

A single Ensenada record represents Baja California material; Dawson and Neushul (1966) allude to an intertidal collection in La Jolla.

## CERAMIACEAE

*Aglaothamnium cordatum* (Børg.) Feldm.-Maz.

616

Thalli with regular branching from every cell in alternate spiral arrangement; in thick masses or tufts to 4 cm high; branches becoming smaller in diameter toward tips; uninucleate, thus differentiated from California species of *Callithamnion* that are multinucleate.

This is a late-summer to fall alga that is found abundantly on the docks and mudflats in south San Diego Bay, rarely in open coast intertidal sites. We have not seen reproduction. Spencer *et al.* (1981) state that, because other characters do not now appear to be well correlated with the number of nuclei in species related to *Callithamnion*, "most authors still include uninucleate specimens as *Callithamnion* species."

\**Aglaothamnium endovagum* (Setch. and Gardn.) Abb.

617

Thalli partly endophytic within blade-like red algae; creeping filaments irregularly to unbranched; erect filaments to 200  $\mu\text{m}$  high irregularly or rarely branched.

Reported from La Jolla (Dawson, 1945d, as a *Callithamnion* species) as an endo- or epiphyte associated with *Grateloupia abbreviata* (= *G. doryophora*) in June.

\**Antithamnion defectum* Kyl.

573

Specimens from San Diego County are a few mm high (less than 10), with lateral (secondary) branchlets strictly opposite, and with third-order branching only from the upper side of the branchlets. This tiny feathery-appearing species is very common in offshore subtidal sites where thalli remain beneath the summer thermocline and thus are seldom exposed to summer surface-water temperatures. We have collected it on a variety of substrates: on *Tethya* and other sponges, scallop shells, larger (*Gelidium robustum*) or smaller (*Sorella*) algae, in all months of the year, and with all reproductive phases present. Specimens range from very delicate to coarse, branches respectively <10 to >34  $\mu\text{m}$  wide.

*Antithamnion hubbsii* Daws.

573

The species was distinguished (Dawson 1962) as having pinnate branching, gland cells, pointed branch tips, mostly prostrate epiphytic axes, and solitary unbranched rhizoids from basal cells of branches. The type and one other collection were reported from Guadalupe Island off the coast of Pacific Mexico. MAC records an additional collection from a shallow subtidal site near Santa Catalina Island.

We collected thalli that may represent *A. hubbsii* in July from a 27 m site near La Jolla.

\**Antithamnion kylinii* Gardn.

574

We have three collections, one October and two April, that resemble *A. kylinii*, all from subtidal (23–28 m) sponges (*Tethya*). The material included tetrasporangial and spermatangial thalli.

Dawson's Checklist lists the species (as *A. secundatum*) from San Diego Harbor in December. In 1962 (PMR 7) he reported several subtidal collections from Cabo Colnett to Isla Magdalena in Baja California.

\**Antithamnion tenuissimum* (Gardner 1927a) was described from drift material found on a La Jolla beach. He wrote that its affinities were doubtful and the branching pattern unclear. Dawson, in the Checklist, stated that it is an "exceedingly fragile, silky species 3–6 cm long. . . in La Jolla, frequent in June."

Reference to *A. tenuissimum* is omitted from MAC, but no citation of a transfer or combination of the name has been located. It is included here as a separate record from San Diego.

*Antithamnionella* sp.

San Diego subtidal collections of very small filamentous red algae include thalli with branching that closely resembles *Gymnothamnion elegans*, as shown in Figure 571, MAC. Basal cells of branchlets and branches are more or less of the same size as adjacent cells, and tetrasporangia are sessile on branchlet cells as in *Antithamnionella* species. This latter genus includes species with 2–5 branchlets from each axial cell; our specimens are clearly

pinnate. These distichous thalli less than 1 cm high, many from the Loma Sea Cliff, are here referred to *Antithamnionella* sp. Gland cells, clearly seen on one specimen, conform to the description for *Antithamnionella elegans* (see below) but other characteristics do not. The symmetry of branching, position of tetrasporangia, absence of gland cells on some thalli, and dimensions of these San Diego collections closely resemble *Antithamnion scrippsiana*, described by Dawson (1949a) for plants found on a *Macrocystis* holdfast floating near Santa Rosa Island. This *Antithamnion* species was later combined with *Antithamnionella glandulifera* (MAC), a species with large thalli, which is reported to be a common epiphyte in the low intertidal zone along the entire Pacific coast.

*Antithamnionella elegans* (Berthold) Price and John

Cormaci and Furnari 1988; Price *et al.* 1986

*A. breviramosa* (Daws.) Wollaston in Wom. and Bail., 580

Specimens from San Diego County are less than 4 mm high, with prostrate and erect uniseriate axes that grow on various subtidal substrates at depths between 13–30 m. Symmetrically whorled branchlets are 1–4 per whorl, but distichously paired or three per whorl are most often seen. Most thalli in our numerous collections contain some branches with three branchlets, although variation in this feature occurs on individual thalli. Gland cells are frequent. The longest cells in axes are from 3 to 12 times as long as wide, and cell diameter of these larger cells varies between 10 and 50  $\mu\text{m}$ . Erect axes may show only unbranched short branchlets, or a pattern of secondary branching from alternate sides of the axis, usually with an unbranched (but with whorl branchlets) cell in between cells bearing branches. Whorl branchlets may have up to 16 cells, but these characteristically are distinctly smaller than axial cells. All reproductive phases are present in our collections and found throughout the year.

MAC describes *A. breviramosa* as having branchlets, mostly 3 per whorl. Cormaci and Furnari (1988) discussed the reasons for combining *A. breviramosa* with *A. elegans* and described four varieties: “within *A. elegans* the number and arrangement of whorl branchlets in different collections appears to vary within well-defined ranges. . . .” Many of the San Diego plants fall into var. *elegans* [whorl branchlets usually in whorls of 3 (rarely 2 and then distichously arranged)] or var. *sublittoralis* [“. . . usually in whorls of 2 (rarely 3). . . distichously arranged”]. The variability in San Diego material could result from a developmental sequence whereby branchlet initiation and elongation, and the growth of secondary branches, are correlated with the age of the thallus.

[*Antithamnionella pacifica* (Harv.) Woll.

582

Typically, the lower axes twine together, with cells 20+ times longer than broad, gland cells are absent or rare, and one form shows hooked, curved apices. The species is reported as common on *Nereocystis*, which is not found in southern California, or on other large algae and, according to MAC, has been reported from "Alaska to Baja California." No records are known for San Diego County, and Dawson did not report finding it on the Pacific Coast of Baja California.]

*Callithamnion biseriatum* Kyl.

610

Differing from *C. catalinense* (see ff) in having blunter terminal cells, spreading apices, smaller axial cells, but otherwise vegetatively very similar. Tetrasporangia occasional, in clusters of 2-3.

*Callithamnion catalinense* Daws.

612

Filamentous, small thalli, uncorticated, branching mostly in one plane and pinnate; less than 15 mm tall, branchlets simple and alternate, incurved, with sharp tips.

Thalli that we attribute to this species are all from deep (17-37 m) subtidal sites and are found on a variety of substrates: several sponge taxa, scallop shells, tunicate stalks, other algae, and mixed with small forms in nests of the garibaldi fish. All reproductive phases have been found, and specimens have been collected throughout the year. MAC cites only two collections of this species, one from near Santa Cruz Island and another from Santa Catalina Island. If the numerous collections from San Diego County are correctly identified with this species, the circumscription of the taxon and its range should be modified to include southern California material. These collections, however, alternatively may be interpreted as forms of *C. biseriatum*. The key to *Callithamnion* species in MAC contrasts acute vs. blunt tips of branchlet apices or terminal cells to separate the species. The distinction is not clear when our specimens are examined.

\**Callithamnion ramosissimum*, described by Gardner (1927b) as growing on *Hypnea* at La Jolla, is listed in Dawson's Checklist as a species that was commonly overlooked because of diminutive size (8-12 mm). The species was

not treated under this name in **MAC**, and we have not located other references to the epithet.

\**Callithamnion rupicolum* Anders.

613

Thalli less than 1 cm high, branching regularly alternate, but variably pinnate to bipinnate, or mixed; branchlet apices recurved or straight.

Such thalli have been found as intertidal epiphytes at all seasons, and all reproductive phases are represented in San Diego County material. They are often found on species of *Corallina* and on *Pterocladia capillacea*, but are not restricted to these particular taxa

Along the entire coast of California this species is common on other algae in the intertidal. Abbott refers to several variants that in **MAC** are treated as a single species. These include forms attributed to *C. breviramsum* and *C. rigidum* from Baja California. Dawson lists these, as well as *C. rupicolum*, as occurring south to Isla Magdalena.

\**Centroceras clavulatum* (C. Ag.) Mont.

604

Filaments form dense dark-red clumps; individual axes are sparsely branched, often appearing mostly dichotomous; tips abruptly incurved, characteristically forcipate (pincer-like); minute spines protrude from each segment; thalli break easily at nodes.

Seasonally this alga grows epiphytically over large areas of the beach on the surface of algal turf, attached to larger thalli, or directly to rocks in tide pools. It is conspicuous by the contrast between its dark color and the usually paler basiphyte thalli and is most abundant in fall and winter months.

Tetrasporangial and spermatangial plants have been collected locally.

This is a species known from most parts of the world with warm temperate to tropical waters. Thalli are easily recognized by the pincer-like tips of branches, the minute spines, and the manner in which they break when filaments are handled.

*Ceramium* species are recognized by the presence of comparatively large axial cells and by bands of much smaller corticating cells that encircle the filament at the base of each axial cell, obscuring the junctions between the larger cells. *C. californicum*, *C. clarionense*, *C. flaccidum*, and *C. zacaе*? clearly show this

characteristic in all thalli, both apically and basally. Four other species, *C. codicola*, *C. eatonianum*, *C. pacificum*, and *C. sinicola* are more extensively corticated; usually filaments are entirely covered with a layer of very small cells, or the large axial cells are exposed only in younger portions. The unifying pattern, however, can be recognized because the layer of outer cells does not obliterate the outlines of the inner cells. Keys often distinguish species by the relative straightness vs. curvature of apices, but I have not found this useful for most local collections.

\**Ceramium californicum* J. Ag.

594

Corticated only at nodes; thalli of San Diego specimens less than 1.5 cm high, lower axes to 130–200  $\mu\text{m}$  diameter, sparsely branched; branch dichotomies relatively closely spaced above, and branches slender, 40–60  $\mu\text{m}$  near the apices that are slightly curved inward (forcipate).

Most thalli I identify as this species grew on *Sarcodiotheca gaudichaudii* (*Neoagardhiella*) or scallop shells, 15–30 m on isolated rock outcroppings of La Jolla Bay or near the heads of the submarine canyons. Collections during late winter to early spring months have included all reproductive phases.

Intertidal *Ceramium* specimens on *Sarcodiotheca gaudichaudii* (*Neoagardhiella*) tend to resemble *C. gardneri*, which is similar to *C. californicum*. On the Pacific coast, *C. californicum* is reported (MAC) from low intertidal or subtidal habitats, between northern Washington and Baja California and *C. gardneri* from rocks in the low intertidal from British Columbia to the Channel Islands of California.

Dawson reported *C. californicum* from several localities as far south as Bahía Magdalena.

*Ceramium clarionense* Setch. and Gardn.

595

Thalli corticated only at nodes, relatively coarse, with straight apices; often three or more tetrasporangia per node protruding in whorls; the gland cells easily recognized in this species. San Diego specimens to 15 mm high.

This is apparently everywhere a small epiphytic species; we find isolated tufts on larger algae mostly between early summer and fall on intertidal beaches. Tetrasporangia are frequently found; gametangial thalli are rare.

Records cited in MAC indicate this is a warm-water species; the type locality

is Revillagigedo Islands, Mexico, and it occurs south to tropical waters near Oaxaca.

\**Ceramium codicola* J. Ag.

600

Small, completely corticated *Ceramium* thalli that grow on *Codium fragile* are generally identified as this species; it is recognized microscopically as having inflated, pigmented basal rhizoids that grow into the soft *Codium* thallus. Older *Codium* thalli on intertidal beaches often are covered with patches of dark reddish-brown epiphytes, and *C. codicola* is common among these.

\**Ceramium eatonianum* (Farl.) DeToni

600

This completely corticated species is relatively large among San Diego species of the genus, up to 4–5 cm high; gland cells at nodes are easily seen with a microscope, allowing certain identification.

This is one of two common, and often very abundant, intertidal *Ceramium* species. I have collected it throughout the year on numerous algae (often covering *Pterocladia capillacea*), and fertile plants are frequently found. Some of the specimens show conspicuous proliferous branching such as characterizes *C. pacificum*, but other features, including the difference in color ascribed to the two species, lead us to identify all the intertidal plants as *C. eatonianum*. This species extends south to Isla Magdalena, Baja California.

*Ceramium flaccidum* (Kütz.) Ardissonne

Womersley 1978

*C. gracillimum* var. *byssoides* (Harv.) Maz., 597, and *C. taylorii* Daws.  
598

(After Womersley:) Thalli slender, variable in height, mostly 0.5–5 cm, usually growing as epiphytic tufts; prostrate basal filaments producing several to numerous erect axes; branching alternate or subdichotomous, occasionally with moderately short laterals near apices, becoming denuded in lower parts where the red-brown nodes contrast with the colorless, uncorticated, internodal region that consists of a single elongate cell; internodal space up to 8 times as long as node. Branch dimensions variable, partly correlated with the degree of water movement (100–250  $\mu\text{m}$  wide below, 60–100  $\mu\text{m}$  above). Each of the 6–7 cells in the first ring of nodal cells (periaxial cells) cuts off two cells above, but only a single, laterally elongate cell below; this may later divide into 2–4 cells, or may cut off one or two additional cells. Above the original periaxial cells, chains 3–4 cells long are produced. (In Australian specimens, a few outer cortical cells are formed occasionally, some becoming gland-like

and others producing slender hairs. I have not observed these features in California plants.) Tetrasporangia in whorls of 2, less often 4–7, with prominent involucre. Distribution is probably cosmopolitan in cold-temperate to tropical seas.

Thalli of this species, together with *C. eatonianum* and *Centroceras clavulatum*, are the most abundant and widespread small, red filamentous epiphytes in intertidal habitats in San Diego County. [MAC reports that *C. gracillimum* var. *byssoides* is rare in California, while *C. taylorii* is "occasional" in southern California.] *C. flaccidum* is extremely fine and delicate, easily recognized by the elongated internodes contrasted with narrow nodal bands and the darker apical regions where central cells have not yet elongated (Figure 9). Womersley examined many eastern Pacific species from México and included *C. masonii* and *C. fimbriatum* from Mexican coasts, in addition to the two cited from California, in the synonymy of *C. flaccidum*.

We find all reproductive phases in fall months, peak abundance is in October, and thalli are more common on beaches of La Jolla than south of Ocean Beach. It has been reported (as *C. taylorii*) north only to Los Angeles County.

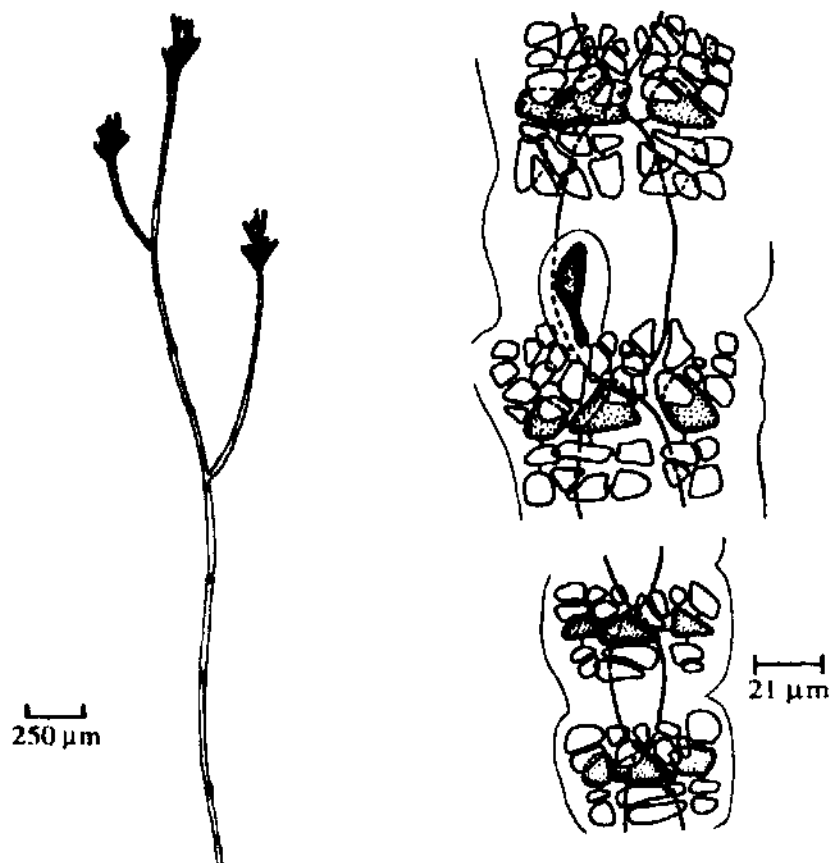


Figure 9. *Ceramium flaccidum*. Branch (left) and nodal cortication pattern (right, from Womersley 1978).



*Ceramium pacificum* (Coll.) Kyl.

600

Thalli completely corticated, clear pink-red in color, branches 200–300  $\mu\text{m}$  in diameter with relatively long intervals between dichotomies; heavily proliferous with short radial branchlets, apices nodding or forcipate, corticating cells small, some more elongate in older basal nodes; tetrasporangia immersed in cortex on branches, irregularly distributed.

We find small, 1–2 cm high, thalli of this species on *Sarcodiotheca furcata* and *S. gaudichaudii* (*Neoagardhiella*) or on shells or small rocks on the sand in La Jolla Bay, 17–23 m. Small thalli often show only primary regular dichotomous branching, lacking the short branchlets that are described as diagnostic for the species.

MAC records it “to Baja California and the Gulf of California”; Dawson (1962) listed it in **PMR 7** on the basis of a drift collection from just south of Punta María, Baja California. It was considered by him (Dawson *et al.* 1960) to be associated with kelp beds in southern California.

*Ceramium sinicola* Setch. and Gardn.

602

Thalli completely corticated, except occasionally in younger filaments; epiphytic, usually less than 3 cm high; branches taper gradually from base to apex, with apices often straight on longer axes, forcipate on younger branches; tetrasporangia embedded in cortical bands.

This species is frequently found when basiphyte algae of intertidal algal turf are examined with low magnification, but thalli are not easily recognized in the field because clumps consist of only a few sparsely branched filaments in many cases and are inconspicuous. Nevertheless, it has been found in all intertidal turf study sites, somewhat more often in fall to spring months, and is easily collected from *Pterocladia capillacea* and *Corallina* with all reproductive phases present.

Distributed (MAC) south of Santa Barbara, indicating warm-water affinities. Type locality is Bahía Todos Santos, Baja California.

*Ceramium* sp. (*zaca*? Setch. and Gardn.)

598

*C. zaca* is distinguished in Abbott and Hollenberg’s key to *Ceramium* (MAC) by being corticated only at nodes, with forcipate apices and

conspicuous tetrasporangia, 1 or 2 per node. These are characteristics seen in many of our subtidal collections of small *Ceramium* thalli (less than 1 cm high), which cannot be clearly attributed to any other species, yet which, in other respects, do not conform to the description of *C. zacaе*. We have collected cystocarpic and spermatangial specimens, but the identification remains tentative.

*C. zacaе* was described from Bahía San Bartolomé, near Bahía Tortugas, in central Baja California in 1937, and since then has been reported only a few times from low intertidal habitats over a wide geographical range. This is one of many species of *Ceramium* that was first described on the basis of single or few specimens; in this instance, the type material cannot be located (P. Silva, pers. comm. 1981) in the Herbarium of the California Academy of Sciences. An extensive study of eastern Pacific *Ceramium*, such as Womersley's for southern Australia, is definitely needed.

\**Griffithsia furcellata* J. Ag.

621

Thalli with large cells, long and narrow compared with cells of *G. pacifica*; dark rose-red in color; subdichotomously branched, 120–270  $\mu\text{m}$  in diameter, 4–5 times as long basally; tetrasporangia single at nonforking nodes, on pedicels of 1 or 2 cells without involucre or trichoblasts; spermatangia in small terminal oval heads.

This species is reported as rare and subtidal in California; the single locality listed (MAC) is Newport Bay, in Orange County. Dawson describes it as a species of quiet water, either sheltered bays or in deep, clear-water sites. We find it abundant in San Diego Bay in clumps to more than 7 cm high on piers or docks in the late summer (July–November). It has also been collected from the La Jolla Submarine Canyon. Fertile thalli are rare; cystocarpic plants have not been found here.

Dawson's Checklist, without giving a San Diego locality, describes it (as *G. multiramosa*) as finely branched, bright pink, very delicate, 5–10 cm high.

\**Griffithsia pacifica* Kyl.

621

Filamentous thalli of large cells (1–2 mm diameter) visible to the unaided eye, conspicuously dichotomously branched; found mostly as small isolated tufts less than 3 cm high, with basal cells attached to substrates by rhizoids.

Single thalli occur on other algae, on rocks, shells, sponges, in garibaldi nests, probably indiscriminately on subtidal surfaces to 27 m; all reproductive phases have been found on San Diego thalli. The cells are very delicate and quickly begin to turn orange-pink when handled or damaged. When alive, in fresh collections, they are clear, bright pink and easily picked out from other algae or debris.

*M. coulteri* Harv. [\**Microcladia californica* Farl.]

606

These two species are both completely corticated with regular alternate distichous branching, often symmetrical throughout the frond. Both are delicate-appearing epiphytes that are restricted to certain larger red or brown seaweeds. In MAC they are separated by the presence (*M. coulteri*) or absence (*M. californica*) of an involucre around the cystocarp; Abbott writes that the vegetative limits of the two species are confused.

*Microcladia* thalli are rare in San Diego County; I have found specimens in the low intertidal zone on *Gigartina canaliculata* and subtidally on *G. exasperata*.

Dawson (1945d) reported finding *M. coulteri* in central and northern Baja California and in San Diego. A recent study (Gonzalez and Goff 1989) has demonstrated other differences between the two species, while establishing that presence or absence of an involucre surrounding the cystocarp is not a reliable distinction. The authors note that they have "not seen specimens of *M. californica* from south of the Monterey Peninsula," indicating that San Diego collections are likely to be *M. coulteri*.

*Neoptilota densa* (C. Ag.) Kyl.

632

(*Ptilota* C. Ag. has been conserved requiring transfer of species presently assigned to *Neoptilota* Kylin.)

Thalli large, feathery, dark red, to 30 cm high; axes compressed, to 3 mm wide, with dense "fringe" of short branchlets; irregularly branched; branchlets curved, sickle-shaped, smooth on margin facing the axis, serrate on opposite margin, and each of these opposite a small branch rudiment that bears reproductive structures.

The branching arrangement that is diagnostic for this species and the variations that distinguish other species of *Neoptilota* cannot be seen clearly without magnification. We have collected the species once, on a rock ledge

about 1.6 km south of Pt. Loma, 17–20 m, in November. There it was associated with other algae that are typically found to the north, or in the pockets of colder water to the south; Dawson (1962) recorded *N. densa* from such sites on the coast of Baja California. He also listed (1945d) *N. californica* (as *Ptilota*) as an epiphyte on *Gelidium* at La Jolla. *Neoptilota* species are very rare in San Diego County.

*Platythamnion pectinatum* Kyl.

588

Thallus uniaxial, uniseriate, entirely uncorticated, 4 branchlets per whorl on lower axial cells, with two opposite long branchlets at right angles to two opposite short branchlets. Branching from these longer branches from the upper side only, regularly arranged and of similar length and these branchlets also pectinately branched. Thalli in central to northern California to 5 cm high; axial cells 2–3 times as long as wide, or much shorter.

The whorled branching from every axial cell and on older cells of major branches gives thalli a dense fuzzy appearance; a microscope is required to see the details of branch arrangement. This species has been collected several times from rocks in La Jolla Bay at 22–27 m, but the specimens are all less than 1 cm high and were found on other algae or pieces of sponge or rock that were collected and examined under low magnification.

Dawson did not find the species on Pacific Mexican coasts.

*Platythamnion villosum* Kyl.

590

Thalli similar in size and morphology to San Diego specimens of *P. pectinatum*; where *P. pectinatum* bears several short branchlets from the upper sides of cells of the longer branches, *P. villosum* bears 1 or 2 from the upper side of each of the branch cells, and one from below. Each of these is only a few cells long, and all are of similar length, giving the thallus a densely spiny appearance. MAC notes that this is a common species in low intertidal to subtidal sites between Alaska and Baja California.

In San Diego County the species is more frequently found than is *P. pectinatum*, but only below approximately 13 m subtidally. We have found it on tunicate stalks, shells, stipes of *Pterygophora*, sponges, and in algal turf in garibaldi nests. Thalli have been found throughout the year, reproductive between January and August.

Dawson (1962) recorded the species from Bahía Blanca and Punta María in central Baja California.

\**Pleonosporium squarrulosum* (Harv.) Abb.

618

Thallus of uniseriate branched filaments, mostly less than 1–2 cm high, with branching regularly alternate from opposite sides of the main axes and branches; main axes strongly percurrent and distinctly larger than lateral branchlets; lower axes with at least light cortication over basal cells (in northern collections larger specimens are more extensively corticated). Polysporangia (a feature of the genus) with 32–64 spores, on short stalks and terminating alternate branchlets; the spermatangial branchlets also terminal on alternate branchlets.

The specimens we find in the same habitats, on the same basiphytes and invertebrate substrates with *P. vancouverianum*, are seldom conspicuously corticated, and usually we must examine the lower axes very carefully with a microscope in order to confirm the presence of even short corticating filaments; otherwise thalli of the two species are vegetatively similar. All San Diego collections are very small (*P. squarrulosum* is recorded as growing up to 20 cm high elsewhere) and grow intertidally as well as subtidally.

Dawson recorded this species from San Diego (1945d; Dawson and Neushul 1966) as *P. polycarpum* and *P. pygmaeum*.

*Pleonosporium vancouverianum* (J. Ag.) J. Ag.

620

Thallus of uniseriate uncorticated branched filaments, mostly less than 1–2 cm high, with branching regularly alternate from opposite sides of the main axes and branches; the distinguishing feature of the genus is the presence of polysporangia (in place of the tetrasporangia that occur in similarly branched *Callithamnion* species); spermatangia in this species develop on alternate sides of lateral branches. A compound microscope is necessary to evaluate these reproductive states in the two *Pleonosporium* species. Our mostly subtidal collections of *P. vancouverianum* are usually less than the 2.5 cm height recorded for northern specimens.

Several species of tiny uniseriate filamentous algae are found almost ubiquitously subtidally. *Antithamnion defectum* and *Antithamnionella elegans* have distinct branching patterns, *Tiffaniella* is irregularly branched, and the cells are relatively long and narrow, while species of *Ceramium* have characteristic internodal cortication. *Pleonosporium vancouverianum* is as common as any of these, and even without reproductive features can be tentatively identified by a process of elimination. Subtidally it occurs on

numerous substrates including other algae; we have collected it only rarely from (low) intertidal habitats. The species is found throughout the year, often reproductive.

*Ptilothamnionopsis lejolisea* (Farl.) Dix.

626

Thalli of minute filaments, monosiphonous, uncorticated, with colorless prostrate branched axes; erect axes pigmented, very sparsely branched, deep red, 1–2 mm high, forming tufts at the joints of articulated corallines (in San Diego, usually *Calliarthron*); the few branchlets tend to be from only one side of axes; all parts similar in diameter, little tapering toward blunt apices; cells nearly as long as wide.

The type locality for this species is San Diego, where it is very abundant and common on collections of subtidal *Calliarthron*. We have collected it throughout the year, with all reproductive phases easily found.

\**Scagelia pylaisaei* (Mont.) Wynne

Wynne 1985c

*Scagelia occidentale* (Kyl.) Woll., 584

Thalli of uniseriate filaments, with branching in whorls of 3 (or 2,4) and branchlets of unequal length on each axial cell; gland cells often numerous on lower cells of branchlets; branching usually at intervals of 1–4 axial cells.

This species was described as a species of *Antithamnion*, then later transferred to a newly described genus. If the whorled branchlets were not uneven in length, the specimens from San Diego that we attribute to the species could be included among the variable forms we consider to represent *Antithamnionella elegans*. Our specimens show three branchlets per whorl and gland cells are lacking. Basal cells are slightly smaller than distal cells in branchlets, and branches are up to 60  $\mu\text{m}$  in diameter. Intertidal on rocks, La Jolla, January.

Dawson does not record the species from Pacific Mexico; it is recorded in his Checklist as a species of *Antithamnion* from rocks near Scripps Pier, La Jolla in May.

\**Spyridia filamentosa* (Wulf.) Harv.

608

Thalli terete, bushy, richly branched, cortication in bands on all axes and

branches, with short spine-like uncorticated branchlets giving a fuzzy appearance to the entire thallus; to 20 cm high, deep bright red in color.

In some years, this is very abundant in mid to late summer months. Thalli attach to other algae in such profusion as to cover all other vegetation in tide pools or shallow channels, or on low rocks in the upper intertidal zone, commonly on La Jolla beaches near the Beach and Tennis Club and in the area around Bird Rock. It is most abundant where there is less surf in summer and surface water temperatures become relatively warm during periods with little wave action to mix water layers. This observation about small scale local distribution is consistent with the geographic distribution in subtropical and tropical regions.

Dawson described it as an "abundant summer annual in the warm bays of Baja California, south of Bahía San Quintín"; its apparent absence in northern Baja is further evidence that the algal vegetation between Santa Barbara and central Baja consists of disjunct associations that are related to local patterns of water circulation rather than presenting a gradually changing north-south continuum.

*\*Tiffaniella snyderae* (Farl.) Abb.

624

Uniseriate, uncorticated filaments; branching in upper parts often from one side of the filament and irregular; with low magnification the narrow cells appear distinctly longer than cells of most other small filamentous algae; 2–3 cm high, occasionally to 4–5 cm in very low intertidal or shallow-water sites that are shaded; the plants can form dense clumps or mats appearing deep red, but individual thalli appear pale; basal axes often form a mesh in sand from which erect branches develop; all axes and branches of similar width and dimension.

The uniform height and width of axes and branches, combined with the often densely aggregated growth habit of the thalli, make them easily recognized where they appear as a dark red fuzz. In this form, thalli cover sandy ledges of the low intertidal region near the border of *Phyllospadix* beds, mostly on beaches with moderate to heavy surf. Here it is associated with *Anisocladella* and *Pogonophorella*, taxa that also grow where sand accumulates. It occurs in subtidal turf and often is a component of the filamentous mat in garibaldi nests. All reproductive phases are present in both intertidal and subtidal collections. In place of tetraspores, this species bears polyspores. Without observing this character, however, one can easily identify the species because no other of the small, filamentous taxa is so irregularly branched nor has cells so long in proportion to breadth (10–20X).

## DELESSERIACEAE

\**Acrosorium venulosum* (Zan.) Kyl.

Wynne 1989

*Acrosorium uncinatum* (Turn.) Kyl., 659

Small irregularly branched thin, pale, asymmetrical blades, tending to linear in shape; microscopic veins irregularly branched; usually epiphytic, low intertidal zone to 30 m in the offshore canyons; to 5 (10) mm wide, and 10 cm high, with narrow tips that often are curved or hooked (uncinate); tetrasporangia are found rarely, gametophytes not found locally.

Thalli are easily recognized when they grow in clumps or masses over other algae. Subtidal clumps of thalli can be conspicuous on rock or worm tubes, as well as growing epiphytically. They are collected from these deep sites at all seasons. McPeak has found it very abundant south of Pt. Lorna at 12–15 m depth.

The microscopic veins of *Acrosorium* thalli probably can be recognized only with magnification; in intertidal habitats *Cryptopleura* blades may be similar, but the basally thickened region, the rounded or ruffled margins, and the duller color will usually identify them as *Cryptopleura*. Subtidally, other morphologically asymmetrical, veinless small blades (*Nitophyllum hollenbergii*, *Cryptopleura*) can grow on the same surfaces with *Acrosorium*, but the uniform thinness, linear shape, tapering or curved apices, and the color of *Acrosorium* set it apart.

A recent study (Wynne 1989) presents evidence that the alga with a worldwide distribution in cool to warm temperate waters that is currently known as *A. uncinatum* is typified by material now identified as *A. venulosum*, requiring the application of this name to California specimens.

*Anisocladella pacifica* Kyl.

653

Thalli are symmetrical, small, leaf-like blades, linear, never oval, with distinct midrib, lateral veins and dentate margins; erect blades mostly 2–4 cm high, to 0.5 cm wide; between veins and midrib the blade portion is one layer of cells thick, giving the plants a fragile appearance. Reproductive structures form between veins, away from midrib. Blades develop from prostrate axes that usually are buried in sand, or attached to rock, sediment or *Phyllospadix* rhizomes. (See Figure 10, and comment for *Phycodrys profunda*.)

Dawson *et al.* (1960) recorded this species to 13 m in kelp beds; we find it only in the low intertidal zone, typically restricted within or near *Phyllospadix* beds where it occurs mingled in sand with *Tiffaniella snyderae* and *Nienburgia*



*andersoniana*. All reproductive phases have been found here. This species was recently found in central Chile; otherwise, it is known only from the Pacific coast of North America.

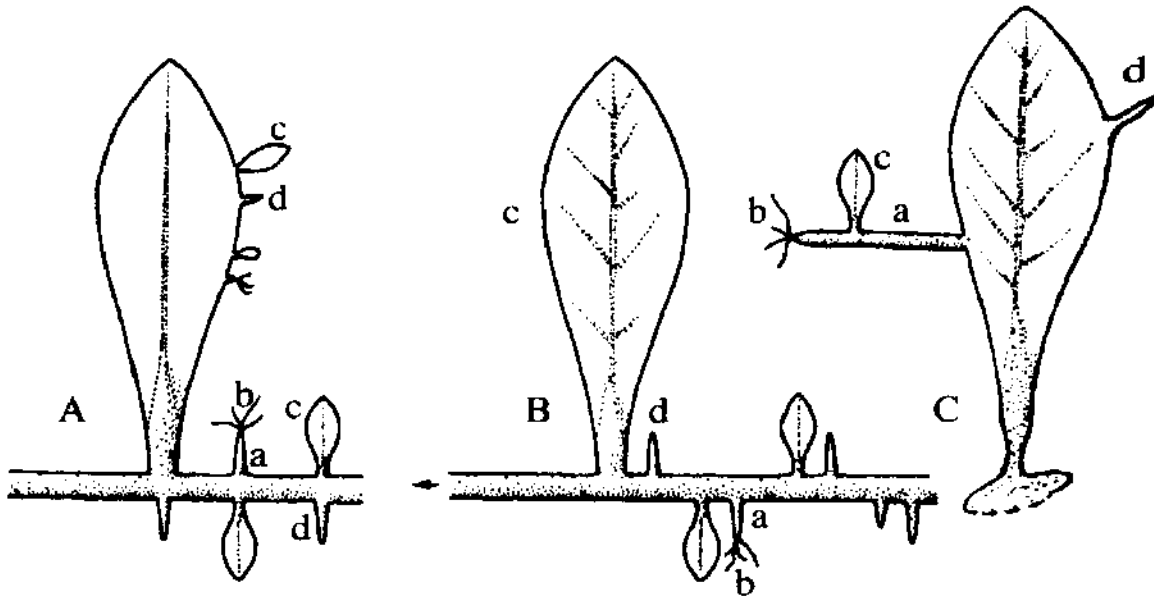


Figure 10. Thallus patterns for (A) *Nienburgia andersoniana*, (B) *Anisocladella pacifica*, (C) *Phycodrys profunda*. Arrow indicates direction of apex in (B). (a = hapteron, b = rhizoids, c = secondary blade, d = spine).

*Apoglossum gregarium* (Daws.) Wynne

Wynne 1985b

*Phrix gregarium* Stewart 1974

Unbranched blades on short branched stipes, less than 1 cm high, 1–2 mm wide; larger blade surfaces often rippled, undulate from the margin into the midline, younger blades more flat; distinct single apical cell and symmetrical lateral rows of cells; central line of extremely elongated cells; single or several blades from basal axes (Figure 11). This is a delicate, almost microscopic alga that is not rare, but difficult to recognize without magnification. It is collected from sponges, masses of bryozoans, algal turf in nests of garibaldi fish, or among other small blades and filaments in subtidal rocky habitats. Reproductive as well as vegetative thalli have been found at all times of the year, in sites beneath the summer thermocline between La Jolla Bay and the outer kelp beds off Pt. Loma (approximately 17–28 m). Elsewhere, specimens have been collected by R. Moe subtidally at the Galápagos Islands and off Palos Verdes in Los Angeles County, and by J. R. Stewart at San Benitos Islands, Mexico. The type specimens (few and damaged) were dredged from 8–16 m, growing on a hydroid, in the southern Gulf of California and identified by Dawson (1966) as a new species of *Hypoglossum*.

Our southern California specimens appear conspecific with Dawson's Gulf

collection. With additional San Diego material available for study, it was found that the species differed in several attributes from the presently accepted limits for *Hypoglossum*, and a new genus (*Phrix*, referring to the deep blade ruffling) was described (Stewart 1974) to accommodate the Dawson type material as well as the collections from southern California. Wynne (1985b) examined the type specimen of *Phrix* (*Hypoglossum*) *gregarium* and offered the opinion that characteristics shared with *Apoglossum* warrant the combination as *A. gregarium*.

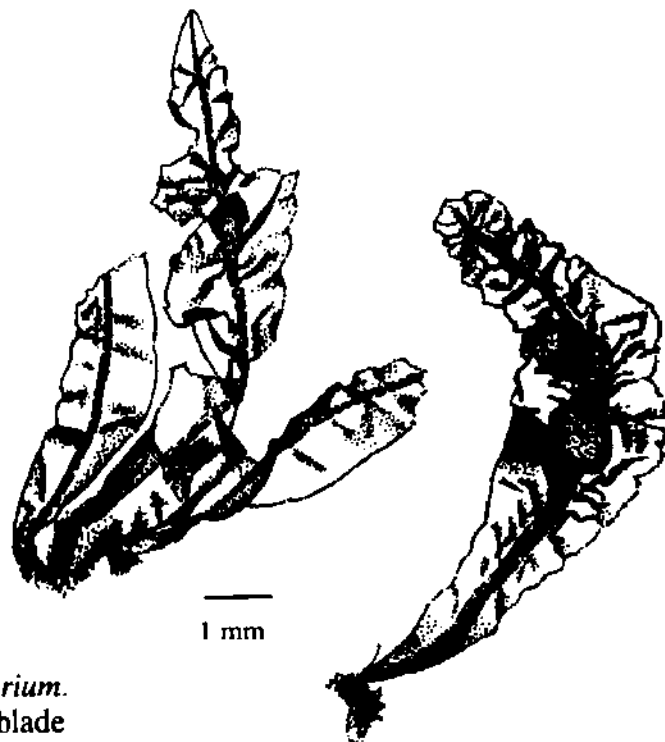


Figure 11. *Apoglossum* (*Phrix*) *gregarium*.  
Clump of blades (left) and blade  
with cystocarp (right).

*Asterocolax gardneri* (Setch.) Feldm. and Feldm.  
658

This species appears as a cluster of pale, very narrow leaflets on blades of larger leaf-like red algae. The entire thallus is 2–3 mm diameter with leaflets 1–3 mm long, and thus is seen only by scanning other algae under low magnification. We have found specimens on *Anisocladella pacifica* in a low intertidal habitat, and on *Phycodrys profunda* from the Loma Sea Cliff.

*Branchioglossum undulatum* Daws.  
636

Small delicate blades with distinct midribs; branching from near base of blade into 1–3 lobes or from stipe; small discoid holdfast; blades pink, with undulate, slightly ruffled margins, 1–2 cm high, 2–5 mm wide.

Dawson (1949a) stated in the description of the new species, that compared with *B. woodii*, the blades are shorter, broader, conspicuously undulate and

apices usually more obtuse. In both species blades may branch pinnately, and new blades develop from margins. *B. undulatum* is frequently found and easily recognized subtidally off San Diego, mostly 10–20 m, rarely as shallow as 5 m, occasionally reproductive.

*Branchioglossum woodii* (J. Ag.) Kyl.

637

Thalli of small linear blades, 1–3 mm broad, 1–2.5 (7) cm high, with a percurrent primary blade/axis that branches from margins.

Small specimens resemble less-branched thalli of *Branchioglossum undulatum*. I have not found larger, more complexly branched specimens from San Diego County sites that could be unquestionably identified as *B. woodii*, and many older references are dubious. The species is included here to point out an apparent extremely disjunct distribution. Dawson (1962) lists no records from southern California or the Pacific coast of Baja California north of Bahía Vizcaíno. The species is, however, well-known both from cold-water localities to the north (British Columbia to central California) and from southern Baja California and the Gulf of California.

\**Cryptopleura corallinara* (Nott) Gardn./ \**C. crispa* Kyl.

666

These two species are very similar. Both have thin broad blades with microscopic veins that can be seen by holding the blade up to the light; a heavier midrib develops in the basal part; blades often are broader toward the apex, with ruffled or undulate margins; tetrasporangia occur in sori along margins or in small marginal leaflets.

In San Diego County one finds numerous morphological forms of *Cryptopleura* thalli, some mostly adherent to the basiphytic alga, some with both adherent and erect free blades. These thalli are common on *Corallina* species, on *Pterocladia capillacea*, or *Gelidium* in the low intertidal and subtidal sites. Very similar non-epiphytic forms grow in the same habitats on rocks and *Phyllospadix* rhizomes. Abbott (MAC) suggests that in the northern part of California, broad small *Cryptopleura corallinara* plants are often difficult to separate from young *C. violacea*. I find that young *C. lobulifera* thalli resemble non-epiphytic *C. crispa* in central California. Size and position of sori are not necessarily useful criteria to separate species, and both *C. corallinara* and *C. crispa* grow on *Corallina* (MAC). Many of the small subtidal specimens from *Calliarthron* or *Gelidium robustum* are likewise difficult to segregate. *C. violacea* in San Diego County is retained for the more narrow, ribbon-like forms.

Type localities for both *C. crispera* and *C. corallinara* are in San Diego County.

\**Cryptopleura farlowiana* (J. Ag.) Ver Steeg and Josselyn  
Ver Steeg and Josselyn 1983

*Botryoglossum farlowianum* (J. Ag.) DeToni, 671

[Scagel *et al.* (1986, p. 244) comment that the combination proposed by Ver Steeg and Josselyn is invalid because they did not cite the basionym.]

Thalli deep rose to brownish red; erect axes 10–50 cm tall, blades to 4 cm wide, with broadly rounded to blunt apices, margins with ruffles and proliferations; larger than other similar *Cryptopleura* species and not epiphytic as are other *Cryptopleura* taxa.

This is one of several taxa that in San Diego are largely restricted to the rocky subtidal off Imperial Beach. The specimens resemble very closely those common in central and northern California, including the variability discussed in MAC. Ver Steeg and Josselyn (1983) found that the location and shape of tetrasporangial sori, in combination with margin morphology, were the most useful taxonomic characters for distinguishing the three *Cryptopleura* species of their study. They concluded that there is no evidence to support continued segregation of *Cryptopleura* and *Botryoglossum* on the central California coast; I concur in their judgement for San Diego County specimens.

*Cryptopleura rosacea* Abb.

668

Thalli growing in clumps on rocks, flabellately branched in ribbon-like lobes 5–10 cm high, branches 2–3 cm broad, ultimate divisions with blunt to spatulate apices.

We list this species here to note that *Cryptopleura* specimens similar to the forms described for *C. rosacea* are occasionally found; the collections we have seen probably represent dense clumps of *C. crispera*. Superficially they can be confused with *Carpopeltis*. Published records for *C. rosacea* refer only to drift specimens at Carmel in central California.

\**Cryptopleura violacea* (J. Ag.) Kyl.

668

Thalli of slender, long, ribbon-like blades, to 25 cm high, deep rose to blackish, or greenish pink; tending to dichotomous divisions, sometimes broader and more flabellate near the tips; lower midribs often appear as stipes after the blade portion has been eroded away; margins undulate, or with proliferous leaflets. Monostromatic with veins as are all species of *Cryptopleura*.

In San Diego, this species is characteristically found under or near *Phyllospadix* in shaded low intertidal habitats, or subtidally on *Gastroclonium subarticulatum*, *Pterocladia capillacea*, and *Corallina* axes. To compound the confusion discussed for *C. corallinara*/*C. crispa* (above), Abbott has written that the forms included in *C. crispa* in southern California could easily be grouped with small young *C. violacea* in the north, suggesting that throughout the Pacific coast range of these several species, there are either 4 species that overlap in distribution and morphology, or 1–3 highly variable species.

*Erythroglossum californicum* (J. Ag.) J. Ag.

648

Thalli with long leaf-like blades, bright pink, with midrib and dentate margins. Larger specimens appear less leaf-like, with branches to 12 cm high, 2–5 mm wide, and lateral blade portions near the base so eroded that the midrib appears as a stipe with blade tissue present only along the upper portions of the thallus. Abbott (MAC) mentions misidentifications (as *Erythroglossum*) of *Anisocladella pacifica* and *Sorella delicatula* specimens. *Erythroglossum californicum* is a very rare alga, with probably only 2–4 verified records from California south of Santa Barbara (type locality). We have found two collections washed up on the beach at Imperial Beach after winter storms, in different years.

A plant Dawson cites as the only record for Baja California was re-examined by Abbott and found to be a specimen of *Sorella delicatula*. A study in progress indicates that the name and taxonomic position of *E. californicum* is likely to be shifted in the near future.

*Gonimophyllum skottsbergii* Setch.

673

Thallus a rosette of simple or lobed blades; considered to be a “parasite” on blades of species in the family Delesseriaceae; clumps less than 1.5 cm diameter, pale pink, blades individually 1–3 mm high with ruffled margins.

Dawson (1945b) cited a single specimen on *Cryptopleura violacea*, 20 m deep off Pt. Loma in 1943, for the only known San Diego record.

\**Holmesia californica* (Daws.) Daws.

640

Thalli with flat, dark red, broad (4–7 cm) blades, 8–15 (20) cm high; branched near base, with undulate margins; primary midrib present below, lacking above; young blades membranous, thicker and leathery when older and

reproductive; reproductive structures on papillae (small leaflets) that develop on the surface of upper parts of blades.

Type locality, Loma Sea Cliff, dredged in 25 m, March 1944. Since this species was first found in San Diego County, it has been collected to the north as far as British Columbia. MAC reports that there are several localities in northern California where it is frequently collected subtidally. A single collection is known from Baja California (Punta Santo Tomás); to our knowledge it has not been relocated in San Diego County.

[*Hymenena* species

660-664

No specimens of any *Hymenena* species are reported south of San Luis Obispo; the occasional thalli from the Imperial Beach area that resemble species of *Hymenena* (*flabelligera*?) probably represent forms of *Cryptopleura* (*Botryoglossum*) *farlowiana*, an uncommon species in San Diego County and in several localities on the coast of Baja California.]

*Membranoptera weeksiae* Setch. and Gardn.

639

Thalli small ribbon-like thin blades, each with a distinct percurrent midrib from the base to near the tip; blade portions to either side one layer of cells thick, thus very delicate and thin, no apparent lateral veins; entire thallus usually less than 4 cm high (in San Diego), clear pink in color.

These are not common, but occasionally abundant on articulated corallines (*Calliarthron* or *Bossia*) below 17 m, often 23-33 m. All fertile phases have been found in late summer collections, but an April collection contained both tetrasporangial and spermatangial thalli. They are often eroded, damaged, and not easily distinguished among other thin-bladed epiphytes (i.e., *Nitophyllum hollenbergii*, *Sorella* spp.) that occur on the same basiphytes.

No specimens have been recorded from localities south of San Diego, although it is unlikely that the range does not extend into Mexican waters.

*Myriogramme caespitosa* Daws.

654

Thalli form clumps of soft, thin, rose-pink blades, mostly less than 1 cm in widest dimension, prostrate, secondarily attached to rocks or other algae by numerous peg-like disks that grow from the surfaces of the blades

(*Cryptopleura* species also re-attach in this manner); blades overlap, margins are more or less ruffled, and venation is completely absent.

Most small blades that are one layer of cells in thickness and that lack any midrib or veins, such as are common on other subtidal algae, are probably best attributed to *Nitophyllum hollenbergii*, although vegetatively many of the specimens resemble forms described as *Myriogramme caespitosa*. This latter species is said to have chains of carpospores, however, and on the thalli we have examined all carpospores have been only terminal, as is characteristic for species of *Nitophyllum*. We list this small *Myriogramme* species only to call attention to the occurrence of small forms that often vegetatively resemble *M. caespitosa*; at present we know of no material that definitely documents this species or any other representative of the genus for San Diego County.

\**Nienburgia andersoniana* (J. Ag.) Kyl.

653

Thalli with prostrate axes that branch to form either new prostrate axes or bear widened blades that branch to form new blade portions; blades are conspicuously dentate, with a thickened midrib in lower parts, but lack lateral nerves; blade portion polystromatic; rose-pink, bright or dull, often with a greenish iridescent sheen when wet. The erect branches (axes) vary in width, from 1 to more than 12 mm wide, and thalli are to 20 cm high.

In low intertidal habitats, often under *Phyllospadix*, the symmetrical leaf-like blades are easily recognized by the marginal teeth, the distinct midrib, and by the presence of creeping, narrow axes that broaden and merge into erect axes that bear lateral blades (Figure 10). Subtidally to 27 m, often in kelp beds, where thalli often are larger, less prostrate, occasionally epiphytic (on *Gelidium robustum*, *Corallina* species, *Bossiella*, or *Macrocystis* holdfasts). Both gametangial and tetrasporangial plants have been found intertidally and in the Mission Bay Channel during late fall to winter months.

*Nitophyllum hollenbergii* (Kyl.) Abb.

658

Thalli 1–2 cm high, blades on short stipes, branched or unbranched, narrow or broadly ovate, with rounded or divided apices; blades are one layer of cells thick throughout, without midribs or veins.

The small, broad blades of this species, variously shaped and with ruffled margins, are found frequently in nests of garibaldi fish, on *Calliarthron* and other large thalli, and among small algae on rock surfaces subtidally 8–37 m. Fertile specimens are found at all times of the year. At present we include with *N. hollenbergii* all small monostromatic blades lacking venation although

thalli often resemble the forms described for *Myriogramme caespitosa* (above). *Cryptopleura* species grow on the same algal basiphytes; these can form small blades that also are ruffled and monostromatic but with the aid of a microscope veins can be detected. The presence of a thickened basal midrib-stipe portion can also help distinguish *Cryptopleura* species from *Myriogramme/Nitophyllum* species.

*Phycodrys cerratae* Daws., Acleto and Foldv.

Dawson, Acleto, and Foldvik 1964

Stewart 1989c

From the same site at about 20 m in the La Jolla Submarine Canyon, we collected specimens in 1974 and again in 1981 of an alga we eventually identified as *P. cerratae* (Figure 12). The site is part of a study area visited regularly by divers, and the algal flora has been monitored carefully; thus, the absence of the species in intervening years is relatively assured. (Additional material will be gratefully received!) Blades are leaf-like, to 12 cm high and 3.5 cm wide, with a central rib but no, or only very faint, lateral venation. Numerous new blades develop from the margins of the primary blade and can become as long as 7 cm.

The San Diego County collections and an additional G.J. Hollenberg collection from Los Angeles County were compared with other *Phycodrys* species, particularly with the Peruvian type material of *P. cerratae* and with collections of *P. isabellae*, a smaller species with less marginal branching and secondary attaching rhizoids from blade margins. The southern California plants clearly represented a single species and were most similar to *P. cerratae* (Stewart 1989c). Dawson *et al.* (1964) list 29 other marine algal species from Peru that also occur in San Diego County, suggesting that there is indeed an affinity between these floras and supporting the assignment of these southern California collections to a species otherwise known only from drift plants collected near Lima, Peru.

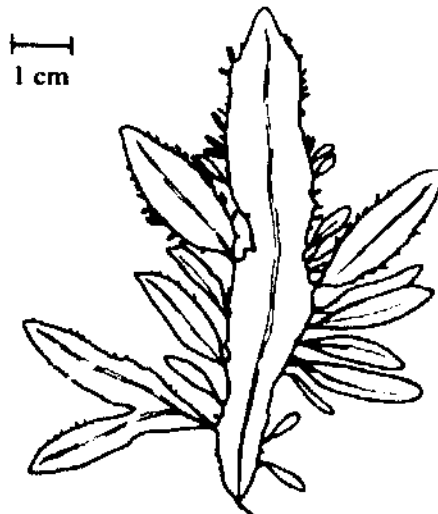


Figure 12. *Phycodrys cerratae*.  
Plant collected off  
La Jolla Shores beach.



*Phycodryis profunda* Daws.

647

Thalli of small pink leafy blades, 2–3 cm high, growing from prostrate axes or basal clumps of stipe-like tissue; each blade usually single on short stipe, with heavy, distinct midrib and lateral nerves or veins, more developed in some thalli, less so in others; margins of blades appearing dentate, or producing secondary blades or haptera that reattach the blade to other algal, animal, or rock surfaces.

Rarely a small blade develops from the side of a lateral hapteron that itself is growing from the margin of a larger blade, but otherwise blades do not grow directly from blade margins. When the blades are picked, the secondary attachment structures are torn and few collected thalli are undamaged. The irregularly spaced lateral “nerves” that produce the leaf-like morphology make this species rather easy to recognize despite the damaged condition of most thalli. It occurs in numerous subtidal sites on rock or scallop and abalone shells, rarely primarily epiphytic, and at all times of the year. *Phycodryis profunda* also grows in the lower intertidal zone on La Jolla beaches where *Anisocladella pacifica* and *Nienburgia andersoniana* also are common. The three can be distinguished by their distinctive regular developmental patterns (Figure 10; see also Stewart 1976). The species has not been recorded from Mexican localities.

\**Phycodryis setchellii* Skottsbo.

647

Leaf-like blades to 20 cm high, dark to bright pink, to 4 cm wide, often branched near the base, with conspicuous, relatively heavy midribs and lateral nerves; margins mostly smooth and lacking lateral proliferations (haptera, blades, or rhizoids).

The genus *Phycodryis* contains the most leaf-like of all red algae, with the blades symmetrically divided by a midrib, and with opposite or irregularly alternate lateral nerves or veins. Large thalli of this species are common in central and northern California in intertidal as well as subtidal habitats. In San Diego County *P. setchellii* is apparently associated with, and perhaps restricted to, habitats off Imperial Beach or beyond the southern end of Pt. Loma. Our specimens are small and generally less “typical” than those illustrated in MAC.

The specimens listed by Dawson from Baja California are from localities of cold-water upwelling, or from very deep offshore island sites.

\**Platysiphonia clevelandii* (Farl.) Papenf.

642

A dissecting microscope will be necessary to recognize both this species and *P. decumbens*, and a compound microscope to distinguish between the two. Thalli of both consist of thin narrow blades and creeping flattened axes. Prostrate and erect portions are polysiphonous, with 4 pericentral cells and several cells laterally arranged in a precise and symmetrical order (see Figure 13); blades grow from the midline of other blades, as illustrated in MAC Figures 854, 855.

MAC describes this species as up to 5–8 cm high, but we find only tiny thalli, prostrate on sponges, shells, in mats of algal turf, or on rocks in low intertidal and subtidal habitats. Tetrasporangia occur February–September, and occasionally spermatangia are found in spring months (see *P. decumbens*). In Pacific Mexico, Dawson recorded *P. clevelandii* south to Scammon's Lagoon, in shallow (4–6 m) water; specimens from the Gulf of California (Dawson 1966) have been re-examined and found to be *P. decumbens*.

*Platysiphonia decumbens* Wynne

644

See description of *P. clevelandii*. Without magnification, thalli of both of these species appear to be thin, delicate, narrow blades that lie close to the substrate. With a microscope it can be determined that *P. decumbens* blades and axes are 7 cells wide, and bladelets grow from only one surface, whereas *P. clevelandii* thalli are 5 cells wide and bladelets can develop on both surfaces (Figure 13).

Both species are widely distributed between here and Puget Sound and south into Mexican localities. Locally, *P. decumbens* has been found growing near *P. clevelandii*; only tetrasporangial reproduction has been observed.

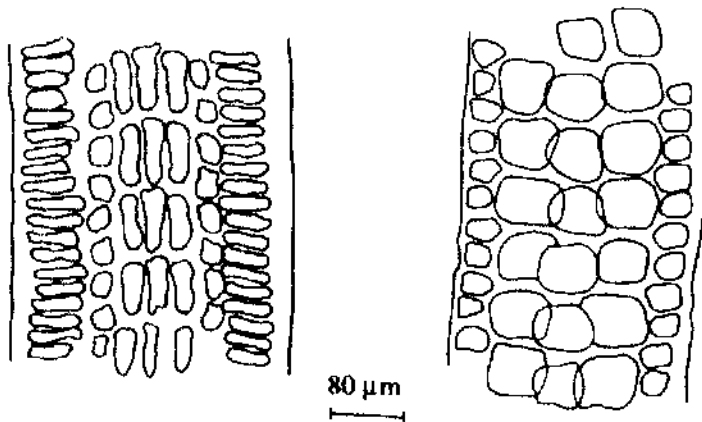


Figure 13. *Platysiphonia clevelandii* (right) and *Platysiphonia decumbens* (left). Magnified whole blade surface.

*\*Polyneura latissima* (Harv.) Kyl.

651

Thalli of erect blades, growing on very small discoid holdfasts or flattened prostrate axes; short stipes, young blades oval and entire and mostly monostromatic (one layer of cells thick), becoming lobed, divided, variously shaped, and polystromatic with increase in size and age; no midrib but with a very conspicuous network of interconnected nerves and veins throughout blade except in upper or very young portions; blades to 45 cm high, sometimes equally wide, deep pink to dull red in color.

This is a very conspicuous and often abundant species in shallow to deeper subtidal habitats along most of the coast of California north of San Diego at least to British Columbia, and is conspicuous by its absence in most sites off San Diego. Where it occurs, it is restricted to depths below about 17 m. Thalli are rare in the La Jolla Canyons, occasionally abundant along the Loma Sea Cliff, south of Pt. Loma, and off Imperial Beach.

Some very large thalli have been collected, as well as thalli with new blades growing from older eroded basal remnants, suggesting perennial growth. Small blades, recognizable by the presence of barely discernible nerves, grow on rocks or as epiphytes on the basal portions of larger algae.

Dawson's Baja California records are from cold-water sites, consistent with the San Diego deep-water distributional pattern. His previous (1945d) San Diego record is based on dredged specimens from the Coronados Islands, south of Pt. Loma.

*\*Sorella delicatula* (Gardn.) Hollenb.

648

Thalli of delicate, narrow blades, erect and regularly branched, mostly dichotomously, with a thin but distinct (with magnification) midrib; lateral nerves or veins are lacking; blades mostly 300–500  $\mu\text{m}$  broad throughout and entire thalli mostly less than 2.5 cm high; on rocks or epiphytic on *Cryptopleura*, *Gelidium robustum*, *Callophyllis flabellulata*, *Calliarthron*, or on worm tubes, sponges, and with other small thalli in nests of garibaldi fish subtidally to 33 m; intertidally on rock ledges on sides of channels in shaded seldom-exposed habitats. All reproductive phases are found, at all times of the year. In culture, the complete life history is completed in 6–8 weeks, indicating this is a fast-growing species (Stewart 1977).

The uniform narrowness of the thalli and branching pattern (Figure 14) easily distinguish *Sorella* (both species) from other small epiphytic blades (*Nitophyllyum hollenbergii* and *Cryptopleura*) that are broader and typically unsymmetrical.

*Branchioglossum undulatum*, *Membranoptera weeksiae*, and *Phycodrys profunda* are symmetrical with mid-lines more or less thickened, but these occur mostly as single simple blades rather than branched thalli (see *S. pinnata*). Neither species of *Sorella* has been recorded from Mexican Pacific localities.

\**Sorella pinnata* Hollenb.

650

Thalli are delicate blades with faint midribs, similar to *S. delicatula*, but broader (800–1200  $\mu\text{m}$  wide) and often with a heavier, more developed midrib; typically specimens attributed to this species are more or less pinnately branched along a percurrent axis-blade; seldom more than 2 cm high (as are *S. delicatula*), and found in the same sites and on similar substrates growing with *S. delicatula* (Stewart 1977).

The study of San Diego collections cited here was not available when MAC was prepared. Extensive sampling from a variety of subtidal and intertidal habitats showed that specimens with the characteristics earlier described for *S. pinnata* are uncommon. In single collections one finds narrow thalli (to 500  $\mu\text{m}$  wide) that are dichotomously or flabellately branched with indistinct central lines (*S. delicatula*) mixed with forms that could be tentatively assigned to *S. pinnata*. Numerous thalli are intermediate in breadth (500–800  $\mu\text{m}$  wide), and branched in atypical patterns (Figure 14). Mature reproductive structures are similar on all vegetative forms and cannot be used for species discrimination. The habitat and morphological intergradation between forms suggests that two distinct species should not continue to be recognized. The species have not been collected from the Pacific coast of Baja California.

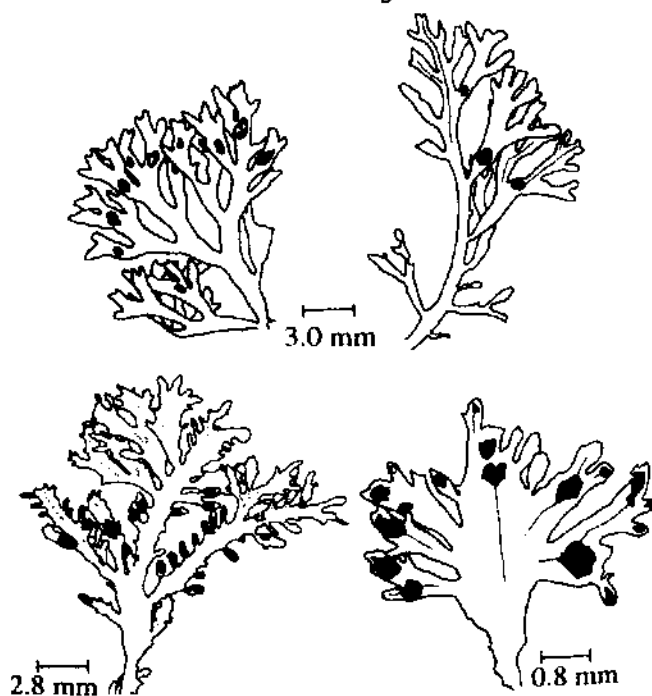


Figure 14. *Sorella* thalli with pinnate branching as described for *S. pinnata*, dichotomous branching as described for *S. delicatula*, and mixed branching.

## DASYACEAE

*Colacodasya californica* Hollenb.

680

Thalli parasitic on *Heterosiphonia erecta*, forming light pink to pale cream-colored, densely tufted growths, 1–2 mm high; microscopic anatomy described in MAC.

Four collections, from intertidal *H. erecta* in November, over several years, have been tentatively identified as this species of *Colacodasya* although they initially were considered as the somewhat swollen congested tetrasporangial stichidia of the “host” species. Few collections are known of this “parasitic” taxon, previously recorded only from between Pt. Vicente in Los Angeles County and Laguna Beach. If the San Diego specimens are in fact the species, the range is extended south to Pt. Loma.

*Dasya sinicola* var. *abyssicola* (Daws.) Daws.

676

Small, delicately branched, with branches appearing as nearly microscopic bottle brushes; deep red-pink; axes sometimes single or in clusters from a variety of substrates. The branchlets mostly are clustered near the tips of the axes and main branches and are formed from uniseriate filaments of cells (monosiphonous). This variety, *abyssicola*, is less than 2–3 cm high, with lateral branches (40–60  $\mu\text{m}$  diam.) and main axes smaller in diameter than the other varieties of the species. Larger thalli are found in warmer southern waters.

In San Diego, this alga is often conspicuous by its color and shape on pieces of sponge, large algae, or other benthic substrates. We have found tetrasporangial and cystocarpic thalli in deep sites, and vegetative plants on piers or barges in San Diego Bay. It appears to have a rather wide distribution in respect to the several factors that differ in these two types of habitats, but it apparently does not grow on intertidal rocky beaches. Our records show no seasonality.

\**Dasya sinicola* var. *californica* (Gardn.) Daws.

676

Thalli 3–10 cm high, determinate laterals 80–110  $\mu\text{m}$  diameter near base and more persistent than in var. *sinicola*.

Dawson terms this a coarser variety. Reviewing the variability in habitat and morphology in our collections of *Dasya* specimens, we find plants that could be identified either as var. *californica* or var. *sinicola* but because they are

mostly less than 3 cm high, we have grouped them at present with var. *abyssicola*. Occasional larger thalli are found in San Diego Bay.

The type collection of *D. sinicola* var. *californica*, as *D. californica*, was from "La Jolla," in 1927. Dawson (1945d) recorded the taxon as *D. californica* from pools at the south end of La Jolla Shores beach in May.

*\*Heterosiphonia erecta* Gardn.

676

Thallus with polysiphonous major axes, 4 pericentral cells, monosiphonous pigmented ultimate branchlets; growth pattern sympodial; entirely uncorticated, with branching every 2 segments; to 5 cm high.

Thalli are very abundant during winter months as epiphytes in the low intertidal zone in turf, or in clumps near *Phyllospadix* beds, or mixed with other algae in more exposed positions. In habitats where plants are exposed to air and sun during winter midday low tides, thalli become pale, almost yellowish pink, but when more shaded they are bright pale pink. The close branching and tapered ultimate (monosiphonous) branchlets give it a fuzzy appearance. This species has not been found subtidally.

The type specimen was collected as an epiphyte from *Phyllospadix*, La Jolla.

*Heterosiphonia japonica* Yendo

678

Thallus with polysiphonous major branchlets, 5 pericentral cells, ultimate portions of branchlets pigmented and monosiphonous; branching distichous, in one plane; main axes cylindrical and corticated near base but noticeably compressed above; branching alternate, mostly with two segments between laterals.

MAC notes that the species is infrequently found, and only as far south in California as Orange County, and that gametophytes are rare in the eastern Pacific. In San Diego County it is not uncommon, but strictly subtidal at mid-depths 10–23 m, often attached to articulated corallines but also on sponges and other benthic surfaces. Cystocarpic thalli have been found in April collections.

*\*Pogonophorella californica* (J. Ag.) Silva

678

Thalli with polysiphonous major axes and monosiphonous pigmented ultimate laterals; sympodial growth (a feature of the family) not clearly observed in this

species; branching radial around cylindrical axes; all axes and branches bare of laterals in lower portions, short tufts of monosiphonous branchlets mostly near branch tips; except for these monosiphonous ultimate branchlets, the thallus is completely and heavily corticated, and the polysiphonous condition cannot be seen; thalli 3–10 cm high, in loose clumps, with prostrate axes often in sand.

The local distribution is restricted spatially as well as temporally. On the rocky beach north of Wind and Sea Beach in La Jolla it is common in *Phyllospadix* beds between November and May and less easily found the rest of the year. In similar habitats south of Ocean Beach it has not been found. Fertile plants are found in the La Jolla populations in winter. It is often associated with *Anisocladella*, *Tiffaniella*, *Nienburgia*, and *Petroglossum* in shallow sand on rocks in the low intertidal zone. It has been reported from kelp beds to 20 m, but we have not found it subtidally, despite searching.

Dawson (1945d) wrote that it was “easily distinguished by the slender smooth, branched axes below, ending in ‘furry’ tips.”

*Rhodoptilum plumosum* (Harv. and Bail.) Kyl.

680

Thalli erect, irregularly distichously branched from percurrent flattened axes; to 4 mm wide, margins densely fringed with monosiphonous branched filaments to 1.5 mm long.

Although thalli from northern California reach 40 cm in height and usually are 10–20 cm high, the few specimens we have found on subtidal rocks are less than 3 cm high. Despite their small size, they are conspicuous by the dense fringe of filaments along soft flat axes. On our specimens the filaments are relatively evenly distributed, rather than tufted or irregularly separated, as described for young thalli.

The only other local specimens we know of were collected by the first scientific diver at Scripps Institution, Conrad Limbaugh, who recognized several thalli as an unusual species in the Scripps Submarine Canyon, probably 1958–59.

RHODOMELACEAE

\**Amplisiphonia pacifica* Hollenb.

721

This species grows in the form of smooth, rounded blades that are completely flattened against rocks, attached by short unicellular rhizoids. The blades are often ruffled at the margins, and new growth overlaps and overgrows older

blades, forming patches several layers thick, and several cm across. Color in the field is dull, dark red, although individual blades separated from the rock are brighter, red-pink.

We have found thalli occasionally in low intertidal habitats, but more often subtidally to 27 m. Both gametangial and tetrasporangial plants have been collected from these sites. A microscope is not necessary to identify this very distinctive species that was first described from Corona del Mar (Orange County) in 1939. It is now recorded from British Columbia to Punta Eugenia in Baja California.

Dawson's Checklist refers to finding thalli on crustose corallines and holdfasts of *Eisenia* in the lower intertidal.

***Chondria* and *Laurencia*.** Pairs of species of each of these two genera share critical vegetative characters, making it often difficult to identify individual thalli. All species of both genera are completely corticated over a primary polysiphonous structure. Size and branching pattern vary similarly in each genus. The flattened *Laurencia* species (*L. spectabilis*, in San Diego) have no local counterparts among *Chondria* species, so it is the terete, radially branched forms that will be most confusing. All *Laurencia* species have a prominent apical pit. Some *Chondria* taxa also show this feature, while others taper toward the branch tips. *Chondria* thalli, in theory, can be distinguished by having a cluster of trichoblasts (hair-like branched filaments formed of several colorless cells) growing from around the apical cell, whether this is within a pit or at the tip of the branch. But in practice, some thalli lack these—perhaps because they are easily broken off and therefore lost before the collection is examined, or because they are naturally deciduous and therefore absent in older material, or because they do not always develop on all thalli. On *Laurencia* thalli trichoblasts are rare, rudimentary or evanescent, but they do develop, thus further blurring this distinction.

Spermatangia develop on specialized flat, round “stichidia” on *Chondria* thalli, as opposed to short, cylindrical branches in *Laurencia*, but male plants are rarely found. Tetrasporangial and cystocarpic thalli are similar for both genera.

Throughout the world, and since algal taxonomy began, workers have studied and argued over these two genera; in San Diego County there are several species in each genus that are clearly recognized, but for others small samples or single thalli will be virtually impossible to identify without considerable experience with field variation and reproductive thalli.



*Chondria arcuata* Hollenb.

724

Thalli dull red when growing in shaded habitats, but pale or almost yellowish in the more common intertidal turf habitats where it grows in San Diego. Erect branches are cylindrical, often somewhat arched or curved as they grow horizontally over other vegetation, secondarily attached at frequent intervals; a tuft of trichoblasts from the apical pit may be conspicuous in freshly collected young (?) material, but in older plants or thalli that have been several hours in containers, this feature may be misleadingly absent. The species is one of the most common and abundant epiphytes growing on *Pterocladia capillacea* and *Corallina pinnatifolia* in algal turf on La Jolla beaches, less common elsewhere in the county. MAC records it as rare in southern California and gives only three known collections from Los Angeles and Orange counties. Dawson (1963b) did not find it in Mexican collections.

\**Chondria californica* (Coll.) Kyl.

724

Thalli mostly 4–5 cm high, but often much larger when it occurs in large clumps of tangled branches; usually epiphytic, purplish, in the water conspicuously pale and iridescent; variously branched, attaching to other algae partly by means of tendril-like branch tips; branches thin, cylindrical, or somewhat compressed, tapering toward the tips, with trichoblasts near, and growing from, the tip.

The description of the habitat for specimens elsewhere in California is appropriate for San Diego County plants: common in various habitats in the low intertidal to shallow subtidal; in San Diego, particularly in pools where plants are seldom, if ever, exposed to air. Dawson (1963b) described forms variously erect or more prostrate, with entwining or more prostrate axes, with straight to hooked tips, and attached to rocks or other algae—"a widespread tropical plant with extensive occurrences in well insolated subtropical and temperate waters along the Pacific Coast." (This species in other localities is the "host" for *Jantabella*, an epiphyte/parasite not reported from San Diego County.)

Type locality, La Jolla.

*Chondria dasyphylla* (Woodw.) C. Ag.

726

Thalli with terminal pit and tuft of trichoblasts; irregularly alternately branched, to 5–15 cm high; differs from *C. oppositoclada* primarily in branching pattern.

This species is widely distributed on North Atlantic coasts, Japan, and the Pacific Coast of North America. MAC cites no San Diego County collections, but Dawson (1946, 1958) recorded specimens (as *C. telmoensis* and *C. pacifica*) from La Jolla. Our collections include thalli with branching patterns characteristic both of *C. dasyphylla* and *C. oppositoclada*, suggesting that either both species are present here or that locally a single variable taxon occurs.

*\*Chondria decipiens* Kyl.

726

This is a very robust species with coarse, densely branched main branches 12–20 cm high; otherwise similar in most features to *C. nidifica*.

Dawson (1945d) reported finding thalli cast up on La Jolla beaches in June, but we have not seen any specimens that resemble this species.

*\*Chondria nidifica* Harv.

726

Thalli 15–20 (40) cm high, dark red, with few to many cylindrical axes growing from basal holdfasts and haptera; erect axes 1–2 mm diameter, irregularly branched from all sides; branch tips often appearing as if bitten off by fish (?); fertile branches usually recognized in tufts or clumped, whereby reproductive thalli appear very different from vegetative.

This species is mostly restricted to very low intertidal rocks, often in or near beds of *Phyllospadix*; on several La Jolla beaches it becomes quite abundant and easily found winter to spring. Occasionally it occurs in the upper portions of subtidal regions, to 10 m in shallow-water kelp beds.

*Erythrocladia* sp. has been found on *Janczewskia lappacea*, which was in turn growing on *Chondria nidifica* in December.

*Chondria oppositoclada* Daws.

727

Thalli slightly to very bushy, with several to many axes arising from common base; branches cylindrical, irregularly and radially alternate, often with subopposite pairs or triplets; to 15 cm high; apical pit and terminal trichoblasts distinguish the species from forms of *Laurencia* that can be similar.

Epiphytic or on rocks, low intertidal to subtidal (18 m), locally often associated with *Phyllospadix* beds. The distribution is apparently limited to the coast between San Diego County and Scammon's Lagoon in Baja California.

Between Sunset Cliffs and the tip of Pt. Loma, this species has been collected with tetrasporangia and cystocarps. *C. dasyphylla* is a very similar species, distributed throughout the eastern Pacific, with predominantly alternate branching.

Type locality, La Jolla, on *Egregia* at 10 m.

\**Erythrocyctis saccata* (J. Ag.) Silva

738

Thalli epiphytic on species of *Laurencia*, where it grows out of the tip of the host plant and appears bright to brownish red; at first the form is a simple spherical sac, then larger thalli become rough, convoluted, or lobed.

In San Diego intertidal sites this alga is often quite abundant, both on terete (*L. pacifica*) and flattened (*L. spectabilis*) species. It is most often found in the low intertidal habitats where these *Laurencia* taxa are most common.

*Herposiphonia littoralis* Hollenb.

718

Thallus polysiphonous, 10–12 pericentral cells, uncorticated; branching from near one side of the axis, appearing somewhat secund, with no bare nodes between branches; all axes and branches prostrate, with 3 erect determinate branches between successive indeterminate branches; determinate branches simple, with indeterminate lateral branches mostly not, or little, developed.

This species was described for collections from Orange County and is recorded as being often common in thin patches 4–8 cm broad on rocks in the midtidal to upper intertidal levels. Rocky areas in the northern part of San Diego County, where habitats are similar to those described for adjacent Orange County beaches, have not been regularly sampled, but south of Del Mar the species is rare. G. J. Hollenberg confirmed a collection from the Flood Control Channel.

\**Herposiphonia plumula* (J. Ag.) Hollenb.

718

Thallus polysiphonous, with mostly 8–12 pericentral cells, uncorticated; brownish red, branching strictly distichous, with 3 alternate determinate branches between successive alternate indeterminate branches; determinate branches  $\pm 1.2$  mm long, broadest at base, tapering to acute apices, with 10–12 segments; indeterminate branches progressively longer from apex to base of main axes.

In San Diego, this species is found subtidally and, based on our records, is most abundant during late fall to early spring months, often growing on *Corallina officinalis* or *Calliarthron*, but not restricted to these substrates. It is recognized by the regular arrangement of branches, flattened against and attached to surfaces, with little or no erect growth.

Dawson 1945d, as *H. parva*, noted this species is “commonly epiphytic on corallines.”

**\**Herposiphonia secunda* (C.Ag.) Ambronn f. *tenella* (C.Ag.) Wynne  
Wynne 1985a**

*Herposiphonia tenella* f. *secunda* (C. Ag.) Hollenb., 720

Thallus polysiphonous, 8–10 pericentral cells, uncorticated; brownish red; branching on one side only; axes attached and creeping over other algae or other substrates; indeterminate branches more or less developed, arranged from slightly alternate surfaces every third or fourth segment, with 1 or 2 bare and/or one determinate branch between successive indeterminate branches; determinate branches simple, erect, curved toward apex to some degree.

G.J. Hollenberg confirmed the identification of one of our collections from 17 m in a kelp bed near the Coronados Islands, growing on *Gelidium nudifrons*, for a recent San Diego County record. The secund branching pattern of these thalli is distinctive, but the species is rarely found.

Dawson lists it (as *H. secunda*) only from the Gulf of California and south of La Paz in Mexico (1963b).

**\**Herposiphonia verticillata* (Harv.) Kyl.  
720**

Thallus polysiphonous, with 14–16 pericentral cells; primarily prostrate and matted, with free, erect branches 1–2 cm long, dark reddish brown; determinate branches distichous, but curved and thus appearing to grow from all sides of the axis; 3 alternating determinate branches between successive indeterminate branches and no bare nodes; indeterminate branches mostly undeveloped, segments mostly shorter than broad; common epiphyte, low intertidal.

As it is elsewhere on the California and Mexico coasts, this is a common species in San Diego County on brown and red algae and several non-algal substrates, along the Loma Sea Cliff to 13 m.

Dawson (1945d) noted that the "tips of the branches (are) curved or tending to coil."

\**Janczewskia gardneri* Setch. and Guerns.

739

Thalli small, pinkish, warty cushions to 1 cm diameter, growing on *Laurencia spectabilis* or *L. splendens*, free branches 2 mm long. Fertile specimens have been collected on *L. spectabilis* in November on La Jolla beaches. Frequently seen during winter to early spring months.

\**Janczewskia lappacea* Setch.

739

Thalli resemble thalli of *J. gardneri* (small, 3–5 mm diameter, pinkish, with protruberances emerging from a central cushion). This species grows on *Chondria nidifica*, which in San Diego County is usually confined to shaded or protected habitats in the low intertidal zone.

[*Jantinella verrucaeformis* (Setch. and McFadd.) Kyl.

713

A whitish "parasite" on *Chondria californica*, to 1.5 mm diameter; central solid portion with short, free polysiphonous branches; 7–8 pericentral cells, transversely divided.

Although *Chondria californica* is often abundant in San Diego intertidal habitats, we have not observed the "parasite" nor have others, including Dawson, recorded it from San Diego County localities.]

*Laurencia lajolla* Daws.

731

Dark red, with erect branched cylindrical axes 2–3 cm high arising from tangled creeping branches attached by frequent irregular disks; erect axes branched more above than below, with short branches mostly 700–850  $\mu\text{m}$  diam.; sexual plants unknown.

Described by Dawson (1958) as a turf-forming species, attached to coralline algae. He noted that the species had not been found during previous intensive surveys of the site (type locality) during the early 1940's. Recently we have found specimens that resemble *L. lajolla* in a Pt. Loma intertidal site where it had not been seen during several prior years, suggesting that presence or absence may be influenced by environmental factors that vary from year to year.

Type locality, north of Wind and Sea Beach, La Jolla.

\**Laurencia pacifica* Kyl.

732

Thalli terete, cylindrical in all parts; variable in size, habitat, and color. The numerous radially arranged branches on axes to 30 cm high are often approximately 2 mm in diameter below; main axes clearly percurrent; branching somewhat even (not tufted or dense) above, sparse below.

For many years intertidal terete forms (see Dawson 1963b) of *Laurencia* that grow as discrete thalli rather than in somewhat prostrate mats on the Pacific coast of North America have been described as a group of similar species or a single species (*L. pacifica*) with many ecological and morphological variants, as in MAC. Dawson distinguished several forms in San Diego, but our collections cannot be easily sorted by published criteria. For this reason we refer to them simply as *L. pacifica*. The taxon includes some of the most common epiphytes in algal turf and on rock surfaces, but also forms that occur as individual larger thalli in other habitats. Color can vary from greenish yellow to dark red to purple. These assorted collections may also include specimens of *L. lajolla* and *L. masonii*. Dawson (1963b) wrote: "This (*L. pacifica*) is an exceedingly variable species that assumes many perplexing forms under different local conditions. It is now recognized as having a much wider range than heretofore supposed. In its more characteristic 'typical' form it ranges throughout the cool exposed coastal waters from central California to Isla Magdalena, Baja California. In warmer areas within this range, such as Catalina Island, Isla Guadalupe, Bahía Viscaíno, Isla Magdalena, it occurs together with the morphologically similar *L. masonii* with which it may often be confused if only external form is taken into account."

*L. papillosa* is a species widely distributed in warm seas throughout the world, but not on the coast of California. It is likely that a densely branched specimen of *L. pacifica* accounted for the inclusion of *L. papillosa* in Dawson's Checklist for San Diego.

\**Laurencia sinicola* Setch. and Gardn.

732

Thalli flattened as for *L. spectabilis*. Branching in *L. sinicola* is less regularly distichous, and main axes and branches are not of markedly different lengths; often small, to 9 cm high, and probably rare; found on other algae.

Occasionally we collect algae with congested, flat branches that externally resemble *L. sinicola*, epiphytic on other algae (e.g. *Gigartina canaliculata*) on beaches between La Jolla Cove and Pacific Beach. Without examining the critical anatomical features that separate this species from *L. spectabilis*, the plants can only be tentatively identified.

As *L. scrippsensis*, Dawson (1945d) reported finding the species (10–16 mm high, epiphytic on *Sargassum agardhianum* and other algae in the lower intertidal zone) from La Jolla, and in **PMR 8** (1963b) he recorded a Cardiff specimen.

*Laurencia snyderae* Daws.

734

Thalli are recognized as *Laurencia* species by the terminal pit on rounded apices; branches and axes are terete, but the main branches are densely covered throughout with short simple branchlets; thalli are dark red-purple to black, with one or few relatively long (12 cm) percurrent sparsely branched axes that lie limply over intertidal rocks.

On San Diego beaches this is strictly a late spring to mid-summer alga and is particularly easy to find on beaches near Bird Rock in La Jolla and on the broad platform beaches along the west side of Pt. Loma. It grows on tops or sides of rocks exposed to desiccation and light during low tides. We have most frequently found it in years of warm summer water temperatures. Once identified, it is distinct and resembles no other alga of that particular habitat.

Dawson (1953a) believed it to be an indicator species of “warm spots” along southern California and Baja California, regularly absent from stations with cold upwelling, and present where surface waters are warm.

Type locality, La Jolla.

\**Laurencia spectabilis* Post. and Rupr.

734

Thalli flattened; branching distichous, pinnately alternate to nearly opposite; often with branches short above, symmetrically longer below, thus giving fronds a pyramidal outline; apices broad and rounded.

This species contains several variants that have been described for particular branch dimensions and arrangements. Dawson treated Baja California collections of the species as a complex of three named varieties, each with geographic and morphological forms, and related by intermediate forms. San Diego forms mostly represent the taxon he refers to as var. *diegoensis*. In San Diego County these compressed-to-flat specimens of *Laurencia* are seldom found away from the shading or protection of other algae, overhanging rock edges, or *Phyllospadix* leaves, and therefore are restricted to low intertidal habitats and shallow-water kelp beds. The “parasitic” (=pale pink) alga that grows on this species is *Janczewskia gardneri*.

Listed in the Checklist as *L. diegoensis*, based on a La Jolla type specimen.

\**Laurencia splendens* Hollenb.

735

Very similar to *L. spectabilis*, more often epiphytic, with the main axis prominently percurrent.

Dawson's *L. maxineae* (in the Checklist), described for an epiphyte on *Corallina* from La Jolla, was removed to synonymy with *L. splendens* in **PMR 8** (1963b). MAC, for this latter species, lists no San Diego records, but based on the treatment of the type collection of *L. maxineae*, *L. splendens* is included in the San Diego County flora.

*Laurencia subdisticha* Daws., Neush. and Wild.

737

A small, flattened species that was collected once (type specimen) in 20 m, at Isla Coronado del Sur, and to our knowledge never re-collected.

\**Laurencia subopposita* (J. Ag.) Setch.

738

Thalli deep rose red, branch apices appearing blunt; commonly epiphytic on *Phyllospadix* where it entwines around itself and the "grass" leaves as do tendrils on pea vines; large clumps of *Phyllospadix* + *L. subopposita* are often conspicuous in the low intertidal zone. We have also collected *L. subopposita* subtidally to 20 m. Small plants can attach directly to rocks both in the low intertidal and subtidal regions. There is no other alga with which this species can be confused.

*Levringiella gardneri* (Setch.) Kyl.

713

This "parasite" occurs on *Pterosiphonia baileyi* or *P. dendroidea*; thalli are small (600 µm tall), tufted, radially branched, appearing densely and irregularly branched.

Recorded once for San Diego County (as *Stromatocarpus*) from *P. baileyi*, La Jolla, December (Dawson 1945b).

*Ophidocladus simpliciusculus*

\* (Crouan and Crouan) Falk.

704

Thalli of polysiphonous filaments, 16–18 pericentral cells; uncorticated, erect; branches often with twisted appearance; sparse branching, thalli mostly in dense "fuzzy" mats on rocks in areas of sand and often heavy surf; trichoblasts, seen with magnification, are unpigmented, branched, often not persistent; tetrasporangia are 2–3 per segment.



At least low-power magnification is necessary to confirm identification of this and other filamentous red algae that occur in mats on rocks in sandy habitats (*Polysiphonia* species, including *P. confusa* and *P. scopulorum*; *Tiffaniella*; *Pterosiphonia dendroidea*) *Ophidocladus simpliciusculus* commonly grows along San Diego County coasts mixed with other tiny epiphytic taxa in algal turf in the lower midtidal region or with mixed vegetation under *Phyllospadix*. Subtidally we have found large, almost unialgal patches on rocks in La Jolla Bay.

***Polysiphonia***. Of the 17 species of *Polysiphonia* treated in **MAC**, 15 are stated to be distributed both north and south of San Diego County and accordingly are listed below. Of these, 10 have been found in our San Diego collections. An additional species, *P. brodiaei*, previously recorded only south to Santa Monica, has been found near Bird Rock in La Jolla.

A compound microscope and a copy of either or both **MAC** or **Pacific Mexican Red Algae 5** (Hollenberg 1961) will be necessary to identify local taxa in this genus. The brief notes here indicate easily seen contrasting characteristics but do not provide complete descriptions of the species. Generally, species in the genus are polysiphonous. When thalli are uncorticated, tiers of cells are conspicuous even with low magnification. Thalli are mostly found as erect clumps of filamentous axes, or entangled epiphytically; branching is variable, mostly radial, sparse and irregular in some species. Trichoblasts (unpigmented, monosiphonous short branchlets) are branched or unbranched, usually present near branch apices, 1 per segment, but soon deciduous, leaving persistent scar cells at points of attachment. Pericentral cells are relatively constant in number for a given species, 4–12 (22–24 in one species); thalli typically are dark reddish brown to black, San Diego forms usually 3–6 cm high except for infrequently found large thalli of subtidal specimens. Several intertidal species form dense mats over rocks in the upper part of the beach. A few species are often abundant and common and can be distinguished in the field by habitat and growth form.

**\**Polysiphonia acuminata* Gardn.**

684

No recent collections.

***Polysiphonia bajacali* Hollenb.**

684

Four pericentral cells; trichoblasts and scar cells commonly present and mostly in regular spiral sequence on each unbranched segment; percurrent axes not

distinct; segments of main axes shorter than, or barely as long as, wide.

Most of the characteristics described for this species are difficult to evaluate; several collections from San Diego Bay and from subtidal rocks in La Jolla Bay are tentatively referred to *P. bajacali*. The morphology resembles *P. flaccidissima* thalli which have been collected in the same habitats.

*Polysiphonia brodiaei* (Dillw.) Spreng.

694

Six to seven pericentral cells, but these are seen only in very small new branches; the only fully corticated species in the California algal flora. Thalli show distinct percurrent axes, with numerous laterals spirally arranged. Thalli to the north can be 15–25 cm high, but a single collection from near Bird Rock, La Jolla, was 3–4 cm high. The new record for San Diego County and recent collections from northwest Baja California (Aguilar and Aguilar 1986) constitute southward extensions of the range of this species.

*Polysiphonia confusa* Hollenb.

696

Eight to ten pericentral cells, uncorticated, abundant trichoblasts; thalli less than 3 cm high; relatively few lateral branches.

Occasionally this species forms extensive mats on the low rocks on north San Diego County beaches.

\**Polysiphonia decussata* Hollenb.

686

Four pericentral cells; trichoblasts and scar cells present, in regular spiral sequence but separated from preceding branch by 1 or 2 unbranched segments; thalli mostly 1–2 cm high; branches and trichoblasts occurring alternately with 2 or 3 segments between branch and next trichoblast in spiral.

This is an infrequently found species, typically growing mixed with other small algae among rocks midtidal to subtidal. We have identified material from tidepools on La Jolla beaches.

\**Polysiphonia flaccidissima* Hollenb.

688

Four pericentral cells; trichoblasts and scar cells commonly present, mostly in regular spiral sequence and on each segment, with branches developing at base

of a trichoblast; thallus soft, flaccid, with creeping filaments attached to substrate by rhizoids growing from pericentral cells.

Subtidal specimens have been collected from worm tubes, *Phyllospadix*, rocks, and scallop shells. G. J. Hollenberg, who studied *Polysiphonia* species for many years, at first identified some of these as *P. mollis*, then later treated them as *P. flaccidissima*, indicative of how similar the taxa can be. Very fine narrow (30–60 µm) forms occasionally are abundant in patches on intertidal *Corallina vancouveriensis*.

*\*Polysiphonia hendryi* Gardn. var. *hendryi*

696, 698

Ten to twelve pericentral cells; trichoblasts present but lacking on numerous of the unbranched segments; thalli dull reddish brown, mostly less than 1.5 cm high, densely branched, epiphytic; main axes quite distinct.

This is frequently found in the algal turf of the midtidal zone on all beaches. In sites where *Pterocladia capillacea* grows intermingled with *Corallina*, *P. hendryi* grows on either of these larger species, as well as attached to and entangled with axes of *Ceramium eatonianum*. *P. hendryi* appears to be most abundant between late fall and early spring.

Dawson's Checklist listed (in addition to *P. hendryi*) *P. gardneri* and *P. collinsii*, both of which are now included in *P. hendryi*.

*Polysiphonia indigena* Hollenb.

698

MAC lists San Diego as source of one of only two collections of this alga.

*Polysiphonia johnstonii* Setch. and Gardn.

699

Five to six pericentral cells; every segment, except for occasional lower ones, bears a trichoblast, scar cell, or branch; relatively stiff thalli, dark brown-red to nearly black; main axes and branches alternately, irregularly, often closely branched at narrow angles; variety *concinna* is mostly less than 2 cm high, with 5 pericentral cells and narrower axes, segments each about one-half as long as wide, in some cases even stouter. Several of our subtidal collections can be treated as *P. johnstonii* var. *concinna*. Some of these appear to have as many as 8 pericentral cells and in other features tend to resemble *P. confusa*, but at present there is inadequate material for comparative study.

The type specimen of var. *concinna* was epiphytic near Scripps Institution of Oceanography. Dawson *et al.* (1960) state this is a common subtidal species.

*\*Polysiphonia mollis* Hook. and Harv.

688

Four pericentral cells; trichoblasts and scar cells commonly present, in regular spiral sequence on each segment not bearing a branch; segments of main axes commonly 2–3 times as long as wide; thalli to 12 cm high, with small discoid base or creeping branches of limited extent; densely branched often apparently dichotomously above. Widely distributed along the Pacific coast of North America and in the tropical and subtropical Pacific.

Several collections identified as *P. flaccidissima* resemble *P. mollis* in many features, and have been found on “rocks, wood, or shells...in sheltered water” as the typical habitat of *P. mollis* is described. Several subtidal thalli from rock outcroppings in La Jolla Bay also probably can be attributed to this species.

Dawson *et al.* (1960) state that this is the commonest of the 4-pericentral species in kelp beds. In the Checklist it was included as *P. snyderae*.

*Polysiphonia nathanielii* Hollenb.

699

The only recorded collection of this species, other than the type collection from Los Angeles County, is from Playa de Rosarito, just south of Tijuana, 1947.

*\*Polysiphonia pacifica* Hollenb.

689

Four pericentral cells; trichoblasts and scar cells absent or very rare; inconspicuous prostrate axes, erect branches to 15 cm high, branching primarily alternate, 2 (4–5) segments between successive branches, segments in main branches 2 (3–10) times as long as wide.

*P. pacifica* is a highly variable species, with several named varieties recognized in California. Thalli we refer to the species are not sorted to variety. Our specimens are mostly less than 3–5 cm high; this may reflect short-lived or juvenile plants, or forms considered as var. *delicatula* by Hollenberg.

*\*Polysiphonia paniculata* Mont.

701

Few Baja California records are cited in Dawson's work; as *P. californica*, the species is listed in the Checklist, but without citing San Diego specimens.

\**Polysiphonia savatieri* Har.

692

Four pericentral cells; trichoblasts and scar cells commonly present mostly in regular spiral sequence on unbranched cells; epiphytic, mostly less than 1 cm high, attached by tuft of rhizoids; erect branches somewhat dichotomous, irregularly branched, giving a bushy appearance; segments mostly shorter than wide.

Among the numerous collections of *P. hendryi* and *P. simplex*, the two common intertidal epiphytic *Polysiphonia* taxa, we have found occasional tufted specimens with 4 pericentral cells (as *P. simplex*) that have certain characteristics of *P. savatieri*, a species widely distributed on central and tropical Pacific shores. There are only a few scattered records from the Pacific coast between Monterey and Guadalupe Island.

As *Polysiphonia minutissima* in Dawson's Checklist.

\**Polysiphonia scopulorum* var. *villum* (J. Ag.) Hollenb.

692

Four pericentral cells; trichoblasts and scar cells, if present, not in regular spiral sequences except sometimes very near branch apices; mostly less than 2 cm high, on rocks; the prostrate axes of this species are extensively developed, and erect branches are unbranched, or with few branches, and grow at irregular distances from the long-spreading prostrate axes that are fastened from the lower surfaces to grains of sand or debris on sandy rock surfaces.

The habitat description in MAC, and in greater detail in Dawson's study of Mexican algae (as *Lophosiphonia villum*, PMR 8, 1963b), applies with little modification to San Diego thalli. In addition to the intertidal turf or matted forms, we also find it subtidally on rocks covered with sediment.

Treated as *Lophosiphonia villum* in Dawson's studies, including the Checklist.

\**Polysiphonia simplex* Hollenb.

694

Four pericentral cells; trichoblasts and scar cells commonly present, mostly in regular spiral sequence on unbranched cells; segments in main axes mostly as long as wide, branching various but not with distinct percurrent (single or few distinct major) axes; on intertidal algae or attached to rock surfaces; 2-3 cm high locally.

The collections we group as *P. simplex* represent forms of *Polysiphonia* that are common in algal turf in high and midtidal vegetation throughout the year and that often are components of the dark red "fuzzy" mats that cover rocks in the high intertidal region in summer and early autumn.

*Pterochondria woodii* var. *pygmaea* (Setch.) Daws.

711

Thalli of erect, thin, narrow branches; entirely corticated, polysiphonous, with 12–30 pericentral cells; branching more or less regularly alternate, distichous; vegetative branches without trichoblasts; thalli 1–2 cm high, branches narrowly divergent and segments mostly shorter than broad.

Although MAC notes that this variety occurs mostly on *Cystoseira osmundacea* in shallow subtidal (1–5 m) sites in San Diego County we have collected subtidal specimens on the stipes of several large brown algae, on *Gelidium robustum*, on rocks to 22 m, from barges in San Diego Bay, and intertidally on *Pterocladia capillacea*. Male plants are easily recognized by the flattened, oval disc-like spermatangial branchlets; non-reproductive plants are distinguished by the flattened polysiphonous morphology.

\**Pterosiphonia baileyi* (Harv.) Falk.

705

Thalli most frequently erect from prostrate branches; percurrent main branches and erect axes with alternate distichous branches, secondary branches markedly shorter and all of similar length; axes cylindrical, completely corticated, to 25 cm high, very dark red to nearly black; ultimate branchlets uncorticated, with 12–14 pericentral cells.

Rare in San Diego County, restricted to a few sites, with few records; from very low intertidal habitats, mixed with other algae on rocks. I have found very small thalli attached near the base of *Corallina* axes, thus epiphytic.

Dawson *et al.* (1960) recorded thalli from kelp beds, but whether these were in San Diego is not clear.

\**Pterosiphonia dendroidea* (Mont.) Falk.

708

The description for *P. farlowii* (as *P. clevelandii* in MAC) needs little modification to encompass specimens of *P. dendroidea*; the single drift thallus on which the former species was based could well have been a variant of the latter. Outside San Diego County, *P. dendroidea* includes large coarse forms with numerous erect branches arising from creeping prostrate branches. Thalli

are characterized as branching from the percurrent axes at intervals of mostly 3 segments; branches of all orders are fused with the parent axis for slightly more than 2 complete segments, with intervals of 2 segments between branch initiation; segments of main axes 200–500  $\mu\text{m}$  broad, distinctly compressed, mostly broader than long.

Specimens in San Diego County, including all reproductive phases, occur subtidally (to 30 m) on a variety of substrates, and in the low intertidal zone are associated with *Nienburgia andersoniana*, *Anisocladella pacifica*, and *Tiffaniella snyderae* in sandy mats near *Phyllospadix* beds, or with *Polysiphonia* species in a low turf over sandy rocks. Thalli are conspicuous by their resemblance to tiny feathers amongst less regularly branched filamentous forms.

*Pterosiphonia farlowii* Hollenb.

Hollenberg 1976

*Pterosiphonia clevelandii* (Farl.) Hollenb., 708.

Small, 2–3 cm high, erect, feather-like, pinnately branched thalli, with compressed percurrent main axes, 300–350  $\mu\text{m}$  broad; polysiphonous with 10–12 pericentral cells, segments twice as broad as long; entirely uncorticated lateral branches at intervals of 2 segments, ultimate branchlets strongly recurved.

According to MAC (p. 708), “known only from the type collection from drift, San Diego, California.” Among numerous collections of small uncorticated *Pterosiphonia* thalli, few show “strongly recurved” ultimate branchlets, although a tendency to this condition can be found in many of *P. dendroidea* thalli (see above).

\**Pterosiphonia pennata* (C. Ag.) Falk.

708

Thalli with erect main branches only slightly compressed, from prostrate axes at intervals of 3 segments; 1–2.5 cm high; once or partly bi-pinnate; branchlets cylindrical, mostly simple, slightly incurved, mostly 1–1.5 mm long, at intervals of 2 segments; fused with axis for about 1 segment, segments in main axes approximately 140  $\mu\text{m}$  wide, pericentral cells 8–10.

This species is distinguished from *P. dendroidea* in localities north of San Diego by its smaller dimensions (height, width of segments, and less branched), as well as the tendency to show incurved ultimate branchlets. We have found no large specimens of *P. dendroidea* here, and all our collections of small uncorticated *Pterosiphonia* are similar. We have identified, with

confirmation from G. J. Hollenberg, several specimens from subtidal habitats as *P. pennata*. Some of these collections also contained thalli more like *P. dendroidea*, raising the question of whether one or two small species grow in these sites.

*Veleroa subulata* Daws.

702

*Murrayellopsis dawsonii* Post, 701

Dawson (1944) described the genus and species for filamentous polysiphonous thalli, to 15 mm high, that were found in a subtidal dredge collection from Bahía Tepoca, Sonora, Mexico. The genus was characterized as having monopodial, sparingly branched thalli, with large persistent pigmented monosiphonous branchlets (= ramuli, or trichoblasts), 1 per segment in spiral sequence; main axes with 4 uncorticated pericentral cells, and 1 tetrasporangium per segment, also in spiral sequence. The species was further described as having segments 1.5–2 times longer than wide; ramuli to 700  $\mu\text{m}$  long, mostly simple or with “2–3 limbs” from near the base; tapering from base to tip.

Another new genus, *Murrayellopsis*, was later established (Post 1962) for a collection from a nest of the garibaldi fish on the Loma Sea Cliff in San Diego County. The generic characters were similar to those described for *Veleroa*, but the monosiphonous ramuli were stated to be branched, and tetrasporangia were 2 per segment.

We frequently find one or both of these species on rocks or various subtidal benthic surfaces. I maintained cultures under several different laboratory regimes of temperature and light for over two years to examine vegetative growth. The young polysiphonous axes branch regularly to produce monosiphonous branchlets of uniform size. Initially these are unbranched, and they remain unbranched under some conditions. As the plants become older, all the ramuli on some axes become branched while on other axes on the same thallus they may remain simple. Based on this experimental information and observations of long and short branches and unbranched trichoblasts (ramuli) in collections from natural habitats, I concluded that the degree of branching and the length of the monosiphonous trichoblasts depends on the age and/or environment of the plant and are not taxonomically useful criteria.

A second feature initially thought to separate *Veleroa* and *Murrayellopsis* was the number of tetrasporangia per segment. Most of the thalli we find, including specimens with and without branched trichoblasts, have a single



tetrasporangium per segment, but occasionally thalli are found with both one and two per segment on the same plant. Observations of one very large tetrad, and one very much smaller in a single segment, suggest that after the first series in an axis forms and is shed, a second can develop. We also find specimens with two tetrasporangia of the same size in the same segment as shown in Figure 653 (MAC) for *M. dawsonii*.

For these reasons subtidal collections from diverse sites in San Diego County cannot be sorted into two species. The two taxa were merged (Stewart 1989c) at both the generic and species level; for reasons of priority, *Murrayellopsis dawsonii* becomes a synonym of *Veleroa subulata*, which is typified by the few scraps now deposited in collections at AHFH (LAM). Material studied (Stewart 1989c) included cystocarpic plants, not previously described, from the type locality of *M. dawsonii* (garibaldi nests on New Hope Rock) at 13 m in January.

## MARINE ANGIOSPERMS

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Two genera of monocots, "seagrasses," occur in San Diego County in salt water habitats. *Phyllospadix* (surfgrass) species are dioecious (staminate and pistillate flowers on separate plants); rhizomes attach by closely spaced short roots to rocks exposed to surf on the open coast. Several species are distributed in the Pacific from Japan to Baja California; two occur in southern California. *Zostera marina* (eelgrass) is monoecious; rhizome internodes are more elongate with roots and rhizomes buried under sand or mud, seldom on exposed rocks. This *Zostera* species was common and formerly abundant in quiet water on U.S. east and west coasts, as well as along the European Atlantic coast. When shallow-water bays, estuaries, and lagoons are developed as harbors, marinas, or for other aquatic recreational uses, much of the *Zostera* habitat is lost. In San Diego Bay, Mission Bay and in the Flood Control Channel at the mouth of the San Diego River, *Zostera marina* leaves are typically about 5 mm wide. A form with leaves about 1 cm wide, var. *latifolia*, grows in La Jolla Bay on a sandy bottom between 10 and 25 m. Clumps of leaves, conspicuously wide and bright green, are often washed ashore onto La Jolla Shores Beach after storms.

On many rocky San Diego beaches two species of *Phyllospadix* form conspicuous beds in the low intertidal and shallow (to about 10–15 m) subtidal zones. *P. torreyi* has narrow (1–2 mm), compressed, often almost wiry leaves that are frequently more than 1 m long when they grow in tide pools or in lower less-exposed habitats. On surfaces where the plants are more often exposed to air, leaves are shorter and brown-tipped during seasons of daytime extreme low tides. Flowering stems are long, with several (2–5) spadices. *P. scouleri* leaves are thinner and broader (2–4 mm) and seldom more than about 50 cm long. Flowering stems of this species are short and bear single, rarely 2, spadices close to the base of the shoot. The two species occur together on some La Jolla beaches. *P. torreyi* alone dominates between Ocean Beach and Pt. Loma. Male and female flowers on *P. torreyi* can be found during spring months in these sites, and seeds remain through the summer season. In several localities clumps with leaves intermediate in morphology occasionally are found, and when there are no flowers, identification is questionable.

The genus *Ruppia* is not usually treated as a seagrass by either marine ecologists or taxonomists because it predominantly occurs in sites that are not strictly marine. Within the genus, taxonomy of 1–7 species is subject to differences of opinion. Summer collections from the Flood Control Channel (the portion of the San Diego River subject to tidal water intrusion) can be tentatively identified as *Ruppia maritima*, a species worldwide in distribution in shallow brackish to saline habitats, often in river estuaries. The very narrow leaves and stems distinguish the plants from *Zostera*, which also grows in this brackish-water channel.