

Campbell I: [21] 4 ♀♀ (8–11 mm), 6 ♂♂ (9–14 mm); [19] 5 ♀♀ (10–11 mm), 8 ♂♂ (10–15 mm); [Z2288] 6 juvs (6–8 mm), 4 ♀♀ (8–9 mm), 7 ♂♂ (8–12 mm); [Z1819, Z1824, Z1829, Z1854] 4 juvs (2–5 mm), 16 ♀♀ (9–13 mm), 13 ♂♂ (11–17 mm); [D2] 1 juv. (6mm), 1 ♂ (12 mm); [B190, B191] 3 juvs (6–7 mm), 5 ♀♀ (7–10 mm), 3 ♂♂ (9–12 mm). Also: [Gal. 581] 23 spp; [Z1852] 22 spp.

OTHER RECORDS: Chilton Coll: Tom Bowling Bay, North Cape ('Hinemoa', Jan. 1915); Moko Hinau, Great Barrier I. (coll. C. R. Gow, May 1915); Cuvier I. (coll. Grenfell, 1915); Wellington—Lyall Bay and Island Bay (coll. E. W. Bennett, May 1924); Sumner, Christchurch; Dunedin (coll. G. M. Thomson); Stewart I. (coll. A. Parrott); Chatham Is. (coll. S. D. Shand, June 1909); Auckland Is; Campbell I. (coll. G. M. Thomson). Muriwai Beach, Auckland (Morton & Miller 1968).

HABITAT: Under stones and in pools.

DEPTH RANGE: Intertidal.

DISTRIBUTION: Shores of New Zealand main islands, Chatham Islands, subantarctic islands of New Zealand region.

REMARKS: There is no material labelled "*Exosphaeroma lanceolatum*" from New Zealand in the British Museum collections; there is, however, some labelled *E. gigas*, which we refer to this species.

Monod (1931b) recorded and figured specimens of a sphaeromatid which he attributed to *Exosphaeroma lanceolatum* (White). We have been able to examine these through the courtesy of Dr Richard Bott of the

Senckenberg Museum, and are satisfied that Monod's specimens belong to *Exosphaeroma obtusum* (Dana).

The *Exosphaeroma lanceolatum* of Morton & Miller (1968) is likely to belong to this species also. They describe their specimens as "short, oval-bodied . . . sandy grey in colour and with no dorsal spine" and often to be found in northern New Zealand beaches "burrowing in sand of finer texture".

Barnard's *Exosphaeroma* sp. from Carnley Harbour and Dunedin (Barnard 1940) is clearly referable to this species.

***Exosphaeroma planulum* Hurley & Jansen, 1971 (Fig. 54)**

*Exosphaeroma planum* Hurley & Jansen, 1971\*: 472. Jansen, 1971: 270.

**DIAGNOSIS**

*Exosphaeroma* with wide, flattened body. Coxal plate of pereonite 6 produced posteriorly to overlap pereonite 7 and pleonite 1. Uropod outer ramus about half length of inner. Sexes similar.

\*Although the date of this paper is nominally December 1970, it was not actually published until April 1971.

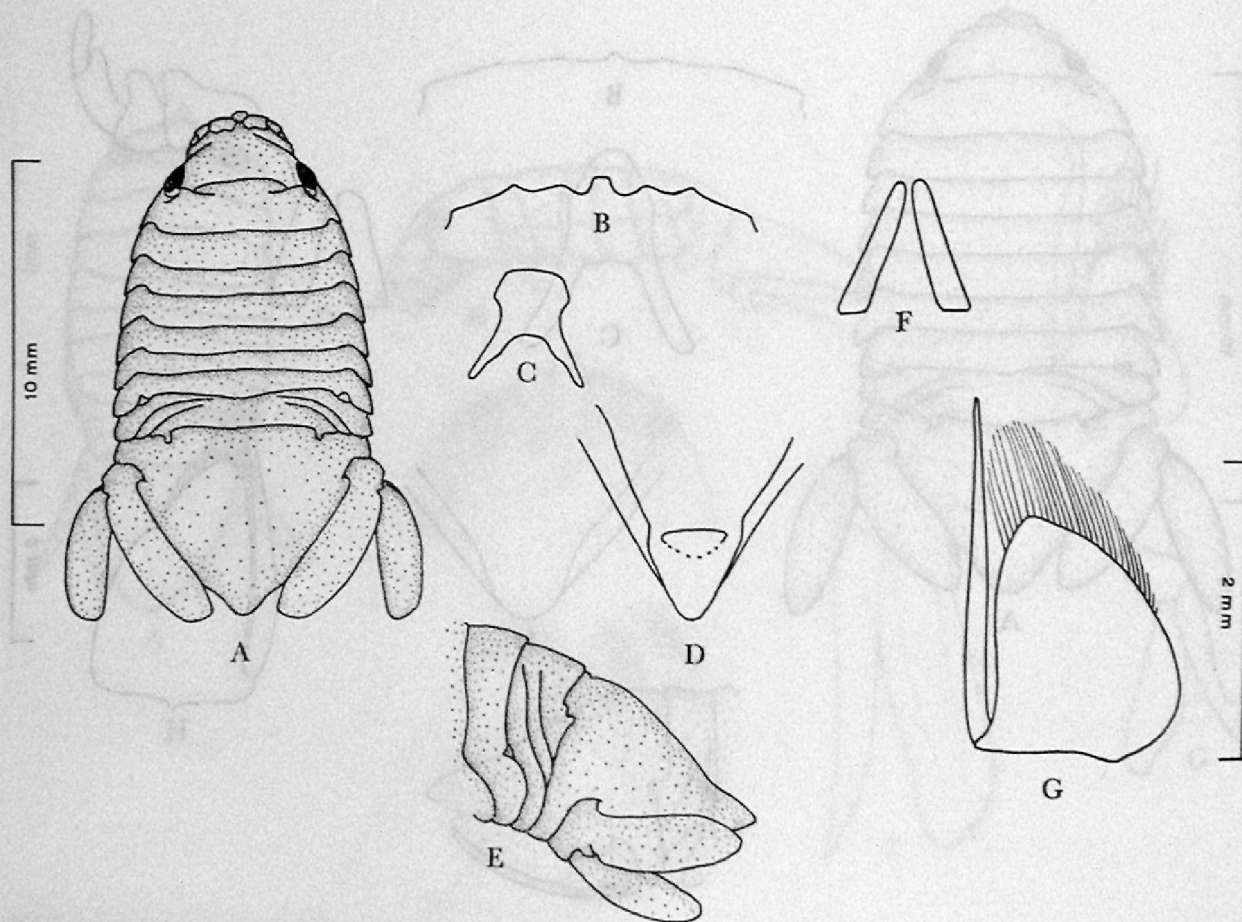


FIG. 53. *Exosphaeroma obtusum* (Dana), mature ♂: A, whole animal; B, frontal margin of head, dorsal view; C, epistome; D, pleotelson apex, ventral view; E, pleon, side view; F, penes; G, pleopod 2, inner ramus.

**TYPE MATERIAL**

Holotype: Canterbury Museum Type No. AQ3403 [121, ♂, 7 mm].

Paratypes: Canterbury Museum Type No. AQ3428 [121, 2 ♀ ♀, 6 mm].

TYPE LOCALITY: Heathcote-Avon Estuary, Christchurch.

**MATERIAL EXAMINED**

Whangarei: [E955] 7 juvs (3-6 mm), 31 ♀ ♀ (5-7 mm), 7 ♂ ♂ (5-8 mm).

Auckland: [126] spp.

Christchurch: [120] 1 juv. (2 mm); [121] 2 ♀ ♀ (6 mm), 1 ♂ (7 mm).

Portobello: [Z2302] 20 juvs (3-5 mm), 26 ♀ ♀ (4.5-6.5 mm), 30 ♂ ♂ (3.5-7 mm).

**HABITAT:** All recorded localities are strongly influenced by fresh water, particularly at low tide, the animals being found under stones in and about the direct fresh-water inflow.

**DEPTH RANGE:** Intertidal.

**REMARKS:** In our preliminary diagnosis (Hurley & Jansen 1971) we inadvertently used a specific name, *planum*, already in use for a South African species. We have here amended the specific name of the New Zealand species to *planulum*. We would have amended it to a more distinctive name, but *planulum* allowed a paper in press on the biology of the New Zealand species (Jansen 1971) to go ahead with a minimum of alteration to figures and text.

***Isocladus* Miers, 1876**

*Isocladus* Miers, 1876b: 112; 1876a: 228-9. Hansen, 1905: 103, 118-19. Menzies, 1962a: 129.

TYPE-SPECIES: *Isocladus armatus* (Milne Edwards).

**DIAGNOSIS**

Hemibranchiate Sphaeromatidae with slender, mesial, dorsal spine on pereonite 7 in males. Maxillipeds with well developed lobes on last three palp segments. Pleotelson apex considerably produced with a ventral groove in both males and females. Broodplates do not reach midline. Pleopod 3 outer ramus of two segments.

**REMARKS:** The species of *Isocladus* are rather similar in general appearance, but are clearly separated by a number of small morphological features, with no intermediate conditions in sympatric species-populations. For example, *Isocladus armatus* occurs in Otago Harbour with *I. spiculatus*. (Mature males of *I. armatus* are distinguished by a small tooth either side of the spine on pereonite 7—these teeth are absent in *I. spiculatus*—and by the shape of the spine and of the uropods.) Similarly, *I. armatus* occurs together with, and is distinguished from, *I. inaccuratus* in the Chatham Islands, and *I. reconditus* and *I. dulciculus* on the east coast of the North Island. Distinct differences in the morphology of mature males in sympatric species-populations have been taken to indicate that these are not merely individual variants within a variable species, and that the species are reproductively isolated, conforming with the species criteria of Mayr *et al.* (1953: 79-80). Moreover, in each situation, immature males, females, and juveniles have been available for comparison, as well as mature males, further removing the likelihood of the differences being due to individual variation.

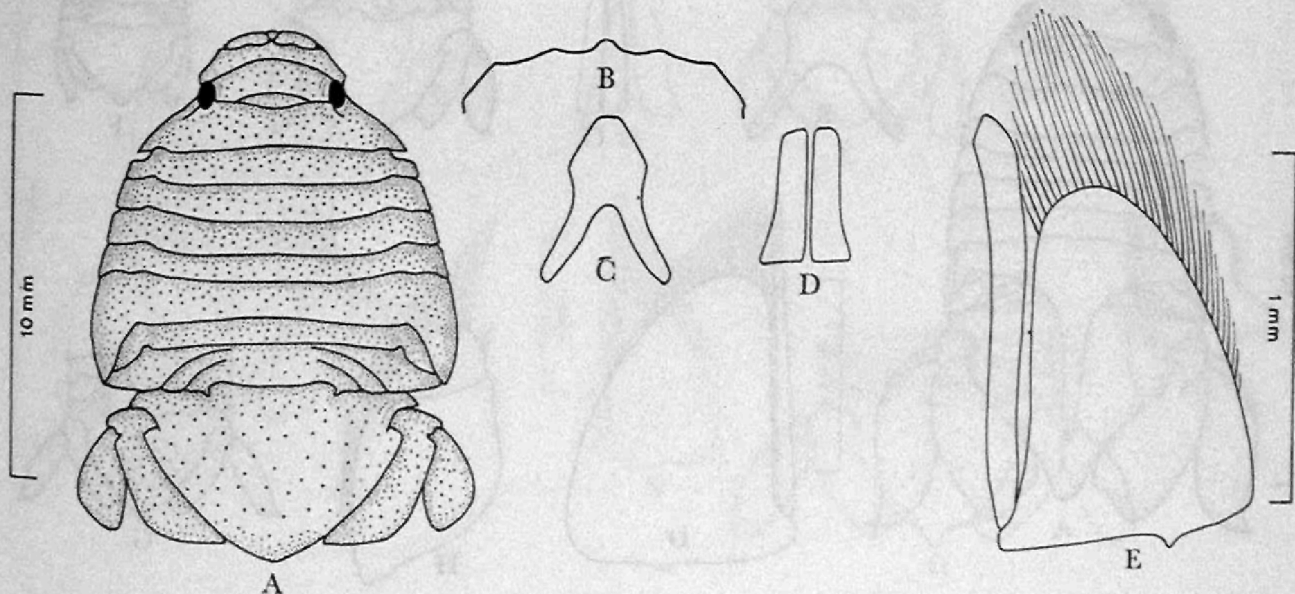


FIG. 54. *Exosphaeroma planulum* Hurley & Jansen, mature ♂: A, whole animal; B, frontal margin of head, dorsal view; C, epistome; D, penes; E, pleopod 2, inner ramus.

KEY TO NEW ZEALAND AND SUBANTARCTIC SPECIES OF  
ISOCLADUS

1. Adult males: with small tooth on pereonite 7 each side of base of spine ..... 2
- Adult males: without small tooth on pereonite 7 each side of base of spine ..... 4
2. Uropod outer ramus lanceolate, with strongly sigmoid outer margin, apex acute and turned outwards; pereonite 7 spine in mature males about three-quarters pleotelson length, apex acute; pleotelson apex also acute, strongly produced ..... ARMATUS
- Uropod outer ramus with broadly rounded apex ..... 3
3. Uropod outer ramus with apex of outer margin recurved and excavate; pereonite 7 spine in mature males about half pleotelson length, tapering to acute apex; pleotelson apex obtuse ..... DULCICULUS
- Uropod outer ramus margin feebly emarginate posteriorly, apex obtuse; pereonite 7 spine in mature males about three-quarters pleotelson length, parallel-sided, apex rounded ..... RECONDITUS
4. Uropod outer ramus broad, apex rounded; pereonite 7 spine in mature males about half pleotelson length, tapering to rounded apex ..... CALCAREUS
- Uropod outer ramus narrow-lanceolate with sigmoid outer margins ..... 5
5. Uropod outer ramus with strongly sigmoid outer margins, acute apex; pereonite 7 spine in mature males about three-quarters pleotelson length, expanded towards apex ..... INACCURATUS
- Uropod outer ramus with weakly sigmoid outer margin, less acute apex; pereonite 7 spine in males about half pleotelson length, tapering to acute apex ..... SPICULATUS

**Isocladus armatus** (Milne Edwards, 1840) (Fig. 55)

*Sphaeroma armata* Milne Edwards, 1840: 210-11.  
*Sphaeroma armata*. Dana, 1853: 780, pl. 52 fig. 7.  
*Isocladus armatus*. Miers, 1876b: 112-13; 1876a: 229. Nierstrasz, 1917: 108; 1931: 196. Tattersall, 1921: 217-19, pl. 5 figs 9-17. Monod, 1931b: 23-4, fig. 16c. Naylor, 1961: 9-11, figs 2e-g. Hurley, 1961: 270. Hicks, 1971: 52, 56. Jansen, 1971: 264-6, 270, fig. 6.  
*Sphaeroma spinigera* Dana, 1853: 780-1, pl. 52 figs 8a-c.  
*Isocladus spiniger* Miers, 1876b: 113, pl. 3 figs 4, 4b; 1876a: 229. Chilton, 1906: 272. Nierstrasz, 1917: 108; 1931: 197. Naylor, 1961: 9, figs 2a-d. Hurley, 1961: 270.  
 [Not] *Isocladus spiniger* (Dana). Morton & Miller, 1968: fig. 67.3.

DIAGNOSIS

*Isocladus* with uropod outer rami lanceolate, with apices acute and turned outwards, and with strongly sigmoid outer margins. Pereonite 7 spine not terminally expanded in mature males, has a small tooth each side of base.

TYPE LOCALITY: Coasts of New Zealand.

MATERIAL EXAMINED

Whangaroa: [44] many spp.  
 Bay of Islands: [Cop. 6] spp.  
 Auckland: [950] 3 ♂♂ (8-10 mm); [E957] 1 juv. (6 mm), 1 ♂ (9 mm). Also: [47] 2 spp; [39] 20-30 spp; [126] spp; [Gal. 667] 4 ♂♂.  
 Mt. Maunganui: [E958] 3 juvs (5-6 mm), 1 ♀ (8 mm), 2 ♂♂ (8 mm); [E960] 1 ♀ (7 mm), 1 ♂ (9 mm).  
 Cape Kidnappers: [Cop. 13] spp.  
 Mahia Peninsula: [E961] 5 juvs (4-5 mm), 3 ♀♀ (5-7 mm), 5 ♂♂ (6-13 mm); [E962] 1 ♀ (9 mm), 1 ♂ (7 mm).  
 New Plymouth: [Z2284] 1 ♀ (9 mm), 11 ♂♂ (6-11 mm).  
 Wellington: [27] 13 spp.  
 Kaikoura: [104] 1664 juvs (1-6 mm), 294 ♀♀ (5-9 mm), 377 ♂♂ (5-12 mm). Also: [E972] 6 spp; [89] 2 spp; [101] 1 sp; [107] 20-30 spp.  
 Akaroa: [Cop. 18] spp.  
 Otago Harbour: [34] 2 ♀♀ (7 mm), 2 ♂♂ (5-9 mm). Also: [Z2292] 9 spp; [Gal. 597] spp.  
 Chatham Is: [CIE 11] 1 juv. (6 mm), 26 ♂♂ (6-11 mm), 7 ♂♂ (8-11 mm); [E161] 2 ♀♀ (10-12 mm). Also: [CIE 9] 2 spp; [E132] 1 sp.

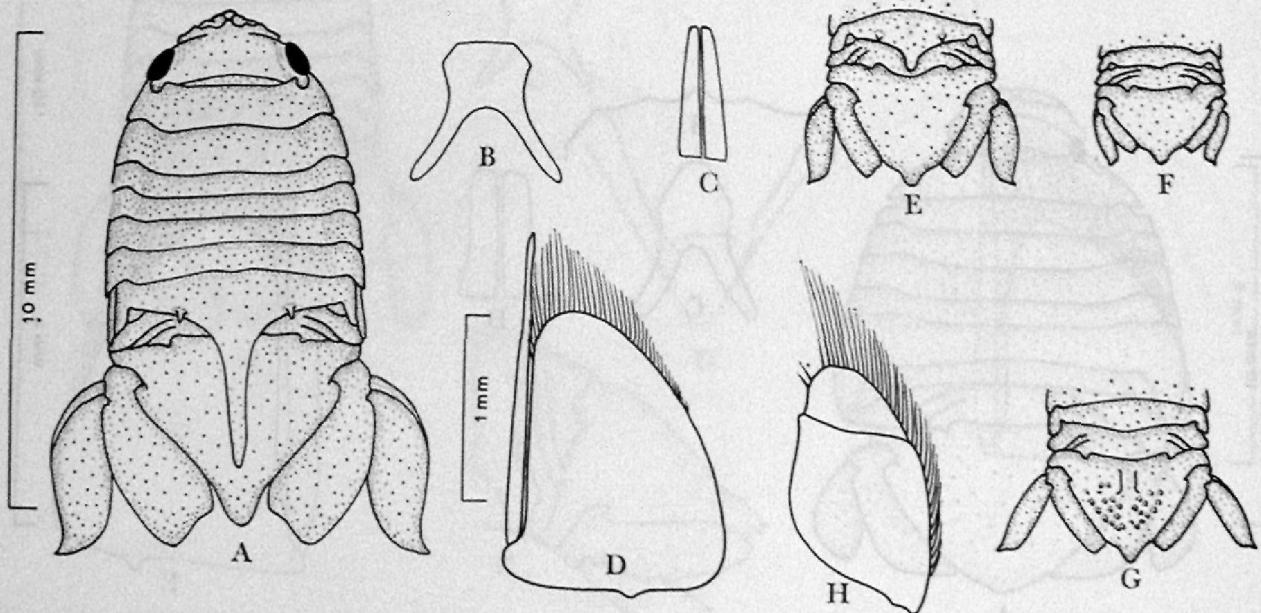


FIG. 55. *Isocladus armatus* (Milne Edwards), mature ♂ except E, F (immature ♂♂) and G, H, (♀): A, whole animal; B, epistome; C, penes; D, pleopod 2, inner ramus; E-G, pleon, dorsal view; H, pleopod 3, outer ramus.

OTHER RECORDS: "Bay of Islands, along rocky shores" (Dana 1853); "coasts of New Zealand" (Milne Edwards 1840); Christchurch, Sumner (coll. E. W. Bennett, Dec. 1923); Otago Heads, 126 m (coll. Young, Sept. 1924); Stewart I., Paterson Inlet (Monod 1931:23).

HABITAT: Very abundant (up to about 5 000m<sup>-2</sup>) on moderately sheltered shores, on and under stones, in sandy pools; less abundant (<100m<sup>-2</sup>) on more exposed shores, in rock pools and crevices (Jansen 1971).

DEPTH RANGE: Intertidal.

REMARKS: The conspecificity of *Isocladus armatus* (Milne Edwards) and *I. spiniger* (Dana) was confirmed by laboratory observation (Jansen, unpubl. data) of live immature males of *I. armatus*. On several occasions such specimens were seen to moult and emerge as mature males of the 'spiniger' form.

The figure labelled *I. armatus* in Morton & Miller (1968: fig. 71.4) is described as "not quite adult", and it is not possible to attribute it to any of the species described here with certainty.

The figures of "*Isocladus spiniger*" (Morton & Miller, 1968: fig. 67.3) are too diagrammatic to be specifically identifiable, but could be *dulciculus* or *calcareus*. Only *dulciculus* is recorded from north of Castlepoint.

### *Isocladus calcareus* (Dana, 1853) (Fig. 56)

*Spheroma calcarea* Dana, 1853: 77-7; 1885: pl. 52 fig. 2a-c.

*Isocladus magellanensis* Richardson, 1906a: 14-15, fig. 18.

Stephenson, 1927: 363-4, fig. 26a. Nierstrasz, 1931: 197.

*Isocladus magellanicus*. Hurley, 1961: 270.

*Isocladus calcarea*. Menzies, 1962a: 129-30, figs 42b-g.

### DIAGNOSIS

*Isocladus* with uropod outer ramus broad, apex rounded. Pereonite 7 spine in mature males about half pleotelson length, tapering to rounded apex, without small tooth each side of base.

TYPE LOCALITY: 46°53'S, 65°11'W, off Fuegia, 50 fathoms.

### MATERIAL EXAMINED

Castlepoint: [E983, E984] 4 juvs (3-5 mm), 2 ♀♀ (8-9 mm), 1 ♂ (9 mm); [Z2299] 1 ♂ (9 mm).

Kaikoura: [108] 471 juvs (1.6-6 mm), 445 ♀♀ (5-10 mm), 361 ♂♂ (5-12 mm). Also: [84] 1 sp; [86] 1 sp; [88] 1 sp; [104] many spp.

Oamaru: [131] 1 ♀ (7 mm), 2 ♂♂ (10-11 mm).

Otago: [E974] 17 juvs (2-6 mm), 3 ♀♀ (7 mm); [132] 2 spp; [Z2290] 6 spp.

Stewart I: [Cop. 21] spp.

Snares Is: [64, 72] 7 ♀♀ (6-8 mm), 1 ♂ (7 mm).

Auckland Is: [52, 57, 58, 60] 2 juvs (4-5 mm), 8 ♀♀ (7-8 mm), 1 ♂ (6 mm); [Cop. 22] spp.

Chatham Is: [CIE 16] 1 ♀ (8 mm).

HABITAT: More numerous on moderately exposed shores.

DEPTH RANGE: Intertidal, subtidal.

### *Isocladus dulciculus* n.sp. (Fig. 57)

### DIAGNOSIS

*Isocladus* with uropod rami broad; outer ramus has outer margins posteriorly recurved, apex moderately acute and turned outward with small emargination in posterior margin. Pereonite 7 in adult male has small tooth on each side of base of spine; spine tapers to acute apex, is about half pleotelson length. Pleotelson apex broad, rounded.

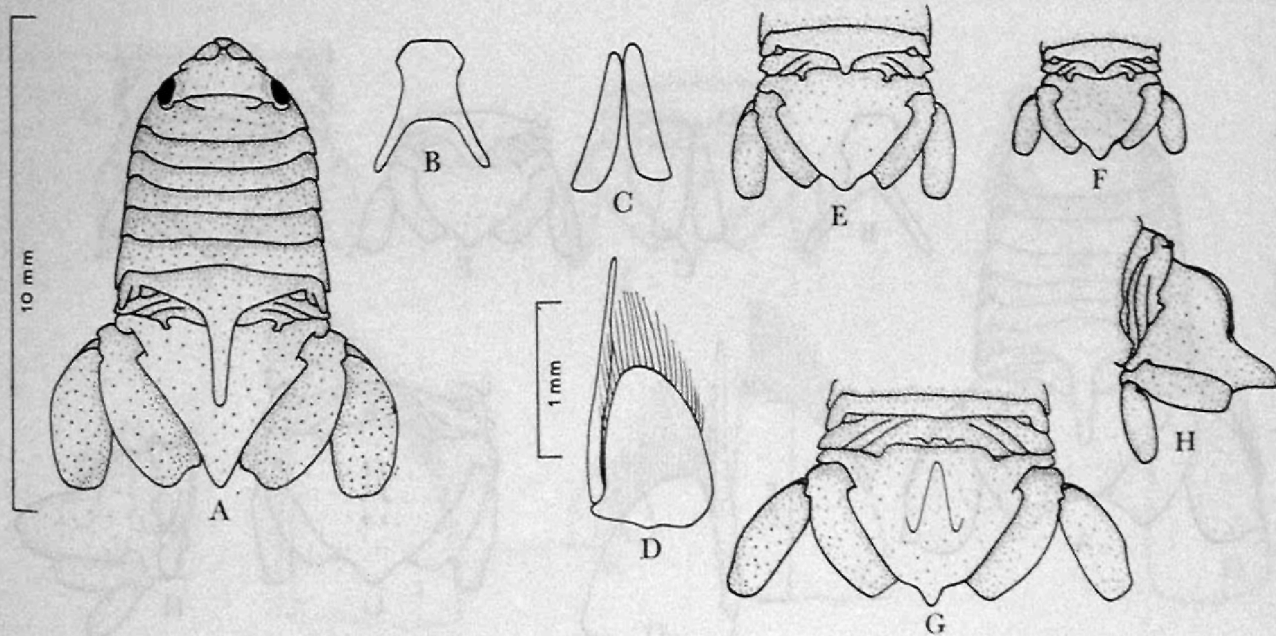


FIG. 56. *Isocladus calcareus* (Dana), mature ♂ except E, F (immature ♂♂) and G, H (♀): A, whole animal; B, epistome; C, penes; D, pleopod 2, inner ramus; E-G, pleon, dorsal view; H, pleon, side view.

TYPE MATERIAL

Holotype: Canterbury Museum Type No. AQ3405 [125, ♂, 7 mm].

Paratype: Canterbury Museum Type No. AQ3430 [125, 2 immature ♂♂, 1 juv].

TYPE LOCALITY: Leigh, Auckland.

MATERIAL EXAMINED

North Cape: [Cop. 4] spp.

Auckland: [E956, 957] 2 juvs (4-5 mm), 12 ♀♀ (4-7 mm), 5 ♂♂ (5-7 mm); [E975, 976, 977] 70 juvs (1.5-4 mm), 31 ♀♀ (4-5 mm), 24 ♂♂ (4-7 mm); [139] 1 ♂ (6 mm).

Also: [125] 4 spp; [Cop. 11] spp.

Whangaparaoa Peninsula: [E980] 1 juv. (3.5 mm), 1 ♀ (5.5 mm), 1 ♂ (7 mm).

Mt. Maunganui: [E959, 960] 3 juvs (1.5 mm), 49 ♀♀ (5-7 mm), 3 ♂♂ (5-7 mm).

Gisborne: [E982] 80 juvs (1.5-5 mm), 5 ♀♀ (5-6 mm), 9 ♂♂ (4-8 mm).

Coromandel: [Z2280, 2308] 30 juvs (3-7 mm), 8 ♀♀ (5-7 mm), 5 ♂♂ (6-7 mm).

Castlepoint: [E983] 4 ♂♂ (5-7 mm). Also: [Z2287] 2 spp.

Wellington: [27] 1 ♂ (6 mm).

Chatham Is: [CIE 12] 6 juvs (3-5 mm), 11 ♀♀ (4-8 mm), 15 ♂♂ (5-7 mm).

OTHER RECORDS: None.

HABITAT: Under stones, in pools, amongst algae, moderately sheltered shores.

DEPTH RANGE: Intertidal to 27 m.

REMARKS: The isopod figured by Morton & Miller (1968: fig. 67.3) as *Isocladus spiniger* may belong to this species.

In describing the fauna of *Corallina officinalis* pools near Auckland, they speak of *Isocladus* as burrowing in coarse sand or nesting in the fronds or basal deposits of *Corallina*, and as being a powerful swimmer, "leaving its refuges to career freely about in pools, ventral surface uppermost . . . The camouflage pattern is in no two species alike".

They also give a vivid description of "*Isocladus armatus*", which they found to be a typical inhabitant of protected sand beaches in the coarser shell sand of the

middle beach, "often a rather narrow strip . . . half swimming, half sand-ploughing, thrusting a path with the rounded head between the coarse sand grains below the water table, and coming to the surface as scavengers by night, or at full tide".

*Isocladus inaccuratus* n.sp. (Fig. 58)

[Not] *Isocladus spiniger* (in part) of Naylor, 1961: 9, fig. 2a.

DIAGNOSIS

*Isocladus* with uropod outer ramus narrow-lanceolate with acute, outward-turned apex, moderately sigmoid outer margin. Pereonite 7 dorsal spine in adult males expanded towards apex, without teeth each side of spine base.

TYPE MATERIAL

Holotype: Canterbury Museum Type No. AQ3404 [CIE 22, ♂, 15 mm].

Paratypes: Canterbury Museum Type No. AQ3429 [CIE 22, 18 juvs, 6-8 mm; 21 ♀♀, 7-12 mm; 23 ♂♂ 8-15 mm].

TYPE LOCALITY: The Sisters, Chatham Islands.

MATERIAL EXAMINED

Chatham Is: [CIE 16] 1 ♀ (16 mm); [CIE 22] 18 juvs (6-8 mm), 21 ♀♀ (7-12 mm), 24 ♂♂ (8-15 mm).

OTHER RECORDS: Chatham Is. (coll. S. D. Shand, June 1909; W. R. B. Oliver, Dec. 1909); Naylor (1961:9).

HABITAT: Rock pools.

DEPTH RANGE: Intertidal.

REMARKS: *I. inaccuratus* and *I. armatus* are very similar, but the males are completely separable. Naylor (1961: 9, fig. 2) has apparently confused at least two species: his fig. 2a is a 16 mm adult male *I. inaccuratus*, his fig. 2e is a 13.5 mm immature male *I. inaccuratus*, and his fig. 2b resembles *I. calcareus*. Large samples including animals of all sexes and sizes are needed to avoid this misidentification problem in a group of such closely related species as *Isocladus*.

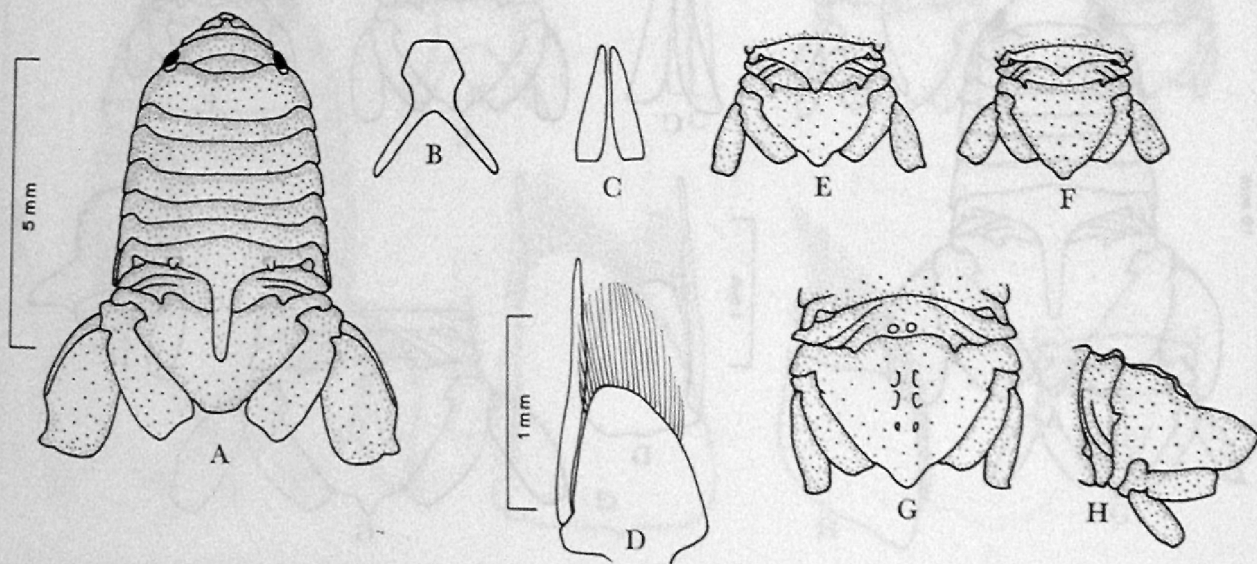


FIG. 57. *Isocladus dulciculus* n.sp., mature ♂ except E, F (immature ♂♂) and G, H (♀): A, whole animal; B, epistome; C, penes; D, pleopod 2, inner ramus; E-G, pleon, dorsal view; H, pleon, side view.

***Isocladus reconditus* n.sp. (Fig. 59)**

**DIAGNOSIS**

*Isocladus* with uropod outer ramus broadly rounded, apex obtuse, feebly emarginate on rear margin and on outer margin posteriorly. Pereonite 7 spine in adult males about three-quarters pleotelson length, parallel-sided, apex rounded, small tooth each side of base.

**TYPE MATERIAL**

Holotype: NZOI Type No. 135 [E958, ♂, 9 mm].  
Paratypes: NZOI Type No. P192 [E958, E959, 23 juvs 2-6 mm; 29 ♀♀ 6-9 mm, 17 ♂♂ 6-9 mm].

**TYPE LOCALITY:** Mt Maunganui.

**MATERIAL EXAMINED**

Dargaville: [E952] 2 juvs (6-7 mm), 8 ♀♀ (6-9 mm), 7 ♂♂ (6-10 mm). Also: [127] about 20 spp.  
Whangarei: [E953] 5 juvs (5-6 mm), 2 ♀♀ (6-7 mm), 3 ♂♂ (7-10 mm).

Mt. Maunganui: [E958, E959] 23 juvs (2-6 mm), 29 ♀♀ (6-9 mm), 17 ♂♂ (6-9 mm).

**OTHER RECORDS:** None.

**HABITAT:** Under stones, in rock pools, algal holdfasts, on moderately exposed shores.

**DEPTH RANGE:** Intertidal.

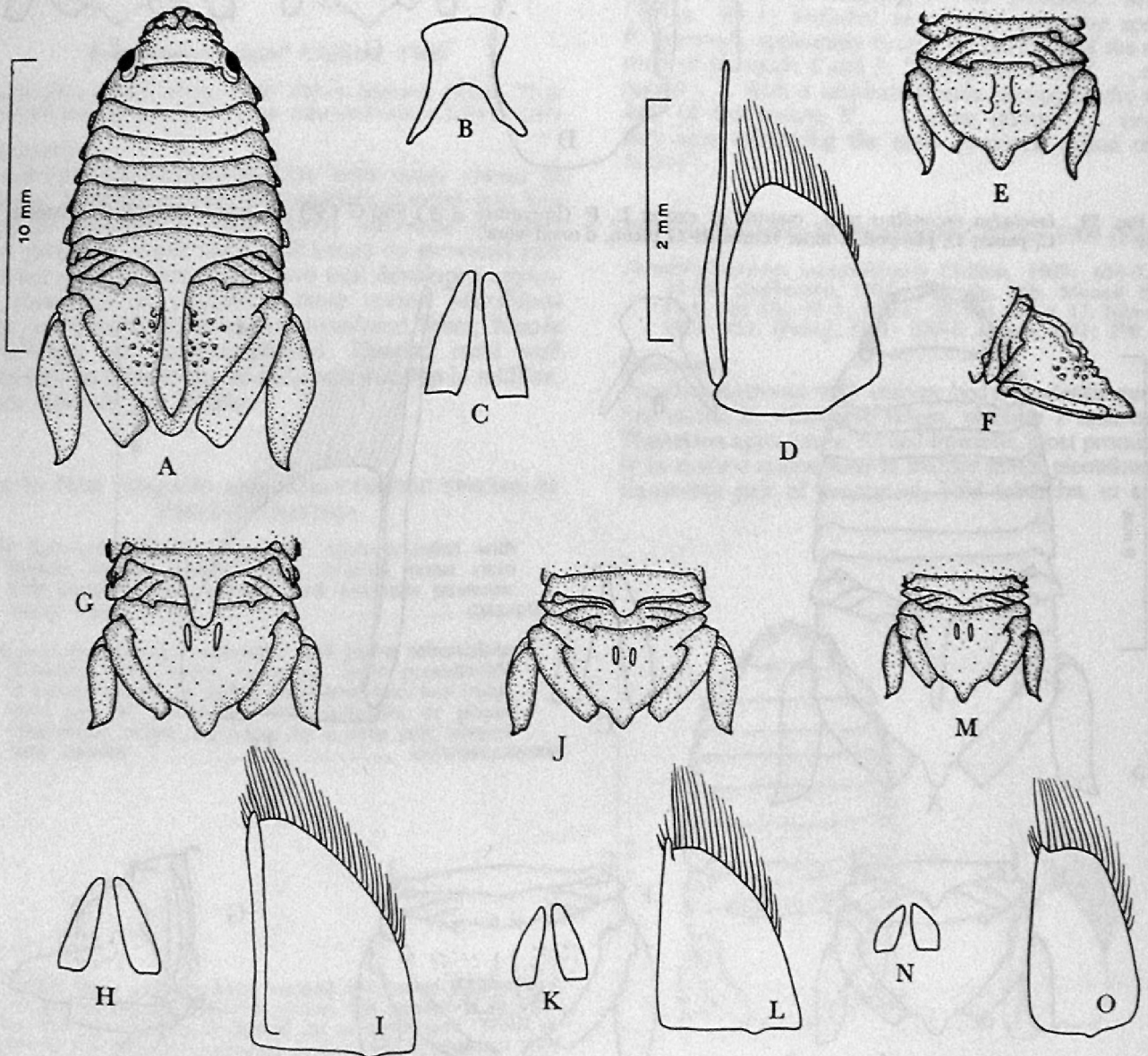


FIG. 58. *Isocladus inaccuratus* n.sp., A-D mature ♂. A, whole animal; B, epistome; C, penes; D, pleopod 2, inner ramus. E-F, ♀ pleon: E, dorsal view; F, side view. G-O, successive stages in immature ♂♂. G, J, M, pleon, dorsal view; H, K, N, penes; I, L, O, pleopod 2, inner ramus.