

New records of marine benthic algae from New South Wales, eastern Australia

Alan J. K. Millar

Royal Botanic Gardens Sydney, Mrs Macquaries Road, Sydney 2000, New South Wales, Australia

SUMMARY

Twenty-four species of marine macroalgae are recorded from the mainland coast of New South Wales for the first time. One species, *Laurencia platyclada* Boergesen, represents a new record for Australia and the Pacific Ocean. Included in these new records is the introduced, invasive and cold-tolerant strain of the green alga *Caulerpa taxifolia*, which was formerly known only as native, non-invasive populations from Lord Howe Island. Based on published accounts, the composition of the marine benthic algae for the state of New South Wales now stands at 131 green, 140 brown and 449 red macroalgae. This baseline information adds significantly to our knowledge of the overall marine biodiversity of the state, as well as to the phycogeography of the southwestern Pacific region.

Key words: Australia, *Caulerpa taxifolia*, *Laurencia platyclada*, Lord Howe Island, marine algae, new records, New South Wales.

INTRODUCTION

During the 1990s, Millar (1990) and Millar and Kraft (1993, 1994a, 1994b) began the task of updating published records and cataloging all new records of the marine benthic algae from the coast of New South Wales, as well as Lord Howe Island in the Tasman Sea (Fig. 1). By 1994, the number of identifiable marine algal species consisted of 381 reds, 139 browns and 113 greens, with Lord Howe Island accounting for 173 reds, 67 browns and 65 green macroalgae. Since then, a number of new species and genera have been described from this coast (Millar 1993, 1994, 1996, 1997, 1998, 2000; Withell *et al.* 1994; Athanasiadis 1996; Millar *et al.* 1996; Townsend & Borowitzka 2001; Harvey *et al.* 2002), and a detailed floristic account of the green macroalgae of Lord Howe Island (Kraft 2000), which included 11 new species, has been completed. In addition, numerous range extensions of southern Australian species, based on Millar's collections, have been recorded for New South Wales through the works of Womersley (1994, 1996, 1998).

Beginning in 1996, the author has been critically surveying the phycologically unexplored coastline from

Cape Howe on the southeastern-most part of the Australian continent to as far north as Montague Island, which lies just off the coast from the township of Narooma at about 35°15'S (Fig. 2). These surveys have resulted in the discovery of 24 new records for the State of New South Wales with many of these species known from the southern Australian coast from Western Australia, South Australia, Victoria and Tasmania. The new records are listed here with annotations regarding their taxonomy and distribution.

NEW RECORDS

Division: Chlorophyta

Family: Caulerpaceae

Caulerpa taxifolia (Vahl) C. Agardh (1817), xxii; Lucas (1935), 198, fig. 2; Kraft (2000), 604, figs 34(E), 35(A) (Fig. 3)

Type locality: St Croix, Virgin Islands.

Distribution: The native strain exists as a pan tropical/subtropical species from the Indian, Pacific and Atlantic Oceans. In Australia the native strain occurs from Broome, Western Australia around northern Australia down to Southport, Queensland, and on Lord Howe Island. In NSW, now confirmed from Lake Macquarie in the north to Burrill Lake in the South. Unknown on the open coast.

Specimens examined: Quibray Bay, Botany Bay, J. Hannan, 7.iv.2001, NSW 471420; Cronulla Wharf, Gunnamatta Bay, Port Hacking, M. Miller, A. J. K. Millar and N. Yee, 25.v.2000, NSW 440641; Gunnamatta Bay, J. Hannan, 13.iv.2000, NSW 439791 (Fig. 3); South side of Lake Conjola, Western side of Township, A. J. K. Millar, N. Yee, M. Miller and P. Gibbs, 8.vi.2000, NSW 441208.

Remarks: In NSW, *C. taxifolia* was previously known only as native (non-invasive) populations from Lord Howe Island, where it was first recorded by Lucas

*To whom correspondence should be addressed.

Email: alan.millar@rbgsyd.nsw.gov.au

Communicating editor: K. Kogame.

Received 28 June 2003; accepted 27 November 2003.

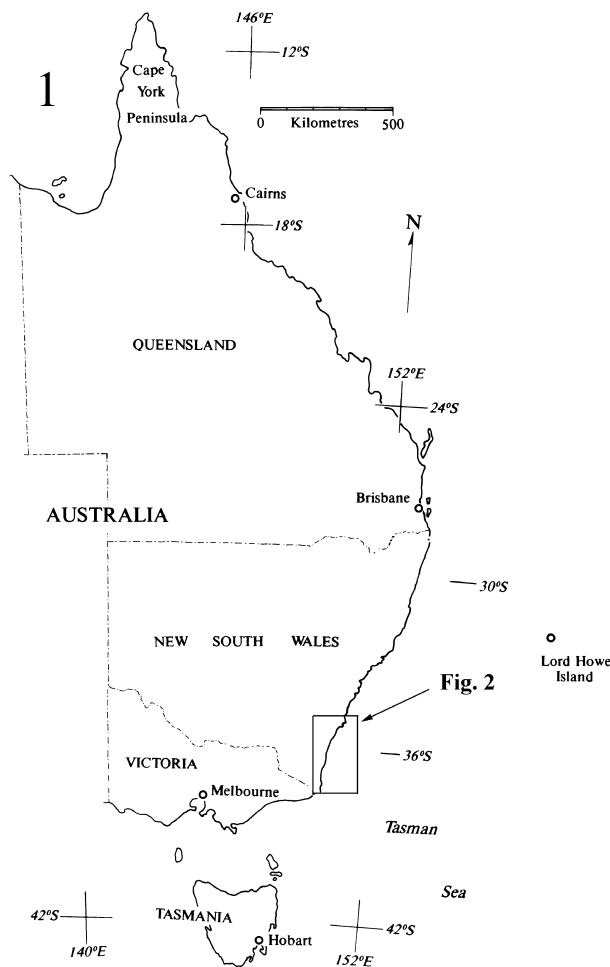


Fig. 1. Map of eastern Australia.

(1935) and later by Millar and Kraft (1994b) and Kraft (2000). The invasive, cold-tolerant strain of this species was first discovered on the mainland of NSW in March 2000 at Fishermans Bay, Port Hacking. It has since been confirmed from Burrill Lake, Narawaree Inlet, Lake Conjola, Botany Bay (south of Sydney), Sydney Harbor to Careel Bay and Lake Macquarie to the north of Sydney (Millar 2001). Its mode of introduction to the NSW mainland is considered to be anthropogenic and the result of at least two separate introductions (Jousson *et al.* 2000; Schaffelke *et al.* 2002). Fama *et al.* (2002) demonstrated that the invasive strain of *C. taxifolia* lacks an intron in its *rbcL* gene and this is the case for the NSW mainland populations. In NSW waters, the invasive strain grows only in association with seagrass beds in shallow, protected, estuarine environments. It is as yet unknown from the open coast.

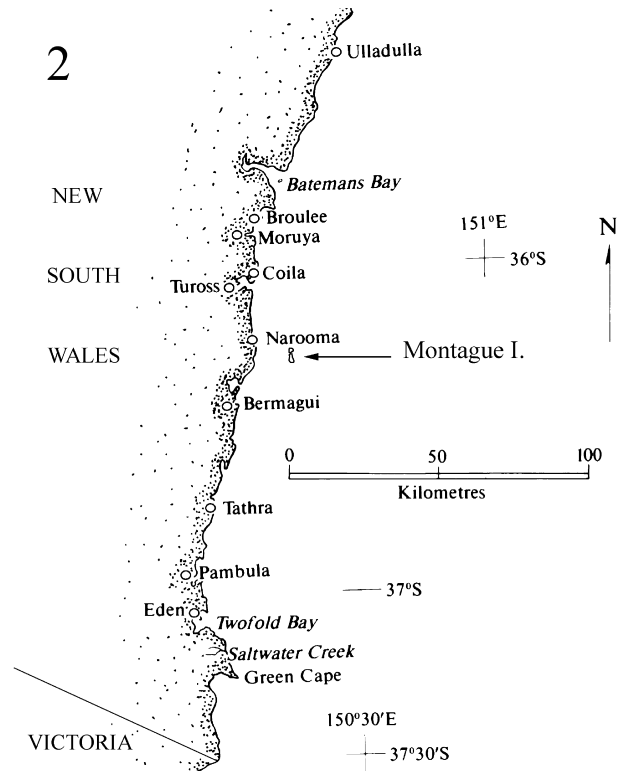


Fig. 2. Map of southern New South Wales.

Division: Heterokontophyta

Family: Sporochneaceae

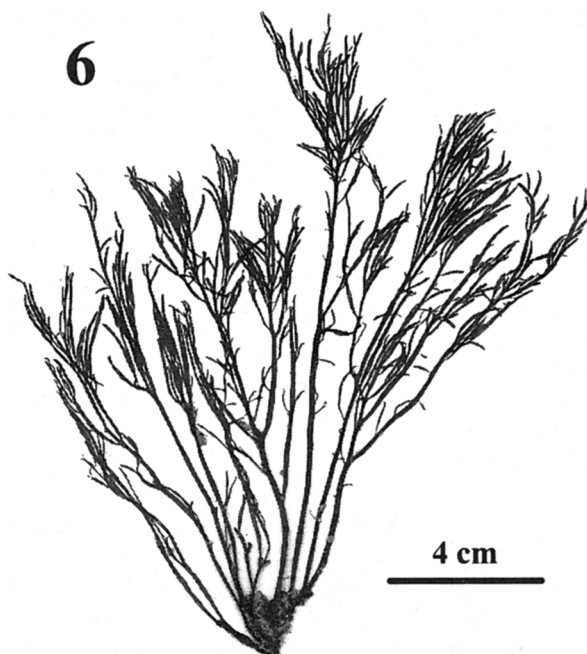
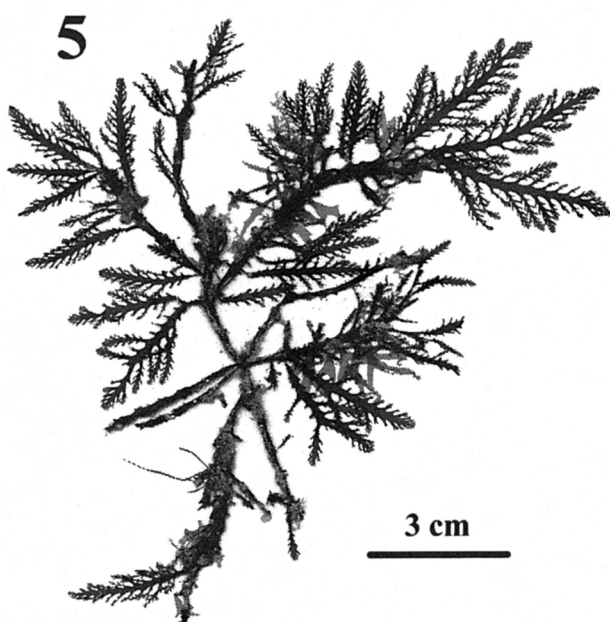
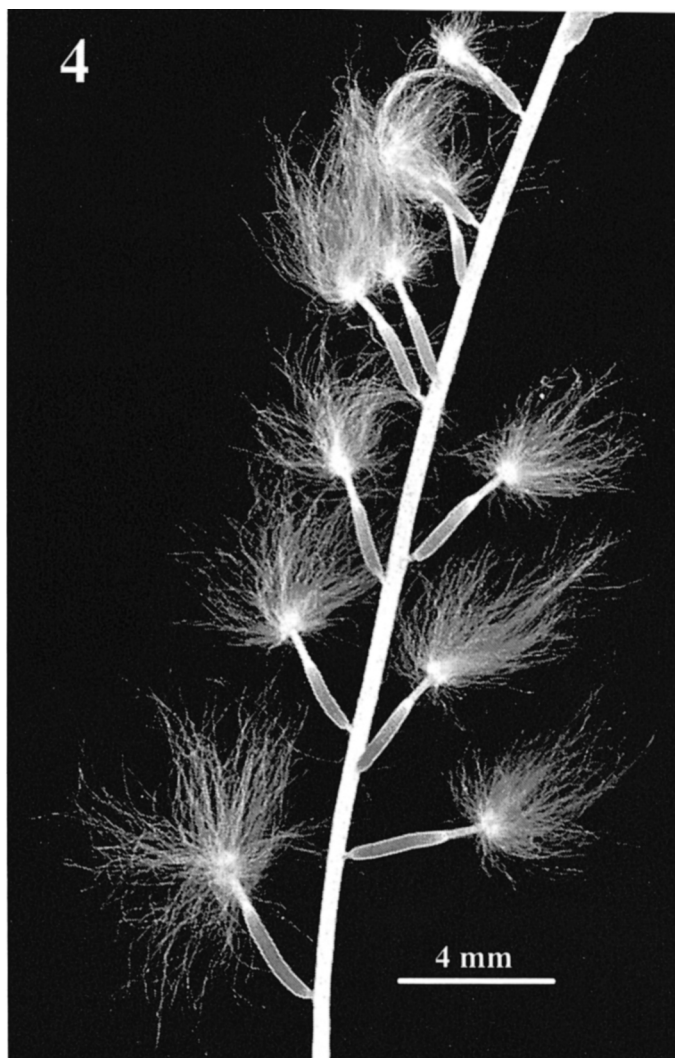
Sporochnus stylosus Harvey (1855), 216, pl. 109B; Lindauer *et al.* (1961), 241, fig. 58; Womersley (1987), 276, figs 99(B), 101(A,B); Adams (1994), 92, pl. 29 (Fig. 4)

Syntype localities: Otago Harbor and Foveaux Strait, New Zealand.

Distribution: In New Zealand from Three Kings Islands in the far north to Stewart Island in the south. In Australia from the southeast coast of Tasmania north to Mowarry Point (just north of Green Cape) in southeastern NSW.

Specimens examined: Mowarry Point, South of Twofold Bay, A. J. K. Millar, C. O'Brien and D. Hardin, 9.xii.1996, NSW 434676, NSW 434658.

Remarks: *Sporochnus stylosus* is one of the more distinctive species owing to its sterile region between the apical hair tufts and inflated soral areas of the lateral branches (Fig. 4). This character is partially shared with two other species: *S. elsiae*, in which the sporangial sorus is constricted several times (Adams 1994) and *S. rostratus* (Taylor 1945). The status of the latter species remains in doubt as Lindauer *et al.* (1961) and Yee (pers. comm. 2004) consider this species to be conspecific with the earlier described *S. stylosus*.



Figs 3–6. Habits of marine algae. 3. *Caulerpa taxifolia*, NSW 439791. 4. *Sporochnus stylosus*, NSW 434676. 5. *Dictyomenia harveyana*, NSW 395777. 6. *Chondria bulbosa*, NSW 439112.

Division: Rhodophyta

Family: Nemastomataceae

Platoma australica Womersley and Kraft, Womersley (1994), 284, figs 89(D), 90(G–I)

Type locality: Encounter Bay, South Australia.

Distribution: From Waldegrave Island in South Australia to southeast Tasmania and up to Montague Island, southeast NSW.

Specimens examined: Montague Island, A. J. K. Millar, N. Yee and J. Eu, 28.ii.2000, NSW 440232; between Honeysuckle Point and Red Point, Twofold Bay, A. J. K. Millar and P. G. Richards, 4.ii.1992, NSW 290895, 290896.

Remarks: The NSW specimens are small, sterile and presumably juvenile. They lack gland cells and are thus noticeably different from the type species of the genus *P. cyclocolpum*, shown by Huisman (1999) and others to consistently bear gland cells in contrast to Womersley's (1994) definition of the genus *Platoma*. Saunders and Kraft (pers. comm. 2004) have found that *P. australica* and another *Platoma* species (*P. foliosa* Womersley et Kraft in Womersley) represent a separate and new genus, which they are describing.

Family Mychodeaceae

Mychodea marginifera (Areschoug) Kraft (1978), 551, figs 16, 17, 38, 39; Womersley (1994), 466, figs 166(A–C), 167(A–F)

Type locality: Port Phillip Bay, Victoria.

Distribution: From Port Denison, Western Australia to Gabo Island in eastern Victoria. In NSW to Aughinish Rocks, Montague Island (off Narooma).

Specimens examined: Southern pinnacle of Aughinish Rocks, south of Montague Island, A. J. K. Millar, C. O'Brien and J. Eu, 11.xii.1998, NSW 434526; A. J. K. Millar, P. Richards and N. Yee, 1.iii.2000, NSW 440097; West of Green Cape Lighthouse, Disaster Bay, A. J. K. Millar, N. Yee and P. Richards, 24.ii.2000, NSW 439665.

Remarks: The NSW plants discovered extend considerably the depth limits of this otherwise southern Australian endemic species. Kraft and Womersley in Womersley (1994) record it above 11 m depths, yet in NSW waters the species is found only at 28–30 m.

Family: Cystocloniaceae

Craspedocarpus venosus (Kützinger) Min-Thein and Womersley (1976), 113, figs 41, 42, 64; Womersley (1994), 423, figs 145(C–G), 146(F–I)

Type locality: Novae Hollandiae.

Distribution: From Fremantle, Western Australia to Flinders Island, Bass Strait. In NSW known only as far north as Twofold Bay.

Specimens examined: Honeysuckle Point, Twofold Bay, A. J. K. Millar and P. G. Richards, 19.x.1992, NSW 292199, slide 6–36; Mowarry Point, south of Twofold Bay, A. J. K. Millar, C. O'Brien and D. Hardin, 9.xii.1996, NSW slide 26–19.

Remarks: Although the NSW plants grow to heights of only 1 cm and are thus much smaller than is typical for southern Australian plants (5–10 cm), there are no other obvious characters to separate the two populations. Final confirmation awaits molecular studies.

Family: Champiaceae

Champia insignis Lucas (1931), 409, pl. 25, fig. 1; Reedman and Womersley (1976), 81, figs 2(E,F), 11(A); Womersley (1996), 123, figs 50, 51(A,B) (Fig. 11)

Type locality: Sandy Bay, R. Derwent Estuary, Tasmania, Lucas October 1925. NSW 288779. (Note: Womersley 1996 incorrectly cites the lectotype as NSW 136559.)

Distribution: Formerly known only from southeast Tasmania. In NSW we have recorded it as far north as the ship wreck of the Henry Bolte, just south of the mouth of Twofold Bay.

Specimens examined: Henry Bolte Wreck, off Twofold Bay, Eden, A. J. K. Millar, C. O'Brien and D. Hardin, 4.xi.1997, NSW 440153, NSW 440159, NSW 440158; West of Green Cape, Disaster Bay, A. J. K. Millar, C. O'Brien and D. Hardin, 27.i.1996, NSW 395615.

Remarks: The NSW plants do not reach the large size of the typical Tasmanian specimens, but otherwise are very similar in their mostly opposite branching, which characterizes the species to some extent.

Family: Rhodymeniaceae

Erythrymenia minuta Kylin (1931), 13, pl. 4, fig. 10; Womersley (1996), 67, figs 23, 30(B) (Fig. 8)

Type locality: Port Phillip Heads, Victoria.

Distribution: From Sorrento, Western Australia, to Portsea, Victoria and the east coast of Tasmania. In NSW, known from Montague Island south to Twofold Bay.

Specimens examined: Northwest Trench, Montague Island, A. J. K. Millar, N. Yee and P. Richards, 28.ii.2000, NSW 439989; Southern pinnacle of Aughinish Rocks, south of Montague Island, A. J. K. Millar, C. O'Brien and J. Eu, 11.xii.1998, NSW 434525, NSW 434524, A. J. K. Millar, N. Yee and P. Richards, 1.iii.2000, NSW 439758, NSW 439757; Henry Bolte Wreck, off Twofold Bay, Eden, A. J. K. Millar and C. O'Brien, 10.xii.1996, NSW 434579.

Remarks: Although considered a shallow water species (down to 15 m depth) in southern Australia, *E. minuta* has only been collected from depths of

28–33 m in NSW. The thick, flattened, ovate blades with a distinctly mottled surface are diagnostic of this species. The larger NSW plants bear marginal proliferations, a feature that is unreported for southern Australian plants. The importance of this character at the species level has yet to be tested.

Rhodymenia prolificans Zanardini (1874), 499; Womersley (1996), 82, figs 29,30(E) (Fig. 10)

Type locality: Georgetown, Tasmania.

Distribution: Lawrence Rock, Portland, Victoria to Gabo Island, and around Tasmania.

Specimens examined: Mrs Macquaries Point, Port Jackson, Sydney, A. J. K. Millar, 12.i.1990, NSW 289569 – NSW 289572.

Remarks: A single population exists at the end of Mrs Macquaries Point in Port Jackson, Sydney Harbor, growing on rocks in 1–2 m of water. Its habitat in southern Australia is similarly upper sublittoral. The species absence from other parts of the NSW coast between Sydney and Gabo Island is noteworthy. Population genetic studies are needed to determine if the NSW populations represent an anthropogenic introduction or range extension. The species is not displaying invasive tendencies in Sydney Harbor.

Family: Ceramiaceae

Antithamnion hubbsii Dawson (1962), 16, pl. 5, fig. 2, pl. 6, fig. 3; Athanasiadis (1996), 146, fig. 66; Millar (1999), 513.

Type locality: Melpomene Cove, Isla Guadalupe, Baja California, Mexico.

Distribution: Baja California, Southeast Africa and southwestern Pacific (Lord Howe Island and Norfolk Island).

Specimens examined: Norfolk Island, Claytons Reef, west of Nepean Island, A. J. K. Millar and P. G. Richards, 15.xii.1994, NSW slides 17–14, 17–17, 17–28; Swiss Cheese Reef, off Kingston jetty, A. J. K. Millar and P. G. Richards, 12.xii.1994, NSW 391157; A. J. K. Millar and J. Marges, 21.ix.1996, NSW slides 20–25, 20–26. New South Wales, Botany Bay, NSW Fisheries, October 1998, NSW slides 24–72, 24–73.

Remarks: The Botany Bay plants are much smaller than those from Norfolk Island, which Millar (1999) identifies as *A. hubbsii*. Dawson's (1962) description of this species records axes that are wider (50–60 µm) than the maximum (40 µm) measured for Botany Bay plants. However, all populations share the same branching pattern and similar gland cells. Athanasiadis (1996) illustrates plants from Baja of a similar size to the Botany Bay specimens.

Acrothamnion preissii (Sonder) Wollaston (1968), 323, fig. 24; Womersley (1998), 120, figs 52(A,B),53(A–J).

Type locality: Rottnest Island, Western Australia.

Distribution: From Shark Bay, Western Australia, around southern Australia to Wilsons Promontory, Victoria, and now from NSW as far as Newport Beach. Also known from South Africa, Japan, the Mediterranean and the Philippines.

Specimens examined: Southwest Reef, Montague Island, A. J. K. Millar, C. O'Brien and J. Eu, 9.xii.1998, NSW 439282 (slides 23–29, 23–59); Newport Beach, J. Taylor, 23.iii.2001, NSW 464513 (slide 25–93).

Remarks: This species has now been confirmed from the mainland in the south of the state at Montague Island and in the north from Newport, a suburban beach north of Sydney. The terminal, highly refractive gland cells of this species are unmistakable.

Ceramium monacanthum J. Agardh (1894), 29; Womersley (1978), 214, figs 1(C,D),5(D–G); (1998), 385, figs 176(D–G),177(C,D)

Type locality: Georgetown, Tasmania.

Distribution: From Kangaroo Island, South Australia to Bridgewater Bay, Victoria and around Tasmania.

Specimens examined: Green Cape, New South Wales, A. J. K. Millar and P. G. Richards, 8.ii.1992, NSW 291094, NSW 291095.

Remarks: This distinctive species is restricted to the southern-most part from Green Cape south to the border. Interestingly, the NSW populations are also restricted to the host *Codium fragile* as is the case for many of the southern Australian records (Womersley 1998).

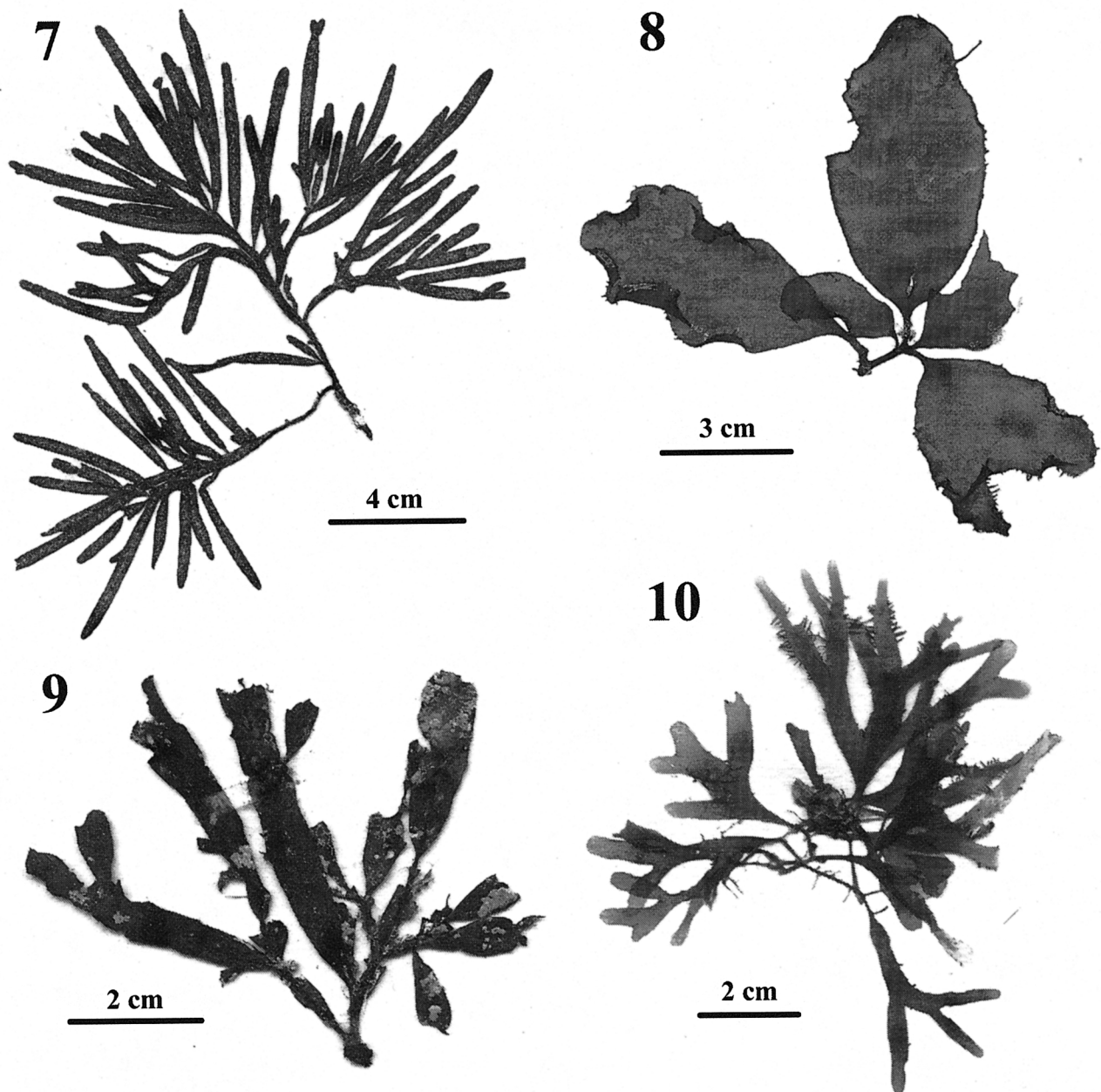
Diplothamnion aff. *gordoniae* Huisman (1991), 118, figs 1–12

Type locality: Cathedral Rocks, Rottnest Island, Western Australia.

Distribution: Known only from Rottnest Island and one record from South Africa (Norris 1992).

Specimens examined: Northwest Trench, Montague Island, 33 m deep on bryozoan, A. J. K. Millar, P. Richards and N. Yee, 13.xii.1999, NSW 436184–436186.

Remarks: The NSW specimens agree well with the genus *Diplothamnion*. The specific identity, however, is not immediately obvious as the tetrasporangia are on axial cells and basal cells of whorl-branchlets, which agrees with *D. tetrastichum* (they are in pairs on all whorl-branchlet cells in *D. gordoniae* and are single on



Figs 7–10. Habits of marine algae. 7. *Epiglossum smithiae*, NSW 477295. 8. *Erythrymenia minuta*, NSW 434525. 9. *Epiglossum proliferum*, NSW 439076. 10. *Rhodymenia prolificans*, NSW 289571.

basal cells of whorl branchlets in *D. jolyi*). Also, axial cells are up to 80 μm in diameter, which most closely matches those in *D. gordoniae* (45–135 μm), whereas they are 20–45 μm in *D. jolyi* and 135–165 μm in *D. tetrastichum*. Lastly, the whorl branchlets are decussate, which is the case for *D. tetrastichum* and *D. jolyi*, but not *D. gordoniae* where they are distichous. The precise identity will remain in doubt pending the discovery of male and female plants.

Pterothamnion francisianum (Wollaston)
Athanasiadis and Kraft (1994), 130;
Womersley (1998), 140,
figs 61(O–Q), 62(A, B)

Type locality: Saint Francis Island, Isles of St Francis, South Australia.

Distribution: In southern Australia known only from three collections: (i) the type; (ii) Blanche Harbor, South Australia; and (iii) Tinderbox, Tasmania.

Specimens examined: Western side of Montague Island, A. J. K. Millar, C. O'Brien and D. Hardin, 10.xi.1997, NSW 437759, NSW 437736, NSW 437742, NSW 437760.

Remarks: Only one population has been discovered in NSW and this was growing relatively deep at 29 m. The type collection (Womersley 1998), was recorded from 55 m. Athanasiadis (1996) discussed the possibility that *P. francisianum* may be conspecific with *P. antarcticum* (Kylin) Moe and Silva, whereas Womersley (1998) chose to maintain them as distinct species until further studies were completed.

Trithamnion gracilissimum Wollaston (1968), 389, fig. 38(I–P); Athanasiadis (1996), 99, fig. 42; Womersley (1998), 178, figs 83(A,B), 84(A–G)

Type locality: Kangaroo Island, South Australia.

Distribution: From the Houtman Abrolhos Island, Western Australia to Rocky Cape in Tasmania. In NSW known only from the south at Montague Island.

Specimens examined: Jetty Bay, Montague Island, A. J. K. Millar, P. Richards and N. Yee, 11.xii.1999, NSW 436192, NSW 436191.

Remarks: While representing a new record for the state and a northeastern range extension for the species, its presence only as far as Montague Island suggests it is predominantly a cold water species. Its presence at the Houtman Abrolhos Islands (Huisman 1997) is certainly its northern-most and warmest water record.

Family: Dasyaceae

Heterosiphonia microcladioides (J. Agardh) Falkenberg (1901), 637, pl. 19, fig. 5; Womersley (1998), 481, fig. 219.

Type locality: Port Phillip Heads, Victoria.

Distribution: From King George Sound, Western Australia to Gabo Island, Victoria and around Tasmania. In NSW known from Cape Howe north to Montague Island.

Specimens examined: Montague Island, bommie in middle of Northwest Trench, A. J. K. Millar, N. Yee and J. Eu, 28.ii.2000, NSW 439919, NSW 439921; Northwest Trench, Montague Island, A. J. K. Millar, J. Huisman and N. Yee, 11.x.1999, NSW 433973, NSW 433971; A. J. K. Millar, P. Richards, and N. Yee, 27.ii.2000, NSW 440014, NSW 440015; Western side of Montague Island, A. J. K. Millar, C. O'Brien and D. Hardin, 10.xi.1997, NSW 437767, NSW 437766.

Remarks: This represents a short northeastern range extension for this otherwise southern Australian species. It is easily distinguished from the two other NSW species, *H. australis* and *H. crassipes*. From both it

differs by being smaller in stature, ecorticate and with branching every four to seven segments.

Family: Delesseriaceae

Hemineura frondosa (Hooker fil. et Harvey) Harvey (1847), 116; Lin *et al.* (2001), 135, fig. 137 (Fig. 13)

Type locality: Probably Georgetown, Tasmania (Lin *et al.* 2001).

Distribution: From the Houtman Abrolhos Islands in Western Australia around southern Australia and Tasmania. In NSW, known only from Cape Howe north to the wreck of the Henry Bolte, which lies in 30 m depths just south of the mouth of Twofold Bay.

Specimens examined: Henry Bolte Wreck, off Twofold Bay, Eden, A. J. K. Millar, C. O'Brien and D. Hardin, 4.xi.1997, NSW 440182; 'X marks the spot', W of Green Cape, Disaster Bay, A. J. K. Millar, C. O'Brien and D. Hardin, 6.xi.1997, NSW 437854, NSW 437855; NSW 437853.

Remarks: This distinctive species is a common element of the marine flora of southern NSW, and this record constitutes the easternmost limit of its distribution on the Australian continent.

Phytomophora linearis (Laing) Kylin (1924), 13; Wagner (1954), 291–5, figs 37–57; Adams (1994), 279, pl. 98

Type locality: Lyall Bay, Cook Strait, New Zealand.

Distribution: In New Zealand from Cook Strait south to Stewart Island. Southern NSW.

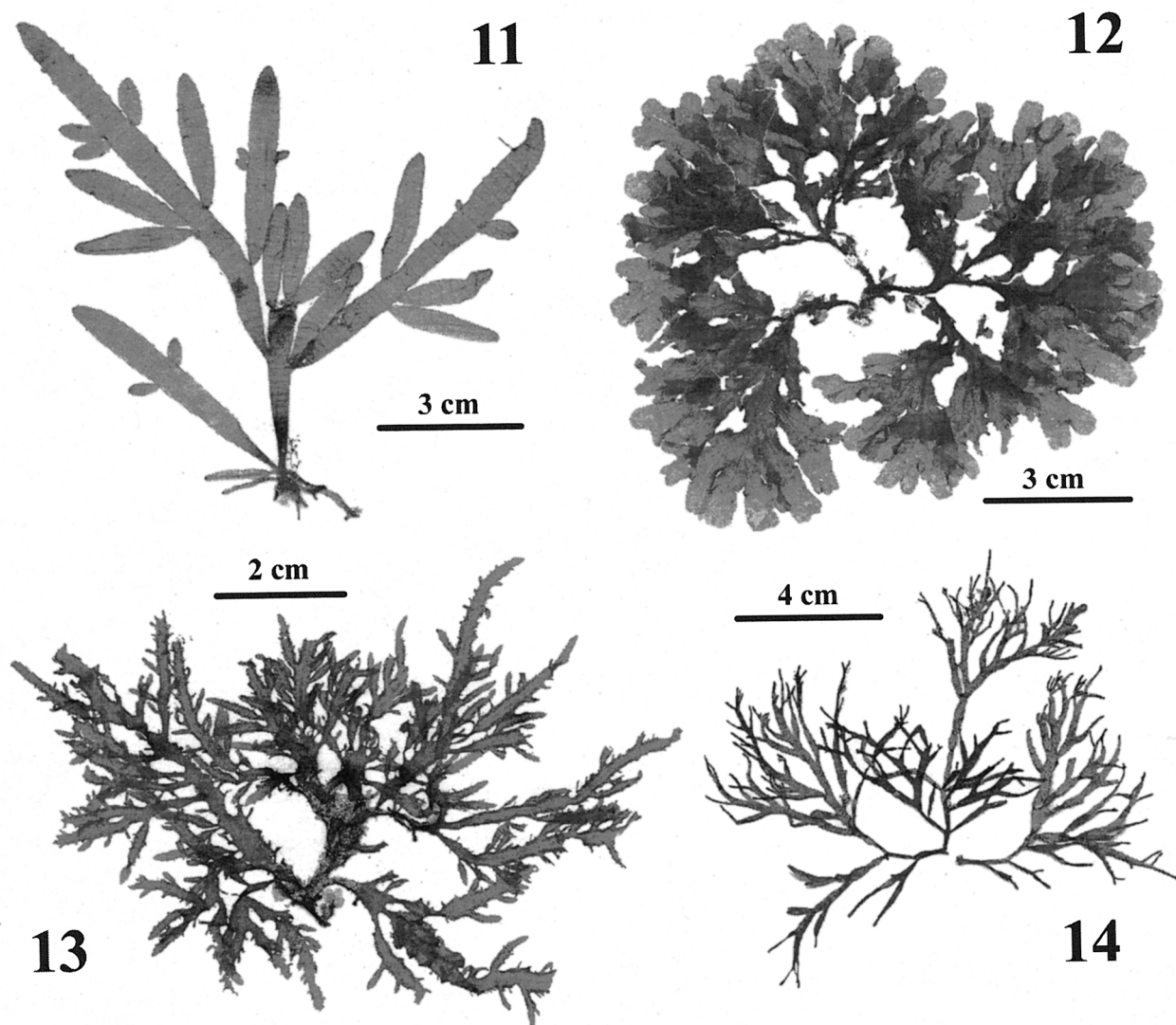
Specimens examined: West of Green Cape Light-house, Disaster Bay, New South Wales, A. J. K. Millar, C. O'Brien, D. Hardin, 28.i.1996, NSW 396579.

Remarks: The NSW plants agree well with the New Zealand species of which there are vouchers filed at NSW. They have a single main blade that is up to 5 mm wide, along which are numerous midrib proliferations. At the base of the main blade are often smaller blades from a common holdfast. This habit differs from the southern Australian species *P. amansioides*, which consists of narrow (1–2 mm) and profusely branched blades.

Schizoseris dichotoma (Hooker fil. and Harvey) Kylin (1924), 68; Adams (1994), 285, pl. 101; Ricker (1987), 286, figs 120–2 (Fig. 12)

Basionym: *Delesseria dichotoma* Hooker fil. and Harvey in Harvey and Hooker (1845) pp. 184–185, LXXI, fig. 11; Kützinger (1866) p. 10, table 24c–f.

Syntype localities: Auckland and Campbell Islands, New Zealand.



Figs 11–14. Habits of marine algae. 11. *Champia insignis*, NSW 440158. 12. *Schizoseris dichotoma*, NSW 395774. 13. *Hemineura frondosa*, NSW 440182. 14. *Laurencia platyclada*, NSW 289277.

Distribution: Mostly known from the cold waters of the sub-Antarctic Ocean – St Paul and Heard Islands, Indian Ocean; in the Pacific from Southeastern Australia and mainland New Zealand, Stewart Island, Chatham Islands and Antipodes, Macquarie Island; in the Atlantic from Falkland Island, Fuegia, Kerguelen, South Georgia and Tristan da Cunha.

Specimens examined: Northwest Trench, Montague Island, A. J. K. Millar, J. Huisman and N. Yee, 11.x.1999, NSW 436203, NSW 436202; NSW 436201, NSW 436204; Henry Bolte Wreck, off Twofold Bay, Eden, A. J. K. Millar, N. Yee and J. Eu, 13.x.1999, NSW 439261; West of Green Cape Lighthouse, Disaster Bay, A. J. K. Millar, C. O'Brien and D. Hardin, 28.i.1996, NSW 395774 (Fig. 12).

Remarks: The species *Schizoseris* displays considerable variation in habit, as shown by Adams (1994), Lin and Kraft (1999) and Ricker (1987). The

NSW specimens appear to most closely match those of *S. dichotoma*.

Family: Rhodomelaceae

Chondria bulbosa Harvey (1859), 297; Gordon-Mills and Womersley (1987), 526, figs 12(G,H), 17(C,D), 18 (Fig. 6.)

Type locality: East coast of Tasmania.

Distribution: From Port Denison, Western Australia to Western Port, Victoria and around Tasmania. In NSW it occurs as far north as Disaster Bay near Green Cape.

Specimens examined: West of Green Cape Lighthouse, Disaster Bay, A. J. K. Millar, P. Richards and N. Yee, 24.ii.2000, NSW 440130, NSW 440131, NSW 440132, NSW 439112.

Remarks: Gordon-Mills and Womersley (1987) record this as a mostly deep-water species and this is the case for NSW specimens, which have only been found at 28 m depths. One noteworthy difference between southern Australian specimens and those from NSW is that the latter have rounded gall-like, rather than elongate bulb-like, swellings at their bases.

Dictyomenia harveyana Sonder (1853), 698–9; Kützing (1864), 33, table 95a,b; Lucas and Perrin (1947), 282–3, fig. 129 (Fig. 5)

Syntype localities: Various in southern Australia.

Distribution: From Port Denison, Western Australia, around southern Australia including Tasmania to Green Cape, NSW.

Specimens examined: West of Green Cape Lighthouse, Disaster Bay, A. J. K. Millar, C. O'Brien and D. Hardin, 28.i.1996, NSW 395779, NSW 395777, NSW 395778; 'X marks the spot', Disaster Bay, A. J. K. Millar, C. O'Brien and D. Hardin, 6.xi.1997, NSW 437802, NSW 437803, NSW 437801, NSW 437804.

Remarks: East coast specimens, although not as large, match well with those collected by Harvey from Tasmania that are filed in NSW.

Epiglossum smithiae (Hooker and Harvey) Kützing (1849), 878; Phillips (2002), 221, figs 9, 10

Basionym: *Polyphacum smithiae* Hooker fil. et Harvey in Harvey (1847), p. 17, pl. III.

Synonym: *Lenormandia smithiae* (Hooker and Harvey) Falkenberg (1901) p. 464, pl. 8, figs 18–21 (Fig. 7).

Type locality: Circular Head, Tasmania.

Distribution: From Memory Cove, South Australia to Gabo Island on the NSW/Victorian border, and in Tasmania as far south as Bicheno. Now known from Green Cape, NSW.

Specimens examined: West of Green Cape Lighthouse, Disaster Bay, A. J. K. Millar and C. O'Brien, 6.xii.1996, NSW 436194, NSW 436193; A. J. K. Millar, P. Richards and N. Yee, 24.ii.2000, NSW 439064, NSW 477295.

Remarks: This species is distinctive with its numerous surface proliferations associated often with a sponge. Formerly known as *Lenormandia smithiae*, Phillips (2002) has shown that it differs in several generic level characters from that genus and thus reinstated the old Kützing name *Epiglossum* to accommodate this and *L. prolifera* (C. Agardh) J. Agardh (see below).

Epiglossum prolifera (C. Agardh) L. E. Phillips (2002), 224, figs 11, 12 (Fig. 9)

Misapplied name: *Rytiphloea simplicifolia* sensu Harvey (1863), pl. 246.

Type locality: 'Fucus No 24, mus. Paris. Novam Hollandiam', probably Victoria or Tasmania. (a Robert Brown collection; LD 42807, Saenger & Ducker 1971, fig. 1).

Distribution: From Robe, South Australia to Walkerville, Victoria and around Tasmania. Now known from southern NSW to Tathra.

Specimens examined: Twin Peaks, off Gillards Beach, just north of Tathra, A. J. K. Millar, C. O'Brien and J. Eu, 12.xii.1998, NSW 434513; North side of Twofold Bay, A. J. K. Millar and P. G. Richards, 5.ii.1992, NSW 291010; Henry Bolte Wreck, off Twofold Bay, Eden, A. J. K. Millar, C. O'Brien and D. Hardin, 4.xi.1997, NSW 440181; West of Green Cape Lighthouse, Disaster Bay, A. J. K. Millar, P. Richards and N. Yee, 24.ii.2000, NSW 439065, NSW 439076, NSW 439075.

Remarks: This species has an unusual habit in NSW waters in that it is regularly found buried in sand leaving only the apices (1–3 cm) exposed. This record constitutes a major range extension for a species formerly known only from southern Australia, including Tasmania.

Laurencia platyclada Boergesen (1934), 21, fig. 13, pl. III (Fig. 14)

Syntype localities: Karachi and 'Sind coast', Pakistan.

Distribution: Known only from India, Pakistan and Sri Lanka in the Indian Ocean. In NSW, known only from Split Solitary Island.

Specimens examined: Split Solitary Island, A. J. K. Millar and R. Millar, 23.ii.1989, NSW 289276, NSW 289277.

Remarks: This is a distinctive species of *Laurencia* in that the branches are flattened (much as in *L. brongniartii*) rather than simply compressed. Apart from a slight narrowing at the bases of dichotomies, the NSW specimens match well with the type specimen in Boergesen's herbarium in Copenhagen. Boergesen (1934) related his species to *Laurencia ceylanica* J. Agardh (1876), which is based on a Harvey specimen from the Ceylon Exsiccatae, no. 17 (see Yamada 1931). Two isotypes (NSW 290782 and 290783) of *L. ceylanica* are filed in NSW and examination of this material confirms Boergesen's comparisons. While both species are flattened, *L. platyclada* is the narrower of the two and lacks the tuberculate laterals considered characteristic of *L. ceylanica*. This constitutes a new record for Australia and the Pacific Ocean.

Polysiphonia teges Womersley (1979),
494, fig. 10(A–C)

Type locality: Frenchmans Bay, Albany, Western Australia.

Distribution: From Albany, Western Australia to Mangrove Point, Spencer Gulf, South Australia. In NSW, known only from the wreck of the Henry Bolte off Twofold Bay.

Specimens examined: Henry Bolte Wreck, off Twofold Bay, Eden, A. J. K. Millar, N. Yee and J. Eu, 13.x.1999, NSW 439226.

Remarks: As Womersley (1979) pointed out, this species looks superficially similar to *P. scopulorum*, but has six pericentral cells per segment rather than four.

ACKNOWLEDGMENTS

The expeditions to the southeast coast of Australia, and to Norfolk Island, which led to the above discoveries, were the result of several generous grants plus help from a large number of friendly and highly qualified personnel. I should like to sincerely thank my many diving partners who have helped during this project. Karlene Christian and Jack Marges (Norfolk Island), Peter Richards, Chris O'Brien, David Hardin, John Huisman, George 'Buz' Wilson, Nick Yee, and especially James Eu have all played a major role in these expeditions. Jimmy was both our Dive Master and Skipper for the majority of our surveys and his experience and innovative skills made the trips both safe and productive. The late Clive Witford, owner of *Rathlin II*, and his extant skipper, Bruce Libbis, gave us excellent service over the first four of our expeditions. Special thanks also to John and Marg Henry of Freedom Charters (Eden) for being so trusting with their lovely boat *Connemara*, our home and platform for the last four expeditions; and my good friends Louise, Ross and Miles of the Merimbula Divers Lodge have supported these trips with equipment logistics and friendly advice. Financial support came from first the Australian Geographic Society, then the National Geographic Society of America and most recently and substantially from the Hermon Slade Foundation. Research funds for Norfolk Island came from the RBG and Environment Australia (in particular Margaret Christian, ANCA – Norfolk).

REFERENCES

- Adams, N. M. 1994. *Seaweeds of New Zealand. An illustrated guide*. Canterbury University Press, Christchurch, 360 pp.
- Agardh, C. A. 1817. *Synopsis algarum Scandinaviae*. Gleerup, Lund, x1 + 135 pp.
- Agardh, J. G. 1876. *Species genera et ordines algarum, Volume n tertium: de florideis curae posteriores. Epicrisis systematiis Floridearum*. Weigel, Leipzig, vii + 724 pp.
- Agardh, J. G. 1894. *Analecta algologica. Continuatio II. Lunds Universitets Årsskrift, Andra Afdelningen, Kongliga Fysiografiska Sällskapetets Handlingar* **30**: 1–98.
- Athanasiadis, A. 1996. Morphology and classification of the Ceramioideae (Rhodophyta) based on phylogenetic principles. *Opera Bot.* **128**: 1–216.
- Athanasiadis, A. and Kraft, G. T. 1994. Description of *Pterothamnion squarulosum* (Harvey) comb. nov. from south-eastern Australia and southern New Zealand, with a taxonomic re-assessment of the genera *Pterothamnion*, *Platythamnion* and *Glandothamnus*. *Eur. J. Phycol.* **29**: 119–33.
- Borgesen, F. 1934. Some Indian Rhodophyceae especially from the shores of the Presidency of Bombay. IV. *Bull. Misc. Info.* **1934**: 1–30.
- Dawson, E. Y. 1962. Marine red algae of Pacific Mexico, Part 7. Ceramiales: Ceramiaceae, Delesseriaceae. *Allan Hancock Pacific Exped.* **26**: 1–207.
- Falkenberg, P. 1901. Die Rhodomelaceen des Golfes von Neapel und der angrenzenden Meeres-Abschnitte. *Fauna Flora Des Golfes Von Neapel, Monographie* **26**: 1–754.
- Fama, P., Jousson, O., Zaninetti, L. et al. 2002. Genetic polymorphism in *Caulerpa taxifolia* (Ulvoephyceae) chloroplast DNA revealed by PCR-based assay of the invasive Mediterranean strain. *J. Evol. Biol.* **15**: 618–24.
- Gordon-Mills, E. M. and Womersley, H. B. S. 1987. The genus *Chondria* C. Agardh (Rhodomelaceae, Rhodophyta) in southern Australia. *Aust. J. Bot.* **34**: 477–565.
- Harvey, W. H. 1847. *Nereis australis*. Reeve, London, viii + 124 pp., 50 pls.
- Harvey, W. H. 1855. Algae. In Hooker, J. D. (Ed.) *The Botany of the Antarctic Voyage of H. M. Discovery Ships Erebus and Terror in the Years 1839–1843, Under the Command of Captain Sir James Clarke Ross, Part II. Flora Novae-Zelandiae*, vol. II. Reeve, London, pp. 211–66, pls 107–121.
- Harvey, W. H. 1859. Algae. In Hooker, J. D. (Ed.) *The Botany of the Antarctic Voyage of H. M. Discovery Ships Erebus and Terror in the Years 1839–1843, Under the Command of Captain Sir James Clarke Ross, Part III: Flora Tasmanica*, vol. II. Reeve, London, pp. 282–343, pls 185–196.
- Harvey, W. H. 1863. *Phycologia Australica*, vol. 5. Synoptic catalogue no. 1–799. Reeve, London, pp. v–lxxiii, pls 241–300.
- Harvey, W. H. and Hooker, J. D. 1845. Algae. In Hooker, J. D. (Ed.) *The Botany of the Antarctic Voyage of H. M. Discovery Ships Erebus and Terror in the Years 1839–1843, Under the Command of Captain Sir James Clarke Ross, Part I. Flora Antarctica. Part I*. Reeve, London, pp. 175–93, pls 69–78.
- Harvey, A., Woelkerling, W. J. and Millar, A. J. K. 2002. The Sporolithaceae (Corallinales, Rhodophyta) in south-eastern Australia: Taxonomy and 18S rDNA phylogeny. *Phycologia* **41**: 207–27.
- Huisman, J. M. 1991. *Diplothamnion gordoniae* sp. nov. (Ceramioideae, Rhodophyta) from Rottneest Island, Western Australia. *Phycologia* **30**: 117–23.

- Huisman, J. M. 1997. Marine benthic algae of the Houtman Abrolhos Islands, Western Australia. In Wells, F. E. (Ed.) *The Marine Flora and Fauna of the Houtman Abrolhos Islands, Western Australia*. Western Australian Museum, Perth, pp. 177–237.
- Huisman, J. M. 1999. Vegetative and reproductive morphology of *Nemastoma damaecorne* (Gigartinales, Rhodophyta) from Western Australia. *Aust. Syst. Bot.* **11**: 721–8.
- Jousson, O., Pawlowski, J., Zaninetti, L. et al. 2000. Invasive alga reaches California. *Nature* **408**: 157–8.
- Kraft, G. T. 1978. Studies of marine algae in the lesser-known families of the Gigartinales (Rhodophyta). III. The Mychodeaceae and Mychodeophyllaceae. *Aust. J. Bot.* **26**: 515–610.
- Kraft, G. T. 2000. The marine and estuarine green macroalgae (Chlorophyta) from Lord Howe Island, southwestern Pacific. *Aust. Syst. Bot.* **13**: 509–648.
- Kützing, F. T. 1849. *Species Algarum*. F. A. Brockhaus, Leipzig, vi + 922 pp.
- Kützing, F. T. 1864. *Tabulae Phycologicae*, vol. 14. K des Verfassers, Nordhausen, 35 pp., 100 pls.
- Kützing, F. T. 1866. *Tabulae Phycologicae*, vol. 16. K des Verfassers, Nordhausen, 35 pp., 100 pls.
- Kylin, H. 1924. Studien über die Delesseriaceen. *Lunds Universitets Årsskrift, Ny Följd, Andra Afdelningen* **20**: 1–111, 80 figs.
- Kylin, H. 1931. Die Florideenordnung Rhodymeniales. *Lunds Universitets Årsskrift, Ny Följd, Andra Afdelningen* **27**: 1–48, 49 figs, 20 pls.
- Lin, S.-M., Hommersand, M. H. and Kraft, G. T. 2001. Characterisation of *Hemineura frondosa* and the Hemineureae trib. nov. (Delesseriaceae, Rhodophyta) from southern Australia. *Phycologia* **40**: 135–46.
- Lin, S.-M. and Kraft, G. T. 1999. *Schizoseris tasmanica* sp. nov. (Delesseriaceae, Ceramiales), a first record of the genus for the Australian marine flora. *Phycologia* **38**: 128–37.
- Lindauer, V. W., Chapman, V. J. and Aiken, M. 1961. The marine algae of New Zealand II. *Phaeophyceae Nova Hedwigia* **3**: 129–350, pls 57(1)–97(41).
- Lucas, A. H. S. 1931. Notes on Australian marine algae. vi. Descriptions of six new species. *Proc. Linnean Soc. NSW* **56**: 407–11, pls 23–27.
- Lucas, A. H. S. 1935. The marine algae of Lord Howe Island. *Proc. Linnean Soc. NSW* **60**: 194–232, plates 5–9.
- Lucas, A. H. S. and Perrin, F. 1947. *The Seaweeds of South Australia. II. The Red Seaweeds*. Government Printer, Adelaide, pp. 107–458.
- Millar, A. J. K. 1990. Marine red algae of the Coffs Harbour region, northern New South Wales. *Aust. Syst. Bot.* **3**: 293–593.
- Millar, A. J. K. 1993. The red algal genus *Callophyllis* Kuetzing (Kallymeniaceae, Gigartinales) from eastern mainland Australia, with notes on the genus *Ectophora* J. Agardh. *Aust. Syst. Bot.* **6**: 321–34.
- Millar, A. J. K. 1994. *Haraldiophyllum infossum* sp. nov. (Delesseriaceae, Rhodophyta), a diminutive turf-forming red alga from the south-western Pacific. *Bot. Marina* **37**: 125–32.
- Millar, A. J. K. 1996. *Dasya roslyniae* sp. nov. (Dasyaceae, Rhodophyta), with a discussion on generic distinctions among *Dasya*, *Eupogodon*, *Rhodoptilum* and *Pogonophorella*. *J. Phycol.* **32**: 145–57.
- Millar, A. J. K. 1998. *Champia womersleyi* (Champiaceae, Rhodophyta), a flattened and dichotomous new species from the South-western Pacific. *Bot. Marina* **40**: 15–21.
- Millar, A. J. K. 1999. Marine benthic algae of Norfolk Island, South Pacific. *Aust. Syst. Bot.* **12**: 479–547.
- Millar, A. J. K. 2000. *Spirophycus acicularis*, a new red algal genus and species in the Lophothalieae (Rhodomelaceae, Ceramiales) from eastern Australia. *Phycologia* **39**: 87–95.
- Millar, A. J. K. and Kraft, G. T. 1993. Catalogue of marine and freshwater red algae (Rhodophyta) of New South Wales, including Lord Howe Island, South-western Pacific. *Aust. Syst. Bot.* **6**: 1–90.
- Millar, A. J. K. and Kraft, G. T. 1994a. Catalogue of marine brown algae (Phaeophyta) of New South Wales, including Lord Howe Island, South-western Pacific. *Aust. Syst. Bot.* **7**: 1–46.
- Millar, A. J. K. and Kraft, G. T. 1994b. Catalogue of marine benthic green algae (Chlorophyta) of New South Wales, including Lord Howe Island, South-western Pacific. *Aust. Syst. Bot.* **7**: 419–53.
- Millar, A. J. K., Saunders, G. W., Strachan, I. and Kraft, G. T. 1996. The morphology, reproduction and small-subunit rRNA gene sequence of *Cephalocystis* (Rhodymeniaceae, Rhodophyta), a new genus based on *Cordylecladia furcellata* J. Agardh from Australia. *Phycologia* **35**: 48–60.
- Millar, A. J. K. 1997. On some flattened species of *Gracilaria* from Australia. In Abbott, I. A. (Ed.) *Taxonomy of Economic Seaweeds VI*. California Sea Grant Program, La Jolla, pp. 111–23.
- Millar, A. J. K. 2001. The invasion of *Caulerpa taxifolia* in eastern Australia. *XVIIth International Seaweed Symposium*, Oxford University Press, Oxford, p. 92.
- Min-Thein, U. and Womersley, H. B. S. 1976. Studies on southern Australian taxa of Solieriaceae, Rhabdoniaceae and Rhodophyllidaceae (Rhodophyta). *Aust. J. Bot.* **24**: 1–166.
- Norris, R. E. 1992. Ceramiales (Rhodophyceae) genera new to South Africa, including new species of *Womersleya* and *Herposiphonia*. *Sth African J. Bot.* **58**: 65–76.
- Phillips, L. E. 2002. Taxonomy of *Adamsiella* L. E. Phillips et W. A. Nelson, General nov. & *Epiglossum* Kützing (Rhodomelaceae, Ceramiales). *J. Phycol.* **38**: 209–29.
- Reedman, D. J. and Womersley, H. B. S. 1976. Southern Australian species of *Champia* and *Chylocladia* (Rhodymeniales: Rhodophyta). *Trans Royal Soc. SA* **100**: 75–104.
- Ricker, R. W. 1987. *Taxonomy and Biogeography of Macquarie Island Seaweeds*. British Museum Natural History, London, viii + 344 pp.
- Saenger, P. and Ducker, S. C. 1971. The morphology and development of *Lenormandia prolifera* (C.Ag.) J. Agardh (Amansieae, Rhodomelaceae). *Aust. J. Bot.* **19**: 51–62.

- Schaffelke, B., Murphy, N. and Uthicke, S. 2002. Using genetic techniques to investigate the sources of the invasive alga *Caulerpa taxifolia* in three new locations in Australia. *Mar. Pollution Bull.* **44**: 204–10.
- Sonder, O. W. 1853. Plantae Muellerianae, Algae. *Linnaea* **25**: 657–709.
- Taylor, W. R. 1945. Pacific marine algae of the Allan Hancock Expeditions to the Galapagos Islands. *Allan Hancock Pacific Expeditions* **12**: 1–528.
- Townsend, R. A. and Borowitzka, M. A. 2001. *Heydrichia homalopasta* sp. nov. (Sporolithaceae, Rhodophyta) from Australia. *Bot. Marina* **44**: 237–44.
- Wagner, F. S. 1954. Contributions to the morphology of the Delesseriaceae. *Univ. Calif. Pub. Bot.* **27**: 279–340.
- Withell, A. F., Millar, A. J. K. and Kraft, G. T. 1994. Taxonomic studies of the *Gracilaria* (Gracilariales, Rhodophyta) from Australia. *Aust. Syst. Bot.* **7**: 281–352.
- Wollaston, E. M. 1968. Morphology and taxonomy of southern Australian genera of Crouanieae Schmitz (Ceramiaceae, Rhodophyta). *Aust. J. Bot.* **16**: 217–417.
- Womersley, H. B. S. 1978. Southern Australian species of *Ceramium* Roth (Rhodophyta). *Aust. J. Mar. Freshwater Res.* **29**: 205–57.
- Womersley, H. B. S. 1979. Southern Australian species of *Polysiphonia* Greville (Rhodophyta). *Aust. J. Bot.* **27**: 459–528.
- Womersley, H. B. S. 1987. *The Marine Benthic Flora of Southern Australia. Part II*. Government Printer, Adelaide, 484 pp.
- Womersley, H. B. S. 1994. *The Marine Benthic Flora of Southern Australia. Rhodophyta, Part IIIA*. Australian Biological Resources Study, Canberra, 508 pp.
- Womersley, H. B. S. 1996. *The Marine Benthic Flora of Southern Australia. Rhodophyta, Part IIIB*. Australian Biological Resources Study, Canberra, 392 pp.
- Womersley, H. B. S. 1998. *The Marine Benthic Flora of Southern Australia. Rhodophyta, Part IIIC*. State Herbarium of South Australia, Adelaide, 535 pp.
- Yamada, Y. 1931. Notes on *Laurencia*, with special reference to the Japanese species. *Univ. Calif. Pub. Bot.* **16**: 185–250, 30 pls.
- Zanardini, G. 1874. Phyceae Australicae novae vel minus cognitae. *Flora* **57**: 497–505.

This document is a scanned copy of a printed document. No warranty is given about the accuracy of the copy. Users should refer to the original published version of the material.