensis* N. Gardner, 1967, SE of Cape Reinga, Tapotupotu, M.156446 (3.10 x 1.60 mm); H, *Cytora tokerau* n.sp., Doubtless Bay, Bushy Point Road, paratype, M.156805 (2.31 x 1.60 mm); I, *Cytora torquillum* (Suter, 1894), Awhitu Peninsula, Jones Bush, M.51793 (2.00 x 1.20 mm); J, *Cytora tuarua* n.sp., NW of St Arnaud, Big Bush, holotype, M.179688 (2.55 x 1.75 mm).

M.106206 (1), M.106279 (9), M.107021 (20), M.107039 (2), M.107133 (4), M.115019 (3), M.115076 (many), M.115104 (2), M.115215 (many), M.120445 (many), M.120475 (21), M.123434 (1), M.123563 (1), M.123593 (2), M.123642 (1), M.123733 (1), M.124021 (1), M.124035 (3), M.124683 (1), M.124709 (4), M.124804 (1), M.124805 (1), M.124806 (1), M.124808 (3), M.124809 (1), M.124811 (7), M.124812 (1), M.124813 (1), M.124814 (3), M.124816 (13), M.124823 (1), M.124824 (1), M.124825 (3), M.124826 (4), M.124827 (1), M.124828 (2), M.124829 (3), M.124830 (1), M.124831 (1), M.124832 (1), M.124833 (1), M.124834 (1), M.124835 (1), M.124836 (1), M.124837 (5), M.124838 (5), M.124839 (12), M.124844 (6), M.124845

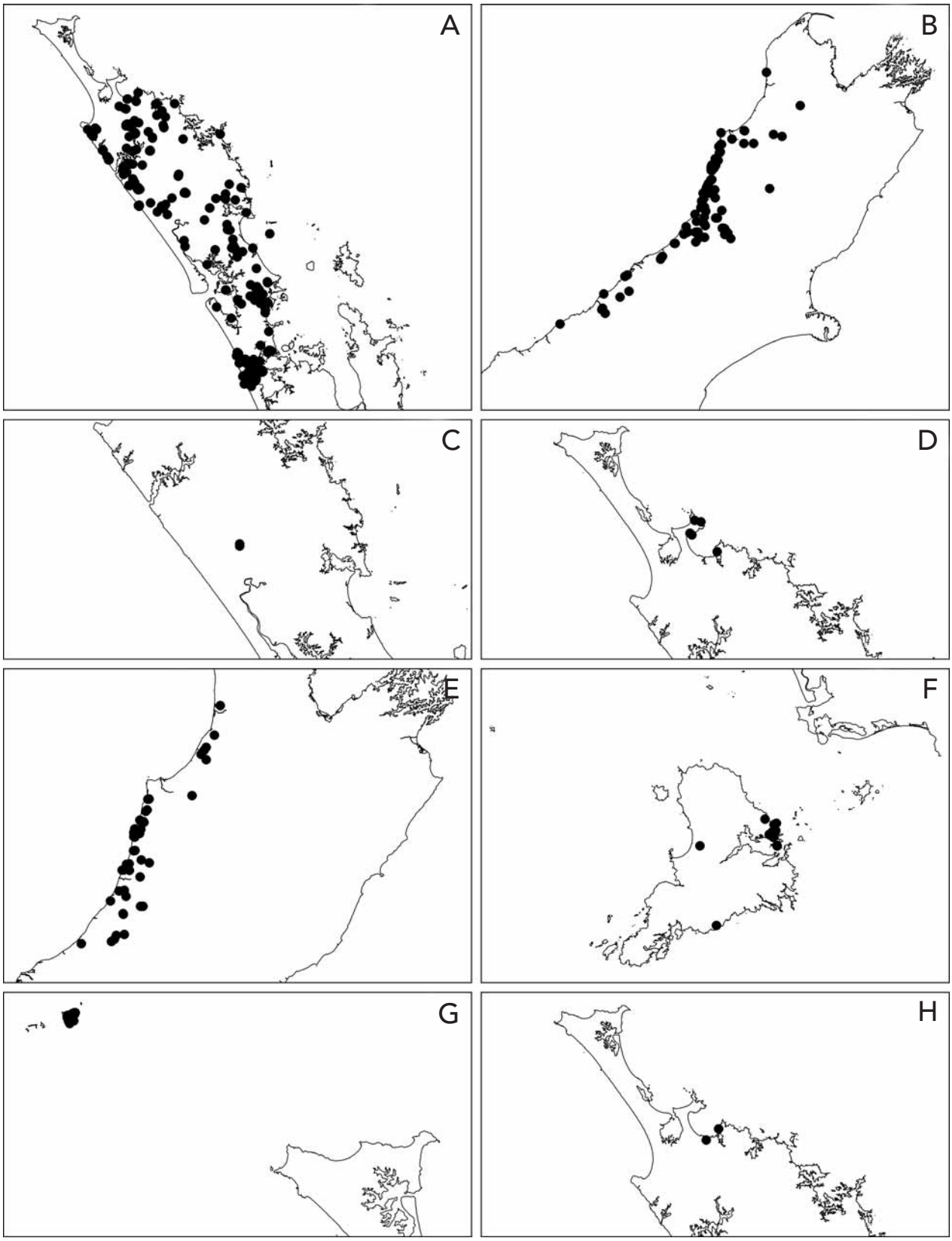


Fig. 17 Distributions of *Cytora* species within New Zealand. A, *Cytora pallida* (Hutton, 1883); B, *Cytora pannosa* (Hutton, 1882); C, *Cytora pakotai* n.sp.; D, *Cytora parrishi* n.sp.; E, *Cytora paparoa* n.sp.; F, *Cytora rakiura* n.sp.; G, *Cytora solitaria* (Powell, 1935); H, *Cytora taipa* n.sp.

(2), M.124848 (30), M.124849 (17), M.124852 (16), M.124853 (7), M.124865 (4), M.124871 (1), M.124883 (20), M.124891 (1), M.124905 (6), M.124956 (1), M.124959 (1), M.124999 (4), M.126237 (1), M.126654 (3), M.129087 (1), M.129088 (1), M.129093 (2), M.129101 (1), M.129151 (11), M.157715 (1), M.157737 (1), M.157843 (1), M.157969 (3), M.159004 (1), M.159033 (2), M.159056 (4), M.159067 (3), M.159385 (8), M.159549 (10), M.159551 (4), M.159585 (2), M.159635 (5), M.161559 (1), M.162418 (1), M.169213 (11), M.170165 (4).

REDESCRIPTION: Shell 2.65–3.75 mm high at maturity, higher than wide (height/width ratio 1.18–1.25), broadly conical (spire angle 59–70°), weakly coeloconoid, spire 1.16–1.68 times as high as aperture, narrowly umbilicate. Translucent uniform yellowish to deep reddish brown; some specimens reddish brown with median whitish or pale buff spiral band on spire and another on outer base, occasional specimens uniform translucent whitish. Periostracum on teleoconch produced at summits of widely spaced collabral riblets as thin lamellae on spire and base, including peripheral row of prominent, sharply triangular projections, numbering about five per mm at end of third whorl.

Protoconch of 2.00–2.25 convex whorls, 650–730 µm wide, fine, crisp spiral lirae throughout, spiral lirae weaker on last half-whorl where traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 3.10–4.10 convex whorls; spire whorls expanding slightly more rapidly than protoconch (weakly coeloconoid), last adult whorl at most weakly constricted; base and sides more broadly rounded than periphery, evenly curving into umbilicus; suture well defined. Sculpture of weak, weakly sigmoidal, widely spaced, prosocline, collabral riblets that are surmounted by periostracal lamellae; additionally with numerous weak, crowded, spiral threads and fine collabral growth lines. Aperture subcircular, rim thin and simple, gently thickened within and typically gently flared at maturity.

Radula (Fig. 2E) with characteristics of the genus.

DISTRIBUTION: Western South Island, from Cape Farewell to as far south as vicinity of Haast (Fig. 17B).

BIOLOGY: Litter-dwelling detritivore of shrublands and broadleaved-conifer and *Nothofagus* forests. Primarily known from habitats below 300 m elevation, but the species is known to occur up to 1400 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora pannosa* is highly distinctive among South Island *Cytora* species in the combination of rather broadly conical spire, moderate size, the enlarged periostracal projections at the periphery, and especially the strongly spirally lirate protoconch.

Since the type material of *Leptopoma pannosa* comprises three species, and the original illustrations are poor, it is impossible to know which one Hutton (1884a: 173, fig. 10U) had in hand when he illustrated the operculum and radula. We have selected the most broadly conical of the syntypes as lectotype, in accordance with the concept of the species generally adopted by New Zealand malacologists.

***Cytora paparoa*** **new species**

(Figs 2G, 16E, 17E, 18C,D)

TYPE MATERIAL: Holotype NMNZ M.179675 and paratypes M.115070 (17), AIM AK 73301 (1): South Island, NNE of Punakaiki, Fox River (NZMS 260 K30/761069), F.M. Climo & K. Mahlfeld, 23 Dec. 1992. Additional paratypes: M.106278 (4), South Island, NE of Punakaiki, 500 m W of Fox River Cave, D.J. Roscoe, 23 Jan. 1982.

MATERIAL EXAMINED (70 lots): Type material (see above), M.13400 (2), M.14178 (3), M.14182 (1), M.28884 (3), M.55544 (1), M.55909 (3), M.56447 (1), M.56540 (1), M.57234 (1), M.57512 (1), M.73133 (4), M.76829 (1), M.77370 (1), M.77870 (1), M.78423 (1), M.78706 (1), M.79866 (5), M.82343 (1), M.84361 (1), M.89125 (1), M.89705 (3), M.91823 (6), M.91825 (1), M.91827 (2), M.96794 (1), M.98963 (1), M.101038 (5), M.101738 (7), M.102736 (2), M.103208 (1), M.103389 (4), M.103768 (1), M.105298 (1), M.105513 (1), M.105858 (4), M.106078 (1), M.106115 (1), M.107087 (1), M.107134 (3), M.114580 (1), M.114633 (1), M.115025 (1), M.115098 (2), M.123435 (1), M.123471 (5), M.123577 (2), M.124036 (9), M.124803 (1), M.124842 (5), M.124850 (1), M.124901 (24), M.124902 (2), M.124904 (12), M.124911 (2), M.124912 (2), M.124913 (10), M.124914 (2), M.124915 (1), M.126232 (3), M.129072 (1), M.159012 (1), M.159458 (1), M.159550 (1), M.159564 (1), M.174820 (1), M.174821 (7).

DESCRIPTION: Shell 2.70–3.20 mm wide at maturity, about as wide as high (height/width ratio 0.96–1.05), broadly conical (spire angle about 85°), spire 1.26–1.39 times as high as aperture, widely umbilicate. Translucent white beneath colourless to deep reddish-brown periostracum. Periostracum on teleoconch smooth.

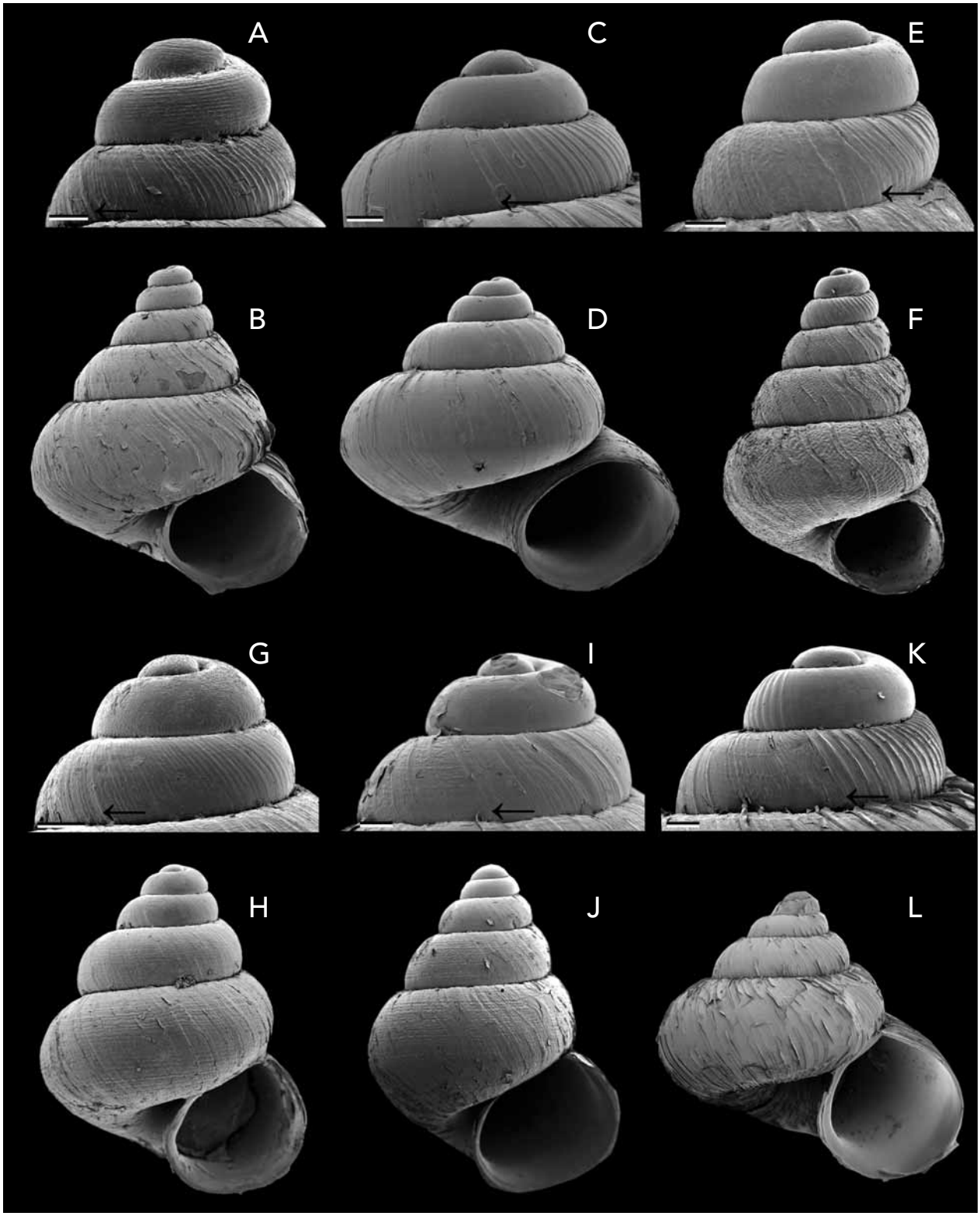


Fig. 18 Lateral views of whole shells and protoconchs (protoconch–teleoconch boundary arrowed) of *Cytora* species (SEM). A, B, *Cytora pannosa* (Hutton, 1882), NNE of Greymouth, N of Rapahoe, M.115215 (B, 2.80 x 2.35 mm); C, D, *Cytora paparoa* n.sp., NNE of Punakaiki, Fox River, paratype, M.115070 (C), and holotype, M.179675 (D, 2.60 x 2.70 mm); E, F, *Cytora parrishi* n.sp., Karikari Peninsula, Whatuwhiwhi, paratypes, M.124755 (F, 2.45 x 1.70 mm); G, H, *Cytora rakiura* n.sp., W of Halfmoon Bay, Fern Gully, paratype, M.88987 (H, 1.95 x 1.50 mm); I, J, *Cytora septentrionalis* (Suter, 1907), SW of Whangamata,

Protoconch of 1.65–1.75 convex whorls, 700–770 µm wide, first whorl smooth, last half-whorl traversed by rounded, regularly spaced, collabral riblets that are stronger and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 2.30–2.75 whorls at maturity; periphery narrowly and roundly angulate, angulation becoming slightly but distinctly elevated in some specimens; spire whorls strongly convex and rather evenly expanding, base broadly rounded from periphery into umbilicus; last adult whorl contracted, end of last adult whorl disjunct and descending; suture well defined. Sculpture of very weak, prosocline, collabral riblets, and fine collabral growth lines. Aperture at maturity subcircular, rim thin and simple, slightly thickened within.

Radula (Fig. 2G) with characteristics of the genus.

ETYMOLOGY: After Paparoa National Park, which includes the type locality.

DISTRIBUTION: Western South Island, from vicinity of Lake Hanlon to Lake Kanieri (Fig. 17E).

BIOLOGY: Litter-dwelling detritivore of broadleaved shrublands, broadleaved-conifer forests and *Nothofagus* forests. Primarily a lowland species, but collection records indicate occurrence at 500–900 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora paparoa* is distinctive in the combination of whitish or uniform brown shell, collabral riblets on last half protoconch whorl, low spire, subangulate periphery and wide umbilicus. The periostracum on the teleoconch is characteristically smooth, but one otherwise typical specimen from the Paparoa Range (M.129072) has thin lamellae at the summits of the axial riblets.

***Cytora parrishi* new species**

(Figs 16B, 17D, 18E,F)

*Cytora* sp. 'Whangatupere' McGuinness, 2001: 636.

*Cytora* sp. 3 (NMNZ M.151437) Hitchmough, 2002: 47.

*Cytora* sp. 14 (NMNZ M.151437) Brook, 2002a: 23; Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.179676 and paratypes M.124755 (30), AIM AK 73302 (2): North Island, Karikari Peninsula, Whatuwhiwhi, W-facing hillside S of mouth of Waihapurua Stream (NZMS 260 O03/475022), in coastal forest, B.A. Marshall, F.J. Brook & K.J. Burch, 28 Nov. 2003. Additional paratypes: M.124454 (many), Karikari Peninsula, W end of Parakerake Bay, B.A. Marshall, F.J. Brook & K.J. Burch, 28 Nov. 2003.

MATERIAL EXAMINED (eight lots): Type material (see above), M.151437 (1), M.156673 (1), M.156804 (many), M.177701 (many).

DESCRIPTION: Shell up to 2.65 mm high at maturity, higher than wide (height/width ratio 1.52–1.54), narrowly conical (spire angle 39–50°), spire 2.06–2.12 times as high as aperture, very narrowly umbilicate. Protoconch deep reddish brown; teleoconch either uniform deep reddish brown or with paler broad, peripheral spiral band. Periostracum on teleoconch produced at summits of collabral riblets as thin lamellae on spire and base, numbering eight or more per mm at end of third whorl.

Protoconch of 1.50–1.75 broadly convex whorls, 550 µm wide, first whorl smooth, remainder traversed by rounded, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 3.75 broadly convex whorls; first two whorls with weak, rounded peripheral angulation that is obscured by succeeding whorls, periphery becoming rounded on next half-whorl, then broadly rounded; spire whorls rather evenly expanding, last adult whorl slightly constricted and insertion point gently descending; suture deeply impressed. Base more broadly rounded than periphery, smoothly and tightly curving into narrow umbilicus. Sculptured throughout with weak, distinctly sigmoidal, prosocline, collabral riblets, superimposed on fine, densely crowded malleations; additionally with fine collabral growth lines. Aperture roundly D-shaped, rim thin and simple.

ETYMOLOGY: After Richard Parrish (Whangarei), who obtained a number of lots that were used for this revision.

DISTRIBUTION: North Island, Northland, from Karikari Peninsula and Waitetoki, Doubtless Bay (Fig. 17D).

BIOLOGY: Litter-dwelling detritivore in lowland coastal forest.

CONSERVATION STATUS: Ranked 'data deficient' by McGuinness (2001). Listed as 'nationally endangered (data

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Wharekirauponga Track, M.82906 (J, 3.95 x 2.90 mm); K, L, *Cytora solitaria* (Powell, 1935), Three Kings Islands, Great Island, M.155694 (K) and M.29248 (L, 3.90 x 4.05 mm). Scale bars 100 µm.

poor; one location; human induced)' by Brook (2002a) and Hitchmough (2002). Brook (2002a) noted that the species is known from only a few specimens collected from a small remnant of coastal forest. The habitat is subject to development. Our assessment is that this range-restricted species continues to be of immediate conservation concern, and should be ranked 'nationally vulnerable' according to the criteria of Molloy *et al.* (2002).

REMARKS: *Cytora parrishi* is extremely distinctive in the combination of small size, smooth first protoconch whorl, dark pigmentation, strongly malleate teleoconch sculpture, and tall, narrowly conical spire.

***Cytora rakiura*** **new species**

(Figs 16C, 17F, 18G,H)

*Cytora* sp. 4 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.30684 and paratypes M.25576 (1), AIM AK 73303 (1): Stewart Island, E of Port Pegasus, island in Seal Creek (NZMS 260 D49/205255), R.K. Dell & B.A. Holloway, 22 Jan. 1955. Additional paratypes: M.14531 (5), Stewart Island, Port Pegasus, Crooked Reach, R.K. Dell & B.A. Holloway, 22 Jan. 1955; M.20655 (5), Stewart Island, Mason Bay, Island Hill Station, E.C. Smith, May 1958; M.37218 (3), Stewart Island, Paterson Inlet, Ulva Island, F.M. Climo, 3 Feb 1968; M.88987 (2), Stewart Island, W of Halfmoon Bay, Fern Gully, M. Leighton, 27 Aug 1967.

MATERIAL EXAMINED (16 lots): Type material (see above), M.36600 (1), M.68327 (1), M.103562 (1), M.124645 (1), M.124646 (3), M.124647 (1), M.157195 (1), M.157197 (1), M.157228 (1).

DESCRIPTION: Shell 1.70–2.00 mm high at maturity, higher than wide (height/width ratio 1.19–1.35), narrowly to rather broadly conical (spire angle 52–66°), spire 1.27–1.57 times as high as aperture, narrowly umbilicate. Translucent yellowish brown. Periostracum thin, produced at summits of few collabral riblets as very weak lamellae.

Protoconch of 1.60–1.75 convex whorls, 470–480 µm wide, first whorl sculptured with minute hemispherical granules, last half-whorl traversed by weak, rounded, regularly spaced, collabral riblets that are more strongly prosocline than collabral growth lines on immediately succeeding teleoconch.

Teleoconch of up to 2.50–3.00 whorls at maturity; spire whorls strongly convex and rather evenly expanding, last adult whorl contracted and descending, base broadly rounded from periphery into umbilicus; suture well defined. Sculpture of weak, prosocline, collabral riblets, crowded spiral threads, and fine collabral growth lines. Aperture at maturity ovate, rim thin and simple, slightly thickened within.

ETYMOLOGY: Rakiura is the Māori name for Stewart Island.

DISTRIBUTION: Stewart Island and the adjacent, smaller Ulva Island (Fig. 17F).

BIOLOGY: Litter-dwelling detritivore of lowland broad-leaved-conifer forests.

CONSERVATION STATUS: Our assessment is that the conservation status *Cytora rakiura* is not of immediate conservation concern.

REMARKS: *Cytora rakiura* is distinctive in the combination of small size (height 2.00 mm or less), finely spirally lirate teleoconch, and the minutely granular sculpture on the first whorl of the protoconch. The only other *Cytora* species known from Stewart Island is *C. tuarua* n.sp., which is described below. Among the known *Cytora* species, *C. rakiura* most closely resembles *C. tawhiti* from the Auckland Islands in gross facies (see below).

***Cytora septentrionalis*** **(Suter, 1907)**

(Figs 16D, 18I,J, 19A)

*Lagochilus chiltoni septentrionalis* Suter, 1907: 238, pl. 22, fig. 9 (in part = *C. houhora* n.sp.).

*Lagochilus* (*Cytora*) *chiltoni septentrionale*.- Suter, 1913: 180, pl. 11, fig. 9 (in part = *C. houhora*).

*Murdochia chiltoni septentrionale*.- Powell, 1937: 67.

*Cytora septentrionale*.- Powell, 1957: 91; Powell, 1979: 85 (in part = *C. houhora*); Goulstone, 1990: 21, text figs; Gardner, 1994: 12, text fig.; Brook, 1999b: 130.

TYPE MATERIAL: Holotype NMNZ M.125180: North Island, Waiheke Island, Cowes Bay, H. Suter.

MATERIAL EXAMINED (43 lots): Holotype (see above), M.15138 (4), M.37088 (1), M.37147 (1), M.37903 (14), M.62500 (6), M.82906 (3), M.83216 (1), M.84640 (2), M.97108 (2), M.97906 (7), M.101626 (3), M.104356 (2), M.114443 (1), M.114482 (4), M.124300 (1), M.124301 (1), M.124532 (1), M.124533 (1), M.124559 (1), M.124562 (1), M.163202 (1), M.163345 (1), M.163853 (1), M.163859 (2), M.163979 (3), M.164064 (2), M.164126 (4), M.164727 (1), M.164736 (5), M.164804 (9), M.165286 (1), M.167846 (1), M.169039 (1), M.169061 (6), M.169062 (1), M.169063 (2), M.169209 (1), M.169210 (6), M.169211 (1), M.169212 (1), M.174817 (1), M.175043 (1).

REDESCRIPTION: Shell 3.60–6.25 mm high at maturity, higher than wide (height/width ratio 1.33–1.49), narrowly

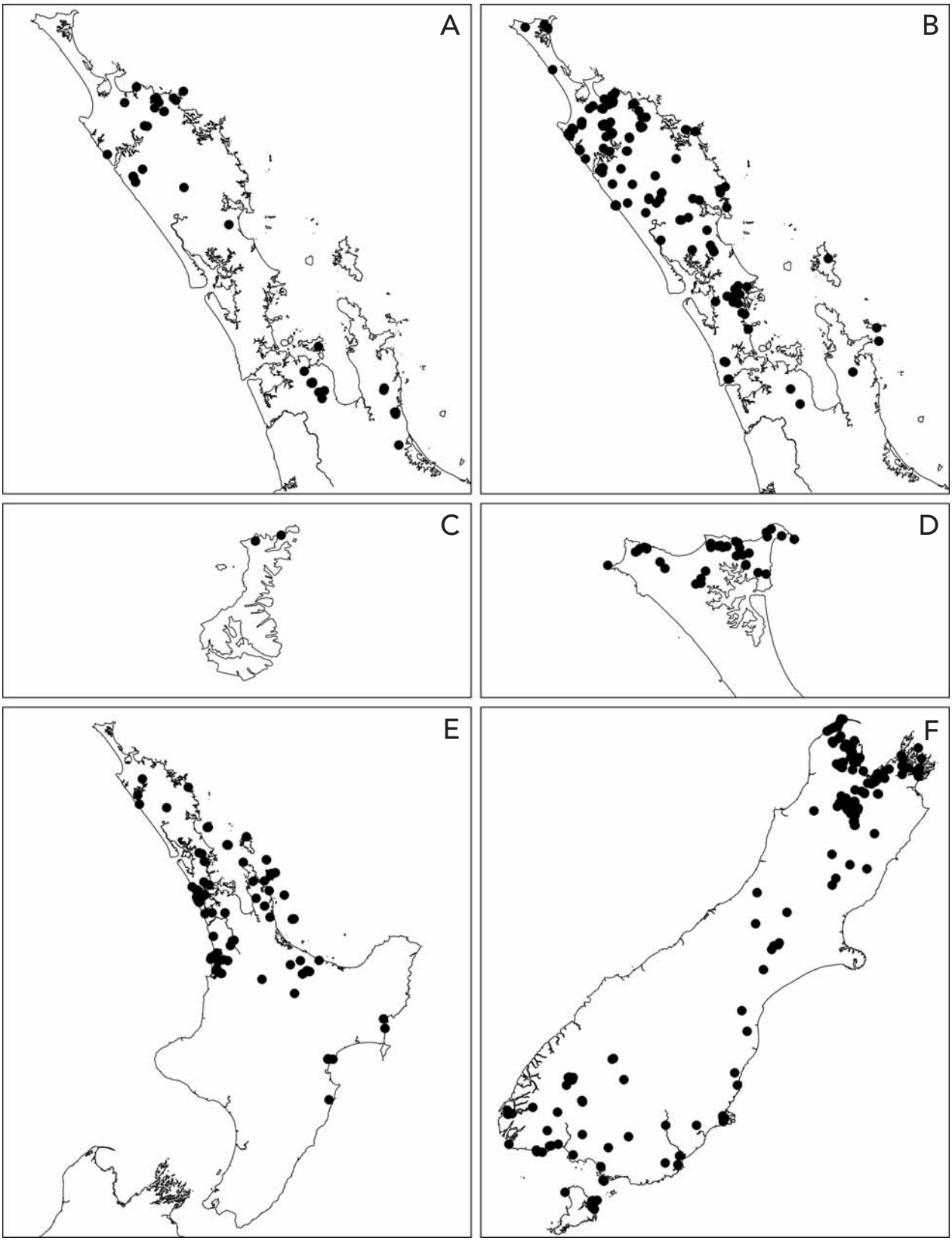


Fig. 19 Distributions of *Cytora* species within New Zealand. A, *Cytora septentrionalis* (Suter, 1907); B, *Cytora tokerau* n.sp.; C, *Cytora tawhiti* n.sp.; D, *Cytora tepakiensis* Gardner, 1967; E, *Cytora torquillum* (Suter, 1894); F, *Cytora tuarua* n.sp.

conical (spire angle 41–58°), spire 1.17–1.43 times as high as aperture, narrowly umbilicate. Protoconch and teleoconch deep reddish brown, protoconch typically darker, periphery of teleoconch with narrow, pale yellowish-brown band. Periostracum on teleoconch produced at summits of collabral riblets as rather prominent, thin lamellae on spire and base, numbering about 15 per mm at end of third whorl, alternate second-fourth lamella strongly elevated adapically to form broad, elevated, subsutural band.

Protoconch of 1.65–1.80 convex whorls, 670–730 µm wide, first whorl smooth and glossy, remainder traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 3.5–4.5 broadly convex whorls at maturity; first three whorls with peripheral angulation that is obscured by succeeding whorls, periphery becoming broadly rounded on fourth whorl; spire whorls rather evenly expanding, last adult whorl very slightly constricted and insertion point gently descending; suture well defined. Base more broadly rounded than periphery, smoothly and tightly curving into narrow umbilicus. Sculptured throughout with fine, rounded, crowded, typically more or less wavy, spiral threads; and weak, weakly sigmoidal, prosocline, collabral riblets; additionally with fine collabral growth lines that may form a faintly malleate pattern where intersecting wavy spiral threads. Aperture roundly D-shaped, rim weakly but distinctly flared.

DISTRIBUTION: Northern North Island, from Doubtless Bay to vicinity of Waipu Caves, Hunua Ranges, Coromandel Range and northern Kaimai Mamaku State Forest Park (Fig. 19A).

BIOLOGY: Detritivore living in litter of broadleaved-conifer and *Agathis* forests, from near sea-level to *c.* 620 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora septentrionalis* is distinctive in the combination of narrowly conical spire, smooth first protoconch whorl, pale peripheral spiral band on otherwise deeply pigmented shell; sculpture of crowded, typically wavy, spiral threads; and well-developed periostracum, with elevated subsutural band. Specimens from the western part of the distribution attain larger size than specimens from Hunua Ranges, Coromandel Peninsula and the type locality, the height of specimens with adult facies (i.e. rounded periphery, narrowed last whorl) in the range of 4.15–6.25 mm, as opposed to 3.60–4.30 mm. They are otherwise indistinguishable in shell morphology. Comparison of gene sequences is desirable.

***Cytora solitaria* (Powell, 1935)**

(Figs 2H, 16F, 17G, 18K,L)

*Murdochia solitaria* Powell, 1935: 244, pl. 26, figs 1, 2; Powell, 1948: 274.

*Cytora solitaria*.- Powell, 1957: 91; Climo, 1973: 574, figs 9D, 19E, I, 20A, B; Climo, 1975: 468; Powell, 1979: 86; Gardner, 1994: 23, text fig.; Brook, 2002a: 20; Brook, 2002b: 71; Hitchmough, 2002: 115.

*Cytora kiama* Climo, 1973: 573, fig. 9E; Powell, 1979: 87.

*Cytora kaima* [*sic*].- Gardner, 1994: 23, text fig.

TYPE MATERIAL: *Murdochia solitaria* – Holotype AIM AK 70498: Three Kings Islands, Great King Island, 150 yards [164 m] up valley to SW of provision depot, A.W.B. Powell, Feb. 1935.

*Cytora kiama* – Holotype NMNZ M.29211: Three Kings Islands, Great Island, Tasman Valley, 200 m below *Tecomanthe* vine, in stable scree under a small grove of broadleaf trees below and right of rock steps in stream bed, F.M. Climo, 16 Nov. 1972.

MATERIAL EXAMINED (54 lots): Type material (see above), M.16820 (4), M.29244 (2), M.29245 (8), M.29246 (5), M.29247 (3), M.29248 (8), M.29249 (4), M.29250 (6), M.29251 (15), M.29252 (2), M.29253 (3), M.29254 (7), M.29255 (1), M.29256 (7), M.29257 (6), M.29258 (1), M.29259 (6), M.29260 (8), M.29261 (15), M.29262 (8), M.29263 (many), M.29264 (25), M.29265 (25), M.37068 (2), M.37768 (12), M.47239 (18), M.47287 (10), M.124876 (12), M.155490 (13), M.155507 (35), M.155519 (1), M.155527 (9), M.155555 (13), M.155575 (20), M.155587 (many), M.155597 (12), M.155619 (21), M.155627 (2), M.155670 (3), M.155676 (17), M.155685 (8), M.155694 (30), M.155713 (20), M.155722 (15), M.155745 (8), M.155755 (3), M.155796 (28), M.155810 (13), M.155820 (17), M.155829 (24), M.156444 (2), M.177693 (4).

REDESCRIPTION: Shell up to 4.70 mm wide, most specimens wider than high (height/width ratio 0.92–1.09), broadly conical (spire angle 83–93°), spire 0.81–0.91 times as high as aperture, widely umbilicate (width 14.6–17.4% of adult shell diameter). Typically reddish brown, teleoconch with white peripheral band; some specimens uniformly whitish beneath darker periostracum. Periostracum on teleoconch rather thick, produced at summits of

collabral riblets as thin, low but distinct lamellae on spire and base, numbering seven to ten per mm at end of third whorl; five or six rows of short spines on axial lamellae on inner base curving into umbilicus.

Protoconch of 1.55–1.85 convex whorls, 670–830 μm wide, first three-quarter whorl smooth, remainder traversed by rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 3.50 broadly convex whorls, periphery broadly rounded at all stages of growth; spire whorls rather evenly expanding, end of last adult whorl slightly but distinctly flared at maturity; suture well defined. Base evenly rounded from periphery into umbilicus. Sculpture of weak, faintly sigmoidal, widely spaced, prosocline, collabral riblets that are surmounted by periostracal lamellae; some specimens with well-defined spiral threads or traces of them, numbering about six on spire and 6–12 on base; additionally with fine collabral and more or less obscure spiral growth lines. Aperture at maturity subcircular with double peristome, rim thin and markedly radially flared.

Radula (Fig. 2H) with characteristics of the genus.

DISTRIBUTION: Three Kings Islands, Great Island (Fig. 17G).

BIOLOGY: Detritivore, living on the ground in litter, under stones and among ground-layer plants. Habitats comprise coastal shrublands and forests.

CONSERVATION STATUS: Not mentioned as being of conservation concern by McGuinness (2001). Listed as 'range restricted (one location; recovering)' by Brook (2002a) and Hitchmough (2002). The species was extremely scarce on Great Island during the early part of the twentieth century (Powell 1935, 1948, 1951) but, as noted by Climo (1973) and Brook (2002a,b), has exhibited remarkable recovery since the eradication of goats from the island in 1946. The species is now widely distributed and locally abundant on Great Island. According to the criteria of Molloy *et al.* (2002), *Cytora solitaria* should be ranked 'range restricted'.

REMARKS: *Cytora solitaria* is extremely distinctive in the combination of relatively large size, low spire, broad umbilicus, pale peripheral band, and the flared mature outer lip with double peristome.

We concur with Brook (2002b) in recognising that the holotype of *Cytora kiama* is merely an old eroded shell of *C. solitaria*, and thus treating *C. kiama* as a junior synonym of *C. solitaria*.

***Cytora taipa* new species**

(Figs 17H, 20A,B)

TYPE MATERIAL: Holotype NMNZ M.179677 and paratypes M.156646 (2): North Island, NE of Kaitaia, E side of Taipa River estuary, hillside S of quarry, 40 m (NZMS 260 O04/538883), in open scrub litter, D.J. Roscoe, 9 Oct. 1976. Additional paratype: M.177736, North Island, N of Mangonui, W of Kaiwheru trig, gully head of Wairua Stream (O04/601939), B.A. Marshall & F.J. Brook, 25 Oct. 2004.

MATERIAL EXAMINED (three lots): Type material (see above).

DESCRIPTION: Shell up to 1.80 mm high at maturity, higher than wide (height/width ratio about 1.25), broadly conical (spire angle 56–62°); 1.33–1.45 times as high as aperture, narrowly umbilicate. Pale yellowish brown. Periostracum on teleoconch produced at summits of collabral riblets as low, thin lamellae on spire and base.

Protoconch of 1.75 convex whorls, 470 μm wide, first whorl essentially smooth, last half of last half-whorl traversed by weak collabral riblets.

Teleoconch of up to 2.80 broadly convex whorls; whorls rather evenly expanding, last adult whorl slightly constricted and insertion point gently descending; suture deeply impressed. Base more broadly rounded than periphery, smoothly and tightly curving into narrow umbilicus. Sculptured throughout with weak, weakly sigmoidal, prosocline, collabral riblets, superimposed on fine, densely crowded, vermicular threads that are oblique relative to direction of growth, and malleations; additionally with fine collabral growth lines. Aperture roundly D-shaped, rim thin and simple.

ETYMOLOGY: After Taipa (Māori), the type locality (noun in apposition).

DISTRIBUTION: North Island, eastern Northland, east side of Taipa River estuary and north of Mangonui (Fig. 17H).

BIOLOGY: Litter-dwelling detritivore in coastal shrubland and forest.

CONSERVATION STATUS: *Cytora taipa* should be ranked as 'nationally critical' according to the criteria of Molloy *et al.* (2002). The species is range restricted, occupying coastal habitat that is subject to development. The forest at the type locality has been partly subdivided for housing in the last few decades.

REMARKS: *Cytora taipa* is extremely distinctive in its minute size, rather broadly conical spire, and the teleoconch sculpture of crowded vermiculate threads. *Cytora climoi* from the northwestern South Island has similar teleoconch

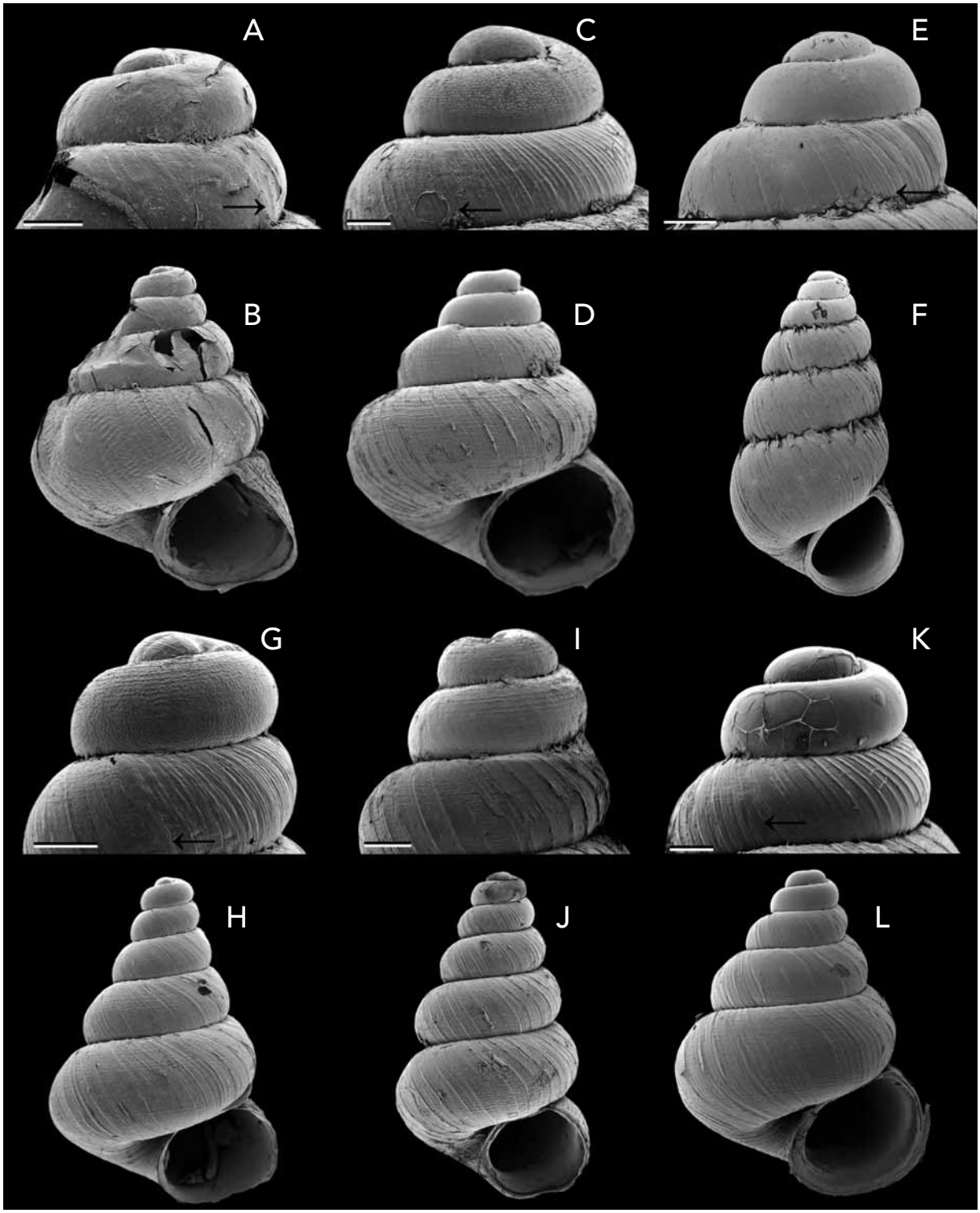


Fig. 20 Lateral views of whole shells and protoconchs (protoconch–teleoconch boundary arrowed) of *Cytora* species (SEM). A, B, *Cytora taipa* n.sp., NE of Kaitaia, E side Taipa River estuary, holotype, M.179677 (B, 1.72 x 1.50 mm); C, D, *Cytora tawhiti* n.sp., Auckland Islands, North Harbour, paratype, M.79152 (C), and Rose Island, holotype, M.146024 (D, 1.58 x 1.35 mm); E, F, *Cytora tepakiensis* N. Gardner, 1967, SE of Cape Reinga, Tapotupotu, M.156446 (F, 3.12 x 1.65 mm); G, H, *Cytora tokerau* n.sp., S of Kaeo, Puketi Forest, paratype, M.165121 (G), and holotype, M.179678 (H, 2.20 x 1.50 mm); I, J, *Cytora torquillum* (Suter, 1894), W of Auckland, Huia, Jackie Hill, M.156941 (J, 2.10 x 1.22 mm); K, L, *Cytora tuarua* n.sp., N of St Arnaud, Big Bush, paratypes, M.121789 (L, 2.45 x 1.85 mm). Scale bars 100 µm.

sculpture, but *C. taipa* is smaller, paler and lacks reticulate sculpture on the first protoconch whorl.

***Cytora tawhiti* new species**

(Figs 19C, 20C,D)

*Cytora* cf. *hedleyi*.- Mayhill & Goulstone, 1986: 88; Mayhill & Goulstone, 2000: 16, 22, text fig.

*Cytora* cf. *chiltoni*.- Mayhill & Goulstone, 1986: 89.

*Cytora* new species.- Mayhill & Goulstone, 2000: 16, 22, text fig.

*Cytora* sp. 13 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.146024: Auckland Islands, Rose Island, 30 m (NZMS 260 AI/059167), P.C. Mayhill, Dec. 1983. Paratypes: M.79130 (5), AIM AK 73304 (1), Auckland Islands, Rose Island, P.C. Mayhill, Dec. 1983; M.79152 (2), Auckland Islands, Auckland Island, North Harbour, P.C. Mayhill, Dec. 1983.

MATERIAL EXAMINED (four lots): Type material (see above).

DESCRIPTION: Shell up to 1.80 mm high at maturity, higher than wide (height/width ratio 1.14–1.25), rather broadly conical (spire angle 57–76°), spire 1.13–1.57 times as high as aperture, narrowly umbilicate. Translucent yellowish brown. Periostracum thin, produced at summits of widely spaced collabral riblets as short lamellae on spire and base.

Protoconch of 1.75–1.85 convex whorls, 570 µm wide, first 1.25 whorls sculptured with minute hemispherical granules, last half-whorl traversed by weak, rounded, regularly spaced, collabral riblets that are more strongly prosocline than collabral growth lines on immediately succeeding teleoconch.

Teleoconch of up to 2.80 whorls: spire whorls strongly convex and rather evenly expanding, last adult whorl contracted and descending; base rather evenly rounded from periphery into umbilicus; suture well defined. Sculpture of weak, prosocline, collabral riblets, crowded spiral threads, and fine collabral growth lines. Aperture at maturity ovate, rim thin and simple, slightly thickened within.

ETYMOLOGY: Far off (Māori).

DISTRIBUTION: Auckland and Rose islands, Auckland Islands (Fig. 19C).

BIOLOGY: Litter-dwelling detritivore of subantarctic *Dracophyllum* shrublands and forests.

CONSERVATION STATUS: *Cytora tawhiti* should be ranked 'range restricted' according to the criteria of Molloy *et al.* (2002).

REMARKS: Mayhill & Goulstone (1986, 2000) recognised two *Cytora* species among the material they collected from the Auckland Islands in 1983. However, we find this material belongs to a single species, here named *C. tawhiti*. Compared with the Stewart Island species *C. rakiura*, which it most resembles, *C. tawhiti* differs principally in having stronger granules on the first whorl of the protoconch, and stronger, more extensive periostracal blades on the teleoconch.

*Cytora rakiura* and *C. tawhiti* are evidently phylogenetic sister species, sharing not only similar size and sculpture (particularly the granular sculpture on the first protoconch whorl), but also southern distributions.

***Cytora tepakiensis* N. Gardner, 1967**

(Figs 16G, 19D, 20E,F)

*Cytora tepakiensis* Gardner, 1967: 216, fig. 2; Powell, 1979: 86; Parrish & Sherley, 1993: 48; Gardner, 1994: 13, text fig.; Brook, 1999d: 389; McGuinness, 2001: 567; Brook, 2002a: 21; Hitchmough, 2002: 115.

TYPE MATERIAL: Holotype AIM AK 71294 and paratypes NMNZ M.31963 (4): North Island, near Cape Reinga, Taputaputa Bay, in small bush remnant, N.W. Gardner, Apr. 1965.

MATERIAL EXAMINED (49 lots): Type material (see above), M.21970 (2), M.25429 (2), M.29622 (17), M.30680 (4), M.38134 (1), M.38602 (4), M.47951 (2), M.54247 (4), M.55468 (8), M.72437 (1), M.72443 (1), M.76594 (many), M.76986 (5), M.77014 (7), M.77042 (30), M.77049 (5), M.77148 (12), M.87803 (1), M.87824 (6), M.87834 (6), M.87878 (1), M.87886 (4), M.87897 (2), M.87910 (2), M.88471 (2), M.88696 (3), M.89820 (5), M.103999 (many), M.116157 (4), M.124336 (13), M.124546 (3), M.127941 (5), M.156445 (many), M.156446 (13), M.156640 (8), M.156641 (32), M.156660 (1), M.161074 (3), M.161156 (2), M.161825 (3), M.161850 (18), M.161852 (2), M.161876 (2), M.162033 (6), M.162098 (1), M.162273 (3), M.175374 (1).

REDESCRIPTION: Shell up to 3.50 mm high, higher than wide (height/width ratio 1.67–2.00), narrowly and weakly cyrtoconoid (spire angle 30–44°), spire 1.55–2.20 times as high as aperture, very narrow umbilical chink. Periostracum on teleoconch dull olive to deep reddish brown, glossy, produced at summits of collabral riblets as prominent lamellae in narrow subsutural band, 10–11 at end of third whorl, very weakly produced elsewhere.

Protoconch of 1.60–2.00 convex whorls, 530–630 µm wide, first whorl smooth, last half-whorl traversed by weak, rounded, collabral riblets that are more closely spaced and slightly more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of up to 4.50 convex whorls; periphery broadly rounded at all stages of growth; spire whorls expansion rate slowing so that adult spire weakly cyrtoconoid, aperture in few specimens slightly but distinctly constricted at maturity; suture strongly impressed. Base smoothly and tightly curved into umbilical chink. Sculpture of weak, more or less straight, widely spaced, prosocline, collabral riblets; and fine collabral and more or less obscure spiral growth lines. Aperture ovate, thin at rim, rapidly but lightly thickened within.

DISTRIBUTION: North Island, northern Aupouri Peninsula (Fig. 19D). Known also as fossils from Holocene dunes at Te Werahi (Brook 1999d).

BIOLOGY: Litter-dwelling detritivore of shrublands and forests.

CONSERVATION STATUS: *Cytora tepakiensis* was ranked as 'declining' by McGuinness (2001), and listed as 'range restricted' by Brook (2002a) and Hitchmough (2002). Brook (2002a) remarked, 'This species has a fragmented, relict distribution as a result of extensive habitat destruction caused by anthropic land clearance for gum-digging, pastoral farming and exotic forestry. The total population is probably still declining as a consequence of continued modification and loss of habitat, and there is a risk that some local populations could become extinct if historical trends continue.' Our assessment is that *Cytora tepakiensis* continues to be of immediate conservation concern because the habitat is vulnerable to disturbance. Accordingly, a rank of 'range restricted' on the Molloy *et al.* (2002) criteria is appropriate.

REMARKS: The shell of *Cytora tepakiensis* is highly distinctive in the combination of small size, narrowly conical and weakly cyrtoconoid spire, broadly convex teleoconch whorls, dark pigmentation, weak sculpture, and the enlargement of the periostracal lamellae in a narrow subsutural band. *Cytora tepakiensis* resembles *C. aranea* (allopatric) in shape and size, but differs in having more broadly convex whorls and in that the periostracal blades are enlarged subsuturally. It also resembles *C. kerrana* and *C. hispida* in shape, but is immediately separable by the lack of periostracal spines. All three are locally sympatric.

***Cytora tokerau* new species**

(Figs 16H, 19B, 20G,H)

*Cytora pallida*.- Rees, 1961: 15 (in part).

*Cytora* sp. 7 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.179678 and paratypes M.165121 (3), AIM AK 73305 (1): North Island, S of Kaeo, Puketi Forest, Waipapa Track, 220 m (NZMS 260 P05/827659), P.C. Mayhill, Nov. 1989. Additional paratypes: M.62501 (2), North Island, SE of Kaeo, P.C. Mayhill, Oct. 1978; M.97910 (5), North Island, SE of Kaeo, Waiare Road, P.C. Mayhill, Nov. 1987; M.164696 (8), North Island, SE of Kaeo, Waiare Road, P.C. Mayhill, Oct. 1978; M.114477 (3), M.164857 (6), North Island, Whangaroa, N of Totara North, Ranfurly Bay Track, P.C. Mayhill, Nov. 1989; M.127987 (many), North Island, S of Ahipara, Herekino N head, above Waiatua Stream, F.J. Brook, 21 Apr. 2004; M.156805 (1), North Island, Doubtless Bay, Bushy Point, B.F. Hazelwood, 29 Aug. 1998; M.163142 (3), S of Kaitaia, Larmers Road, P.C. Mayhill, Oct. 1978.

MATERIAL EXAMINED (163 lots): Type material (see above), M.25441 (2), M.36938 (4), M.37139 (2), M.37703 (4), M.38502 (2), M.48696 (4), M.55481 (1), M.55792 (1), M.58140 (1), M.61829 (1), M.61924 (5), M.62515 (5), M.69806 (1), M.69880 (1), M.69917 (2), M.74033 (2), M.75712 (21), M.76554 (1), M.76581 (1), M.76755 (1), M.77098 (1), M.78590 (5), M.79004 (1), M.80329 (12), M.82451 (1), M.82664 (2), M.82840 (1), M.83143 (3), M.97636 (1), M.97657 (1), M.97959 (1), M.97965 (1), M.98037 (2), M.98345 (1), M.99173 (2), M.101611 (1), M.101667 (1), M.104231 (7), M.104257 (5), M.104403 (2), M.114423 (2), M.114532 (1), M.116106 (1), M.124275 (9), M.124276 (1), M.124277 (2), M.124278 (3), M.124279 (1), M.124314 (4), M.124315 (4), M.124358 (1), M.124364 (2), M.124366 (1), M.124367 (1), M.124389 (1), M.124393 (9), M.124522 (12), M.124547 (1), M.124548 (1), M.124675 (2), M.124747 (18), M.124766 (1), M.124767 (1), M.124768 (11), M.124769 (1), M.124796 (8), M.124859 (10), M.124860 (1), M.124861 (5), M.124909 (1), M.124970 (1), M.124993 (6), M.127985 (15), M.156644 (1), M.156647 (1), M.156650 (1), M.156651 (1), M.156653 (4), M.156655 (3), M.156656 (4), M.156657 (9), M.156659 (11), M.156661 (7), M.156662 (30), M.156663 (8), M.156665 (1), M.156666 (1), M.156667 (1), M.156668 (1), M.156669 (1), M.156671 (2), M.156672 (1), M.161107 (1), M.162074 (1), M.162324 (1),

M.162353 (1), M.163120 (7), M.163180 (2), M.163210 (5), M.163226 (1), M.163288 (2), M.163323 (1), M.163363 (1), M.163414 (4), M.163445 (4), M.163483 (1), M.163603 (2), M.163632 (2), M.163703 (1), M.163729 (1), M.163742 (1), M.163807 (1), M.163874 (3), M.163927 (2), M.164086 (1), M.164301 (2), M.164352 (1), M.164769 (4), M.164883 (5), M.164917 (7), M.165079 (1), M.165166 (2), M.165399 (1), M.165598 (1), M.165642 (3), M.165876 (1), M.166794 (7), M.166942 (1), M.167075 (2), M.167262 (1), M.167308 (3), M.167707 (1), M.167847 (1), M.167958 (1), M.168078 (3), M.168198 (2), M.168390 (1), M.169075 (1), M.169205 (6), M.169453 (1), M.174328 (30), M.174329 (5), M.174332 (2), M.175140 (1), M.175163 (1), M.177722 (20), M.177727 (4), M.177733 (9), M.178067 (7), M.178070 (2), M.178074 (1), M.178083 (1).

DESCRIPTION: Shell up to 2.60 mm high, higher than wide (height/width ratio 1.49–1.82), narrowly conical (spire angle 45–52°), spire 1.81–2.67 times as high as aperture, frequently weakly coeloconoid; narrow umbilical chink. Translucent, deep reddish brown. Periostracum produced as low lamellae at summits of axial riblets that number 6–12 per mm at end of third whorl.

Protoconch of 1.70–1.80 convex whorls, 430–450 μm wide, sculptured throughout with numerous fine, crisp, slightly wavy, spiral threads, forming reticulate pattern on last half-whorl by intersecting rounded collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch; first whorl additionally very finely malleate.

Teleoconch of up to 4.50 strongly convex whorls; periphery rounded at all stages of growth, most broadly and evenly rounded on last adult whorl; whorls typically expanding slightly but distinctly more rapidly than protoconch (weakly coeloconoid), some specimens expanding as rapidly as protoconch (evenly conical); last adult whorl typically weakly contracted at maturity; suture well defined. Base broadly rounded, evenly rounded into umbilical chink. Sculpture of weak, crowded, spiral threads; weak, weakly sigmoidal, prosocline, collabral riblets; and fine collabral and spiral growth lines. Aperture subcircular, rim thin and rapidly thickened within at maturity.

ETYMOLOGY: Northern (Māori).

DISTRIBUTION: North Island, Northland, Hunua Ranges, Great Barrier Island, Coromandel Peninsula, Mercury Islands and Ohinau Island (Fig. 19B).

BIOLOGY: A detritivore living among litter of shrublands, broadleaved-conifer and *Agathis* forests, from near sea-level to *c.* 560 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: Compared with *Cytora torquillum*, which is locally sympatric (e.g. Hokianga, M.156662 and M.174786), *C. tokerau* differs in attaining larger size, in being larger relative to the number of whorls, in having a more darkly pigmented shell, and in having finer, straighter, more numerous spiral threads on the first protoconch whorl.

***Cytora torquillum* (Suter, 1894)**

(Figs 16I, 19E, 20I,J)

*Lagochilus torquillum* Suter, 1893: 149 (*nude name*).

*Lagocheilus torquillum.*- Hedley & Suter, 1893: 622 (*nude name*).

*Lagochilus torquillum.*- Suter, 1894b: 140 (*nude name*); Suter, 1894c: 485, pl. 22, figs 2, 2b; Suter, 1894d: 225.

*Lagochilus* (*Cytora*) *torquillum.*- Kobelt & Möllendorff, 1897: 86; Suter, 1913: 184, pl. 35, fig. 8.

*Japonia* (*Cytora*) *torquilla.*- Kobelt, 1902: 67.

*Murdochia torquillum.*- Powell, 1937: 67.

*Cytora torquilla.*- Powell, 1957: 91; Whitten, 1957: 2; Rees, 1959: 21; Powell, 1979: 84 (in part = *C. motu*), fig. 12/4; Solem *et al.*, 1981: 477; Ballance, 1982: 30; Goulstone, 1990: 21, text fig.; Gardner, 1994: 16 (in part = *C. motu*), text fig.; Brook & Goulstone, 1995: 9; Brook, 1999b: 130; Brook, 1999c: 156; Brook, 1999d: 389; Barker, 2006: 134.

NOT *Cytora torquilla.*- Climo, 1971: 68 (= *C. motu*).

TYPE MATERIAL: Lectotype (here selected) NMNZ M.125191 and paralectotype M.125192: North Island, Auckland, 'Howick', T. Broun (from original label).

MATERIAL EXAMINED (134 lots): Type material (see above), M.32168 (1), M.36401 (12), M.37076 (15), M.39255 (15), M.45672 (8), M.48099 (4), M.51793 (many), M.55215 (4), M.57147 (2), M.57349 (1), M.57654 (5), M.57839 (many), M.61971 (1), M.62715 (2), M.68114 (2), M.70629 (3), M.72488 (2), M.76162 (3), M.76261 (1), M.76957 (4), M.77456 (14), M.77784 (2), M.78557 (many), M.79405 (2), M.79504 (5), M.80277 (2), M.80364 (2), M.82193 (2), M.85052 (1), M.85930 (1), M.89390 (1), M.89757 (1), M.97726 (1), M.99343 (9), M.100239 (2), M.101606 (2), M.102721 (3), M.104168 (5), M.114270 (1), M.114340 (7), M.114380 (1), M.114560 (3), M.114904 (1), M.124333 (7), M.124349

(3), M.124556 (23), M.124771 (34), M.124785 (3), M.129431 (3), M.156599 (8), M.156637 (4), M.156638 (2), M.156639 (1), M.156642 (7), M.156648 (1), M.156652 (2), M.156658 (2), M.156933 (1), M.156934 (2), M.156941 (16), M.156942 (2), M.156943 (8), M.156944 (26), M.156945 (1), M.156946 (1), M.156979 (1), M.163501 (8), M.164167 (1), M.166729 (3), M.167188 (6), M.168447 (1), M.168484 (1), M.168770 (2), M.169064 (1), M.169065 (5), M.169066 (3), M.169067 (1), M.169068 (1), M.169069 (3), M.169070 (2), M.169071 (1), M.169072 (2), M.169073 (1), M.169074 (2), M.169076 (2), M.169077 (30), M.169078 (2), M.169079 (3), M.169080 (3), M.169081 (6), M.169082 (2), M.169083 (1), M.169084 (1), M.169085 (1), M.169087 (3), M.169088 (8), M.169089 (1), M.169090 (10), M.169091 (15), M.169092 (3), M.169093 (2), M.169094 (20), M.169095 (3), M.169096 (12), M.169245 (1), M.169246 (many), M.169247 (4), M.169248 (30), M.169249 (1), M.169250 (many), M.169251 (4), M.169252 (many), M.169253 (30), M.169254 (many), M.169255 (6), M.169256 (1), M.169257 (1), M.169258 (1), M.169259 (3), M.169260 (6), M.169261 (6), M.169997 (1), M.170140 (4), M.174327 (many), M.174783 (2), M.174786 (10), M.175108 (2), M.175345 (1), M.175365 (1), M.176122 (1), M.177724 (3), M.177730 (3).

REDESCRIPTION: Shell 1.70–2.30 mm high at maturity, higher than wide (height/width ratio 1.49–1.78), narrowly to rather broadly conical (spire angle 40–52°), spire 3.00–3.55 times as high as aperture, very narrow umbilical chink. Translucent, periostracum yellowish to reddish brown, typically produced as prominent lamellae at summits of axial riblets that number 12–15 per mm at end of third whorl.

Protoconch of 1.60–1.80 convex whorls, 430–470 µm wide, first whorl sculptured with fine wavy spiral threads, last whorl traversed by rounded, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 3.10–3.60 strongly convex whorls at maturity, periphery broadly rounded at all stages of growth; spire whorls evenly expanding, last adult whorl typically weakly expanded at maturity, weakly contracted in some specimens; suture well defined. Base broadly rounded, evenly rounded into umbilical chink. Sculpture of weak, weakly sigmoidal, prosocline, collabral riblets, with or without well-defined to extremely weak, fine, crowded, slightly wavy, spiral threads. Additionally with collabral and spiral growth lines. Aperture subcircular, rim thin, weakly thickened within, and typically weakly flared at maturity.

DISTRIBUTION: Northern North Island, from northwestern Northland to west of Waimarama, south of Hastings (Fig. 19E). Known also as fossils from Holocene sand dunes at several localities in Northland (Brook 1999b,c,d), and from karst caves in the western Waikato (e.g. M.39255, M.45672).

BIOLOGY: Litter-dwelling detritivore that seems to prefer viable, finely granulated humus on slopes. Occurs in coastal *Metrosideros* forests and broadleaved-conifer forests to *c.* 670 m elevation.

CONSERVATION STATUS: Not of immediate conservation concern. The species is apparently no longer extant in the few small patches of bush remaining in the vicinity of the type locality at Howick, Auckland (B.F. Hazelwood, pers. comm. 2005).

REMARKS: *Cytora torquillum* is characterised by the combination of small, uniformly pigmented shell, elevated spire, strongly convex whorls, and the presence of wavy spiral threads on the first protoconch whorl. Specimens from the western side of the North Island all have well-defined spiral sculpture on the teleoconch, whereas spiral sculpture tends to be weaker or absent in specimens from the eastern side of the island. *Cytora torquillum* most closely resembles *C. motu* from the Poor Knights Islands (see above).

***Cytora tuarua* new species**

(Figs 16J, 19F, 20K,L)

*Murdochia chiltoni*.- Dell, 1954: 138 (not Suter, 1896); Dell, 1955: 1136 (not Suter, 1896).

*Cytora chiltoni*.- Mason, 1988: 90 (not Suter, 1896); Gardner, 1994: 14 (in part + *C. maui*).

*Cytora* sp. 2 Spencer *et al.*, in press.

TYPE MATERIAL: Holotype NMNZ M.179688 and paratypes M.121941 (12), AIM AK 73306 (2): South Island, NW of St Arnaud, Big Bush (NZMS 260 N29/934393), I. Millar, 19 Jun. 1986. Additional paratypes: M.121611 (25), South Island, St Arnaud Village, D.J. Roscoe, 19 Oct. 1983; M.162757 (2), South Island, St Arnaud, P.C Mayhill, Feb. 1981; M.121789 (26), M.121821 (5), South Island, N of St Arnaud, Big Bush, Department of Conservation, 5 Mar. 1986.

MATERIAL EXAMINED (260 lots): Type material (see above), M.14493 (1), M.15139 (11), M.20371 (5), M.20480 (1),

M.20727 (3), M.25474 (1), M.32793 (1), M.36604 (6), M.37026 (1), M.37314 (2), M.37681 (13), M.38850 (1), M.38852 (1), M.38854 (3), M.38857 (2), M.38858 (2), M.46839 (11), M.47065 (1), M.47221 (14), M.55596 (1), M.55691 (1), M.56401 (1), M.56436 (6), M.58170 (2), M.61851 (6), M.63104 (1), M.63188 (3), M.63197 (1), M.68222 (4), M.68299 (2), M.68314 (1), M.68334 (3), M.68360 (2), M.68369 (8), M.68377 (1), M.69168 (4), M.69388 (4), M.69669 (3), M.69808 (5), M.69949 (4), M.70609 (many), M.72190 (1), M.72193 (1), M.72948 (1), M.75391 (1), M.77242 (6), M.77254 (2), M.78992 (4), M.79301 (4), M.79314 (2), M.80904 (2), M.81624 (2), M.82539 (5), M.82644 (2), M.82766 (2), M.87480 (30), M.88869 (2), M.88995 (1), M.89031 (20), M.89036 (many), M.89161 (1), M.89286 (6), M.89659 (many), M.92846 (4), M.92987 (2), M.98397 (3), M.99029 (13), M.99709 (1), M.99728 (1), M.99981 (2), M.100070 (1), M.100093 (4), M.100182 (30), M.100222 (4), M.102056 (6), M.102667 (20), M.102926 (1), M.102971 (5), M.103099 (3), M.103231 (many), M.103278 (1), M.103425 (2), M.103436 (1), M.103545 (5), M.103730 (2), M.103745 (1), M.104637 (1), M.104670 (1), M.104868 (5), M.104948 (2), M.105173 (2), M.105181 (6), M.105233 (1), M.105376 (1), M.105598 (6), M.105675 (2), M.105761 (1), M.105880 (2), M.105948 (14), M.106047 (6), M.106200 (4), M.106431 (6), M.106471 (2), M.106577 (6), M.106736 (2), M.106793 (1), M.106817 (8), M.107139 (4), M.107221 (3), M.107408 (3), M.107469 (6), M.107948 (10), M.107973 (1), M.108063 (4), M.108153 (1), M.108443 (2), M.108565 (10), M.108599 (4), M.108635 (1), M.108659 (6), M.109577 (1), M.109682 (30), M.109707 (2), M.109764 (3), M.109960 (15), M.113974 (4), M.116408 (2), M.120262 (2), M.120383 (2), M.120629 (8), M.120710 (many), M.120887 (2), M.120964 (3), M.121117 (10), M.121312 (3), M.121471 (1), M.121513 (3), M.121560 (2), M.121627 (3), M.121642 (1), M.121753 (2), M.121770 (4), M.121833 (2), M.121854 (8), M.121916 (8), M.121919 (5), M.121930 (6), M.121959 (4), M.122051 (2), M.122087 (9), M.122190 (5), M.122225 (2), M.122354 (1), M.122420 (15), M.122544 (2), M.122559 (4), M.122663 (1), M.122788 (4), M.122830 (1), M.123831 (1), M.122847 (10), M.122950 (2), M.123083 (1), M.123339 (3), M.123963 (1), M.124000 (6), M.124147 (1), M.124447 (3), M.124640 (3), M.124641 (2), M.124642 (13), M.124643 (2), M.124644 (7), M.124658 (5), M.124659 (1), M.124660 (8), M.124664 (4), M.124665 (4), M.124667 (14), M.124669 (1), M.124672 (2), M.124673 (6), M.124676 (1), M.124678 (2), M.124854 (13), M.124881 (1), M.124884 (2), M.124889 (1), M.124916 (2), M.124923 (1), M.124941 (1), M.124950 (1), M.124954 (many), M.124955 (many), M.124966 (1), M.124967 (4), M.124997 (1), M.125446 (2), M.125866 (18), M.125869 (30), M.126045 (30), M.126073 (1), M.126139 (7), M.126178 (5), M.126274 (many), M.127944 (1), M.128611 (6), M.129233 (3), M.129268 (6), M.129400 (7), M.146103 (1), M.146494 (5), M.146545 (2), M.146567 (1), M.146589 (3), M.146643 (3), M.146668 (1), M.146692 (1), M.146749 (1), M.146793 (2), M.146881 (2), M.146910 (3), M.146987 (1), M.156810 (3), M.157018 (6), M.157039 (7), M.157095 (2), M.157126 (3), M.157137 (1), M.157291 (7), M.157920 (1), M.157996 (1), M.159319 (1), M.159351 (1), M.159792 (1), M.161309 (1), M.161442 (many), M.161457 (1), M.161510 (1), M.162525 (1), M.162789 (1), M.162853 (2), M.169850 (1), M.175066 (3), M.175077 (13), M.175095 (9), M.175100 (1), M.175116 (1), M.175118 (3), M.175133 (1), M.175282 (2), M.175812 (7), M.177697 (3).

DESCRIPTION: Shell 2.30-2.85 mm high at maturity, higher than wide (height/width ratio 1.33-1.54), narrowly conical (spire angle 48-58°), spire 1.40-1.60 times as high as aperture, narrowly umbilicate. Translucent, yellowish to reddish brown, last two whorls in adults with or without whitish, broad median spiral band on spire and/or narrower band on base. Periostracum produced as thin, widely spaced lamellae at summits of axial riblets, including peripheral row of prominent, broadly rounded projections, numbering 4-5 per mm at end of third whorl.

Protoconch of 1.75-1.80 convex whorls, 530-570 mm wide, first 1.1-1.3 whorls smooth and polished, last part traversed by fine, crisp, collabral riblets that are more closely spaced and more strongly prosocline than axial sculpture on immediately succeeding teleoconch.

Teleoconch of 3.20-3.75 strongly convex whorls at maturity; periphery rounded at all stages of growth; spire whorls evenly expanding; last adult whorl weakly contracted at maturity; suture well defined. Base broadly rounded, evenly rounded into umbilicus. Sculpture of fine, crowded, spiral threads; weak, weakly sigmoidal, prosocline, collabral riblets; and fine collabral and spiral growth lines. Aperture ovate, rim thin and simple, rapidly thickened within at maturity.

ETYMOLOGY: Second (Māori), the name derived from our number for the species during preliminary study.

DISTRIBUTION: South Island and Stewart Island (Fig. 19F). Known also as Holocene fossils from karst caves at Takaka (M.72948, M.113974).

BIOLOGY: Detritivore of forest floor litter and woody debris, and of humus suspended in epiphytes. Species occurs from sea level to ca. 1300 m elevation, in broadleaved shrublands, and in mixed broadleaved-conifer, conifer, and *Nothofagus* forests.

CONSERVATION STATUS: Not of immediate conservation concern.

REMARKS: *Cytora tuarua* is characterised by the combination of smooth first protoconch whorl, spirally lirate teleoconch, narrowly conical spire, narrow umbilicus, and peripheral row of broadly rounded periostracal lamellae. *Cytora tuarua* is closely similar to *C. chiltoni* in teleoconch facies, including periostracal ornamentation, but differs in the sculpture of the first whorl of the protoconch, which is smooth rather than spirally lirate: the two species are locally sympatric.

# Discussion

In the present revision, a total of 42 species are recognised, of which 23 are described as new. Climo (1975) alluded to undescribed diversity in *Cytora* and the probable existence of infrageneric groupings. Our analyses have confirmed both previously unrecognised taxon diversity and considerable conchological diversity in *Cytora*. *Cytora* is conchologically distinct from *Liarea* (the presumed sister taxon), but phylogenetics analyses based on molecular data are needed to determine properly the relationships between the two genera, and to establish whether intrageneric groupings of *Cytora* are warranted.

# Acknowledgements

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