

soft to touch and slippery, predominantly distichous, alternate; ultimate branches on rapidly growing thalli to 1 mm wide, becoming eroded on older thalli, sometimes appearing paddle-shaped with smooth margins; the obscure midrib and veins that are common in two other species usually are not seen in *F. mollis*.

This description is copied without modification from MAC, as in San Diego County we have found only a single drift specimen on Imperial Beach in May, and the alga is of questionable occurrence in the local marine flora. In central California it is frequent, usually found as isolated thalli on rocks in sandswept areas. It has not been collected south of San Diego as far as we can determine.

Dawson's Checklist lists *F. crassa* (= *F. mollis*) but this may be based on an earlier Cleveland record rather than on his own observations. [Aguilar *et al.* (1984) report finding *F. compressa* about 5 km south of Punta Santo Tomás, south of Ensenada in Baja California.] Lindstrom and Scagel (1987) treat *F. compressa* and *F. crassa* as synonyms of *F. mollis*.

**Leptocladia binghamiae* J. Ag.
363

Thalli uniaxial, with a dome-shaped apical cell that can be seen clearly with a compound microscope; main axes to 4–5 mm wide, to 40 cm high (larger specimens occur north of San Diego County); compressed, deep red, drying to blackish red, repeatedly branched dichotomously or irregularly, and margins of all branches with short teeth; final branchlets often also short and tooth-like.

This alga is infrequently found in very low intertidal sites in San Diego County; in subtidal habitats large thalli are occasionally abundant. Isolated single thalli have been collected to 33 m throughout the year.

Pikea californica Harv.
359

Thalli to 20 cm high, bushy, with several axes arising from single holdfast; branching pinnate but often very irregularly spaced; major branches 1–1.5 mm broad, ultimate branchlets pointed and spinelike; most branches compressed; deep red color, often drying to nearly black.

In some specimens the major axes appear percurrent and uniformly broad and distinct from base to apex; in others the larger major axes and branches are distinctly broader than the secondary or final branches or branchlets.

Leptocladia binghamiae thalli are very similar to and easily confused with

species of *Pikea*. Branching in *Leptocladia binghamiae* is often rather clearly dichotomous without the tendency toward one or two primary axes. Branch margins are somewhat dentate in *Leptocladia* and the thalli tend to be more compressed and often broader.

We have collected confirmed specimens of *P. californica* from a rock outcropping 22–27 m in La Jolla Bay where *Leptocladia* also grows.

Punta Baja, about 360 km south of San Diego, is the southernmost record for this species. Dawson's Checklist reference (from "The Caves," La Jolla, June–September) probably represents *Leptocladia binghamiae*. See *Pikea robusta*, for suggested synonymy.

Pikea robusta Abb.

359

Thallis to 40 cm high, usually only one axis per holdfast; rust red with several major branches 1.5–4 mm wide, percurrent, flattened, arising from single short stipe; pinnate, distichous branching; branches irregular, or somewhat opposite; secondary branches as wide as primary; ultimate branchlets dense, fringing the axes.

The distribution of this subtidal species is stated (MAC) as extending south only to Santa Barbara County. Specimens have been found at Imperial Beach after winter storms and Dawson (1945b) recorded the species (as *P. pinnata*) from the beach at Coronado. Based on these few records, it is likely to be rare in deeper, below-thermocline sites in San Diego, unless the fact that all or most records are drift specimens indicates a northern origin. Lindstrom and Scagel (1987) place *P. robusta* in synonymy with *P. californica*; they suggest that the broader flatter thalli of *P. robusta* represent younger plants, and the less-branched, darker thalli ("*P. californica*") are older, perennating specimens.

Weeksia digitata Abb.

366

We list this species, with no description, only because San Diego is cited (MAC) as the southern end of the range of the species. We have not collected specimens nor located specimens from southern California in herbaria. Thalli are dissected or divided large red blades, resembling other taxa known to be common locally (i.e., *Cryptomenia obovata*). Only careful study can confirm the identification of a *Weeksia* specimen in collections of subtidal algae.

Specimens of another *Weeksia* species have been collected off Pacific Baja California, with a disjunct distribution that brackets San Diego County.

Noncalcified Crustose Genera [in MAC, PEYSSONNELIACEAE, HILDENBRANDIACEAE, HALYMENIACEAE, CRUORACEAE, PETROCELIDACEAE]

These genera are much less common intertidally in San Diego County habitats than they are along beaches in central and northern California, but when rocks are not covered with sand, or in sites exposed to heavy surf, they can be found intertidally and subtidally. The following taxa are those reported in MAC to have Pacific coast ranges that include San Diego County or Orange County although for several taxa we have not been able to document collection records for San Diego. Two species were identified locally by Dawson. We cite none of our own or other unpublished collection information because identification requires comparative microscopic study of several specimens and taxa, and few workers anywhere have the necessary experience. Thalli of *Amplisiphonia pacifica* (RHODOMELACEAE), not allied in the families included in this section, are prostrate blades loosely attached to the substrate and easily recognized. Some of the crustose taxa listed here are now known to represent a stage in the life history of non-crustose species. (Number) refers to page in MAC.

Cruoria profunda Daws. (473)

Cruoriopsis aestuarii Hollenb. (376)

**Dermocorynus occidentalis* Hollenb. (441)

Haematocelis rubens J. Ag., *H. zonalis* Daws. and Neush. (474, 475)

Hildenbrandia dawsonii (Ardré) Hollenb., **H. occidentalis* Setch.,
H. prototypus Nardo. (377-378)

**Petrocelis franciscana* Setch. and Gardn., **P. haematis* Hollenb. (476)

Peyssonnelia profunda Hollenb. and Abb., *P. rubra* var. *orientalis* Web. v.
Bosse (371)

Pulvinia epiphytica Hollenb. (374)

Rhodophysema elegans var. *polystromatica* (Batt.) Dix., *R. minus* Hollenb.
and Abb. (372)

PEYSSONNELIACEAE

Cruoriopsis aestuarii Hollenb. (376). One record from Orange County; possibly part of the life history of *Gloiosiphonia capillaris*, a species not known from San Diego County.

Peyssonnelia profunda Hollenb. and Abb., *P. rubra* var. *orientalis* Web. v. Bosse (371). *P. profunda* thalli are up to 6 cm broad, slightly calcified, subtidal. Abbott (pers. comm.) writes that the species is "not like *P. rubra* var. *orientalis* or *P. meridionalis*." Dawson *et al.* (1960) describe *P. rubra* var. *orientalis* as a small bright red crust-like plant, found to 20 m in kelp beds, and the commonest of several similar species "that can be distinguished only by vertical sections through reproductive parts." Hollenberg and Abbott (1968) cite as *P. meridionalis* (in MAC stated to be a species that probably occurs south to southern California) certain material earlier treated as *P. pacifica*. The reference in Dawson's Checklist to *P. pacifica* therefore suggests a third species may occur in San Diego County "on intertidal rocks and shells."

Pulvinia epiphytica Hollenb. (374). One of the two known collections of this epiphytic species was from Del Mar.

Rhodophysema elegans var. *polystromaticum* (Batt.) Dix., *R. minus* Hollenb. and Abb. (372). Both species recorded from Orange County.

HILDENBRANDIACEAE

Hildenbrandia dawsonii (Ardre) Hollenb., *H. occidentalis* Setch., *H. prototypus* Nardo (377-378). All three species recorded both from the coast of California north of San Diego and from Mexican Pacific islands off Baja California.

Calcified Custose Genera

CORALLINACEAE

These are usually pale lavender-pink, or a pale to bright rose-pink in color, and mostly consist of very thin crusts on rocks, other algae, invertebrates, or any hard stable substrate. After decalcification and microscopic examination, the anatomical arrangement of vegetative cells or the position and form of reproductive structures are compared for taxonomic purposes. Certain taxa can then be associated with field characters, within restricted areas. Even for many of the more common forms there is disagreement among specialists about identification or nomenclature and for this reason we have not attempted to proceed beyond listing the taxa recorded from San Diego sites either in MAC

or Dawson's papers. Numerous taxonomic combinations have been published since Dawson's work and most previous synonyms are listed in MAC. Subsequent studies for several groups have further rearranged species (e.g., Woelkerling *et al.* 1985). The ranges for the following taxa include localities north and south from San Diego. (Number) refers to page in MAC.

Choreonema thuretii (Born.) Schmitz (397)

Fosliella paschalis (Lem.) Setch. and Gardn. (399)

**Heteroderma nicholsii* Setch. and Mason (399). Dawson (1945d), as *Fosliella*, lists this as common at La Jolla on *Dictyota*, *Dictyopteris*, *Eisenia*, and *Cryptopleura* species.

**Hydrolithon decipiens* (Fosl.) Adey (399). Thalli described as macroscopically smooth crusts that in some areas are frequent or common on stones or (mollusc) shells. A small epiphytic coralline crust from San Diego was sent to a specialist in such taxa who identified the specimen as *H. decipiens*. The material represented a common epiphyte in midtidal zones, often seen on erect corallines (*Corallina* or *Lithothrix*). Dawson (1945d) lists the species for San Diego County as *Lithophyllum*. Steneck and Paine (1986) consider the stone- and mollusc-attaching alga to be *L. impressum* in the Washington to Alaska region. These workers transfer specimens from southern California to *Pseudolithophyllum* and describe them as thin, growing on small stones. It is unclear, therefore, how to identify epiphytic coralline crusts that are relatively common in San Diego habitats.

**Lithophyllum grumosum* (Fosl.) Fosl. (393)

**L. imitans* Fosl. (393). Type locality, Pacific Beach. Dawson (1945d) states it is common in San Diego County (presumably intertidal) and lists it from kelp beds (Dawson *et al.* 1960).

L. lichenare Mason (393). Combined as *Pseudolithophyllum muricatum* (Fosl.) Steneck and Paine 1986.

**L. proboscideum* (Fosl.) Fosl. (395)

Lithothamnion (381-387). Eight species, four of which have been recorded in San Diego County.

**L. aculeiferum* Mason (La Jolla)

L. australe (Fosl.) Fosl.

**L. californicum* (Fosl.) (see Steneck and Paine 1986)

**L. crassiusculum* (Fosl.) Mason

**L. giganteum* Mason. Type collection dredged off La Jolla; cited (Dawson *et al.* 1960) as occurring in kelp beds.

L. microsporum (Fosl.) Fosl.

L. pacificum (Fosl.) Fosl. Placed in synonymy with *L. phymatodeum* Fosl., Steneck and Paine 1986.

L. volcanum Daws.

**Melobesia marginata* Setch. and Fosl. (388). Epiphyte on *Laurencia spectabilis* (Dawson 1945d). Similar spots of thin coralline crusts on *Gigartina canaliculata* under *Phyllospadix* leaves resemble *Melobesia mediocris*; if this latter is considered to be obligately confined to angiosperm species, crusts on *Gigartina* may indicate an additional basiphyte for *M. marginata*. MAC lists species of *Gymnogongrus* as well as *Laurencia* as basiphytes.

**Melobesia mediocris* (Fosl.) Setch. and Mason (389). Thalli are epiphytic crusts, thin and irregular in shape to 2 mm diameter, but converging and overlapping on leaves of *Phyllospadix* and *Zostera* (seagrasses). This species has been invariably associated with one of these two genera and customarily is identified on this basis.

Mesophyllum lamellatum (Setch. and Fosl.) Adey (391). As a species of *Lithothamnion*, listed as occurring in (San Diego?) kelp beds (Dawson *et al.* 1960).

**Neogoniolithon setchellii* (Fosl.) Adey (400). As *Hydrolithon*, listed as common near La Jolla (Dawson, 1945d).

Neopolyporolithon reclinatum (Fosl.) Adey and Johans. (392). "Alaska to La Jolla."

Pseudolithophyllum neofarlowii (Setch. and Mason) Adey (397). This is a whitish lavender crust that grows over intertidal rocks, at times very abundantly. It is described as common in northern and central California and reported to be seasonally conspicuous on upper mid-tidal rocks in San Diego. Steneck and Paine (1986) write that "this is the only crustose coralline which survives in the upper reaches of the intertidal zone," but it "also occurs. . .in lower intertidal zones."

**Tenarea ascripticia* (Fosl.) Adey (395). Taxonomy and nomenclature of species included in the current treatment of this taxon are confusing. It has recently been suggested that many *Tenarea* species earlier assigned

to *Dermatolithon* need to be treated as species of *Titanoderma* (Woelkerling *et al.* 1985). As *Fosliella ascripticia* and *F. intermedia*, Dawson recognized specimens on species of *Corallina*, *Gelidium* and other red algae at La Jolla and beaches to the north.

T. canescens (Fosl.) Adey. Dawson **PMR 3** (1960) reported two collections of *Dermatolithon canescens* (Fosl.) Fosl. from southern California; **MAC** noted these, adding that further study is required before the species (as *Tenarea*) can be accepted for the California flora.

T. dispar (Fosl.) Adey (395). Recorded (as *Dermatolithon*) abundantly from *Gelidium* in kelp beds (Dawson *et al.* 1960), forming discs to 1 cm diameter.

Articulated Erect Coralline Taxa

**Amphiroa beauvoisii* Lamour.

Norris and Johansen 1981

A. zonata Yendo, 400

Articulated calcified axes in tufts, dichotomously branched, appearing terete in all axes; 3–6 (10) cm high, segments smooth, uniform dimensions in individual thalli; segments slender, to 1.2 mm diameter and about 10 times (or more) as long; sori in whitish mounded conceptacles on the sides of the branches (as in *Lithothrix*).

A. beauvoisii is a variable species widely distributed in warmer areas of the Atlantic and Indian Oceans, as well as from southern California to Ecuador in the eastern Pacific.

On San Diego beaches the species is seldom abundant or common, but during May–November thalli can be found in pools or on rocky flat beach platforms intertidally and to 7 m or more in shallow subtidal habitats. It is not associated with any other alga or with any single habitat, apparently growing as scattered individual clumps during periods of warmer water. In 1983–84, when water temperatures were warmer than during several prior years, we found *Amphiroa* more commonly than before, confirming the belief that it is a species from semi-tropical waters that occurs in southern California under favorable conditions, but irregularly. Dawson described its distribution in Baja California as usually in warm intertidal areas or in high tide pools subject to heating; lacking from areas of upwelling influence.

Dawson's Checklist refers to three taxa as species of *Amphiroa*. *A. crassa* is a species known from the western Pacific; why the name was associated with

San Diego algae is unclear. (*Jania crassa* occurs in southern California.) *Calliarthron tuberculosa* from San Diego (M. Snyder specimens) was distributed in P.B.-A. as *Amphiroa tuberculosa*, accounting for this latter record. *A. nodulosa* was applied to collections of *Lithothrix aspergillum* distributed as P.B.-A. material.

Bossiella californica (Dec.) Silva spp. *californica*
410

Larger specimens of *B. orbigniana* could be interpreted as *B. californica*, but no southern California sites are recorded for *B. californica* spp. *californica*. *B. pachyclada*, collected from Baja California by Dawson, is now included in *B. californica*.

**Bossiella californica* spp. *schmittii* (Manza) Johans.
411

We have not collected this distinctive dorsi-ventral *Bossiella* form in San Diego. As *Calliarthron schmittii*, the taxon was described in 1937 for plants dredged in 1904 from 9.7 km NW of Pt. Loma Lighthouse.

Bossiella chiloensis (Dec.) Johans.
412

This species is primarily pinnately branched, with intergenicula in upper branches less than 2 mm long. The degree to which axes are branched and the length of lateral branches separate thalli from *B. plumosa*. MAC lists no California collections south of Monterey. Dawson (1958) identified a La Jolla collection as *B. insularis* (= *B. chiloensis*) suggesting that variants of other *Bossiella* species may resemble *B. chiloensis*, or that this latter species does indeed occur in southern California.

**Bossiella orbigniana* (Dec.) Silva
412

Branching mostly dichotomous; flat intergenicula with sharply pointed wings, broader (to 5 mm) than long (less than 2.5 mm); 1–5 conceptacles on each fertile intergeniculum; thalli commonly less than 10 cm high; outer margin of each wing curving convexly down to midrib and not distinguishable from lower margin; wings of successive intergenicula separated by gaps and branches appearing serrate, jagged in outline.

We find these thalli in mostly low intertidal sites, in shallow water along rocks in the channel entrance to Mission Bay, and commonly in kelp beds 10–17 m.

San Diego specimens of spp. *orbigniana* vary in width of the intergenicula (1–2+ mm) and in the degree to which marginal wings are developed. Dawson found it south to Punta Baja, and on offshore Mexican islands. For San Diego County, he listed (1945d) collections as *Bossea orbigniana* and *B. gardneri*. P.C. Silva notes (pers. comm.) that the correct spelling of the epithet should be *orbignyana*.

Bossiella plumosa (Manza) Silva

414

Branching pinnate; intergenicula broader (3 mm) than long (1–1.5 mm), prominently winged, the wings sharp-edged, upper part of wings lacking where branches arise; conceptacles usually 2 (3, 4) on face of fertile intergeniculum; most upper genicula branched, some branches with only 1 intergeniculum.

San Diego specimens occur on rocky beaches, low in the intertidal. The pinnate, frequent branching gives these thalli a dense and markedly different appearance compared with *B. orbigniana*. Lacking separation between successive wings, the axes are more compact in outline than other *Bossiella* species.

Johansen (in MAC) cautions about confusing this species with *Corallina frondescens*, a species (mostly?) from northern California. Branching is similar in both, but fertile *Bossiella* specimens clearly show conceptacles only on the faces of intergenicula.

**Calliarthron cheilosporioides* Manza

414

Branching pinnate or basally dichotomous; to 30 cm high; conceptacles on or near margins of flat intergenicula (occasionally on surface, not strictly marginal); lower intergenicular segments mostly 4–6 mm broad, 2–3 mm above, to 7 mm long; upper margins at 45° angle upward to long axis of branch.

On subtidal rocks, often a dominant understory component of the vegetation beneath and near kelp beds.

Dawson records plants from 18 m at Islas Los Coronados (1953b) and notes that intertidal occurrence in Baja California is limited to northern localities of maximum upwelling intensity. We have not found intertidal thalli in San Diego County.

Calliarthron tuberculosum (Post. and Rupr.) Daws.

416

San Diego County occurrence uncertain. Dawson listed it from Isla Gerónimo, México, and recorded specimens (Dawson *et al.* 1960, as *C. regenerans* Manza) from kelp beds, but it is not clear if this is intended to refer to a San Diego site.

Corallina

Three species are common and, with experience, easily recognized by habitat and morphological features in San Diego County. Each species is variable, thalli are often of similar size, and the distribution on individual beaches overlaps, and therefore single specimens often cannot be confidently identified. It is necessary to examine the range of variation within populations, and to compare thalli in several habitats to learn to distinguish the species. Conceptacles appear terminal on all species of *Corallina* ("axial in origin"). Populations are perennial, with seasonal growth cycles.

Most often, *C. officinalis* grows in the low intertidal region in shallow pools, often within the *Phyllospadix* zone, and into subtidal areas where it is seldom or never exposed to air. *C. pinnatifolia* is one of two common and abundant intertidal species, but also grows in shallow subtidal pools beside *C. officinalis*. The axes of *C. vancouveriensis* are clumped and when small, viewed vertically they appear like tiny rosettes, with the central axis often white-tipped, encircled by branch tips in one or more tight whorls. As the thalli grow, the apices retain this form, but it is less easily recognized when the axes become taller and no longer stand erect. Other species of *Corallina* whose ranges, according to records summarized in MAC, appear to include San Diego, either are undocumented by San Diego County specimens, or were listed on the basis of single or dubious collections.

Corallina frondescens Post. and Rupr.

403

Numerous synonymies are assembled by Johansen in MAC for this species, including *C. pinnatifolia* var. *digitata*. This suggests that some of the forms that we consider to be within the range of variation of *C. pinnatifolia* have been placed with *C. frondescens* by other workers. *C. pinnatifolia* in Mexican localities, as described by Dawson (PMR I, 1953b) includes varieties we find in San Diego. The southern specimens cited by Johansen as *C. frondescens* may instead represent *C. pinnatifolia*, a species that needs further study in this northern part of its range.

**Corallina officinalis* var. *chilensis* (Dec.) Kütz.

405

Fronds whitish, pink, to pale lavender purple, to 15 cm tall, often regularly pinnately branched, with branches progressively shorter near the apex, and in one plane (distichous). Axial intergenicula flat, 1–2 mm long, 1.5 mm broad, not winged; lower portions of main axes often bare of branches with cylindrical intergenicula; coarser and less densely branched compared with *C. vancouveriensis* and *Haliptilon gracilis*. Our collection records conform to the habitats listed in MAC: low intertidal and subtidal rocks to 20 m depth and tidepools in the mid-to upper intertidal zone.

**Corallina pinnatifolia* (Manza) Daws.

405

Fronds to 7 cm high, in compact clumps, axial intergenicula to 1.5 mm long to 2 mm broad, mostly flattened, and lobed or extended in various shapes; pinnate plumose branching, branched on nearly every segment, often with lateral spur developed beneath some or all branchlets.

This is the most abundant anchor species of intertidal algal turf where the morphology is extremely variable. A useful way of separating this species from *C. vancouveriensis* is the appearance of the tips of clusters of young branches; in contrast with the more delicate rosette appearance often seen in *C. vancouveriensis*, *C. pinnatifolia* tips line up in short, approximately parallel series when observed from directly above (Figure 5). This species tends to be whitish, or yellowish to pink; over large areas of the intertidal zone it is exposed to long periods of exposure to sun and dry air. Factors regulating the distribution and relative abundance of *Corallina*-dominated turf above beds of *Phyllospadix torreyi* include both competition and tolerance of exposure to air temperature and desiccation (Stewart 1989a,b).

The species is found at most intertidal rocky shore localities in Baja California on the Pacific coast to Isla Magdalena, but north only to Santa Barbara County in southern California. It is also common and abundant in the Gulf of California.

Dawson included it in the Checklist as *Joculator pinnatifolius*.

Corallina polysticha Daws.

405

Because of the variable branching that can be observed in field studies of intertidal populations of *Corallina pinnatifolia*, we hesitate to identify any San

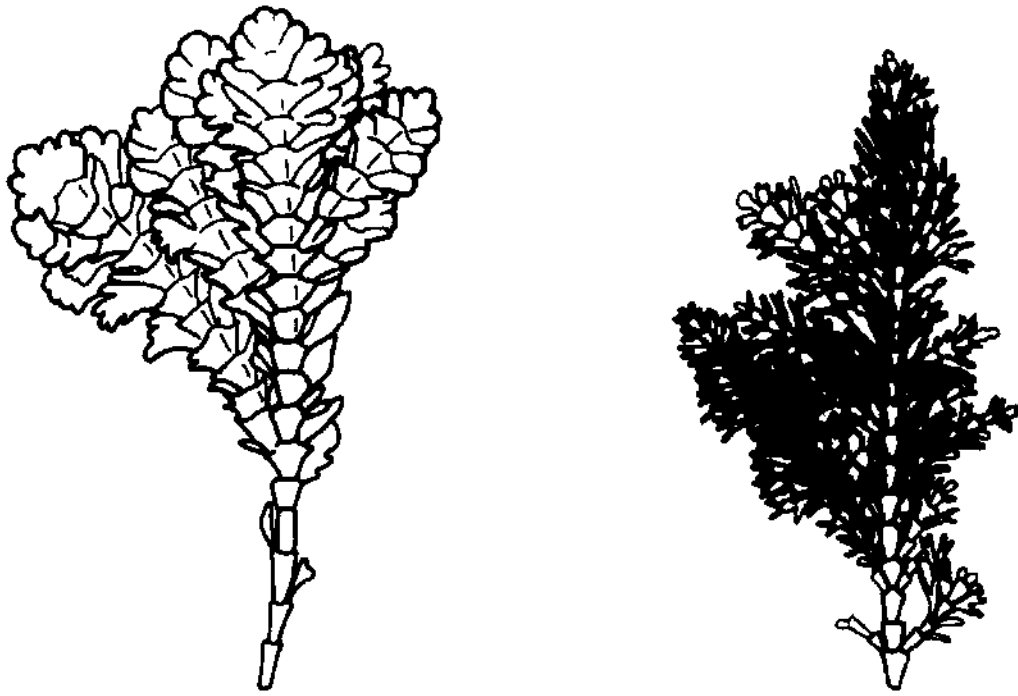


Figure 5. *Corallina pinnatifolia* (left) and *C. vancouveriensis* (right).

Diego County collections as *C. polysticha*. Specimens that correspond to the polystichous branching (more than 2 branchlets from single intergenicula) described for this species can be selected from populations of both *C. pinnatifolia* and *C. vancouveriensis*.

****Corallina vancouveriensis* Yendo**
405

Fronds various in shape and color, to 10 (+) cm high; often densely branched, with lateral branchlets all short and about the same length, frequently more than 2 per segment; some forms with very delicate narrow branches; intergenicula less than 1 mm long, and 1 mm broad.

Several forms are described by Dawson in his treatment of the species in Baja California, and these are similarly found in San Diego County. A distinctive variant with lateral branchlets much more slender than main branches is densely verticillate (2–5 branchlets per segment), with prominent percurrent axes. These thalli, to 14 cm long, and uniformly dark lavender in color, are often congested in limp tufts that hang down on sides of rocks in areas

exposed to relatively heavy surf. Other forms are abundant and dominant in algal mats (turf) that cover large areas of flat intertidal rock platforms. These are more or less densely branched, often less strikingly verticillate except near apices, with longer branchlets that are themselves branched, partly pinnately, with irregular shapes, and mostly less than 7 cm high. The species is uncommon or absent below the intertidal zone. Forms of *Corallina* sp. (*C. officinalis* var. *chilensis*?) that resemble forms of *C. vancouveriensis* can be found to 10 m in kelp beds.

Listed in Dawson's Checklist as *C. gracilis* f. *densa*.

**Haliptilon gracile* (Lamour.) Johans.

416 (as *Haliptylon*)

Thalli with conceptacles at the tips of branches, branching pinnate with intergenicula less than 0.5 mm broad, to 0.8 mm long; branchlets along main axes and branches with terete or subterete intergenicula; to 10 cm high.

Easily identified due to its fine, delicate, narrow branchlets that contrast with the broader thalli of *Corallina* species that grow with it in low intertidal regions where plants are shaded or protected from exposure to air. It often is conspicuous within and near the margins of *Phyllospadix* beds. Most of our records are between late fall and early spring.

Dawson recorded it for San Diego (1945d) as *Corallina gracilis*. Later he found it absent from areas of intense upwelling, confined to the warm spots south to Bahía Tortuga, Baja California. In kelp beds it is uncommon, except in shallow water.

Jania adhaerens Lamour./ *J. tenella* (Kütz.) Grun.

418

Jania species characteristically are strikingly regularly dichotomously branched with terete axes and branches throughout; conceptacles are at the tips of branches. The two taxa considered together here are found in small (1-2 cm high) dense soft clumps, with all axes very delicate, less than 0.2 mm in diameter, in contrast with the coarser axes of *Jania crassa*.

J. adhaerens is described as having the angle between branches mostly more than 45° while in *J. tenella* the angle is narrower, mostly less than 45°. The two species are otherwise similar. In San Diego such thalli are common in tufts or patches during warmer water months throughout the midtidal to lower tidepools, on rocks or growing epiphytically on other algae in turf mats. This

habitat information conforms to the published description of habitats for *J. tenella* in California, yet in a representative sampling of plants collected from several sites and at different times, of 80 measured branching angles, 48 were more than 45°, 20 were less, and 11 were essentially = 45°. In a single clump, angles on one thallus were predominantly (7:1) greater than 45°, while on another from the same clump, the proportion was reversed (1:7) with most angles less than 45°. Generally the thalli appear more like Figure 372 (*J. tenella*) than Figure 370 (*J. adhaerens*) in MAC; although this treatment considers *J. adhaerens* to be "common" and *J. tenella* "uncommon" in San Diego County. Most intergenicula were approximately 100 µm in diameter, with larger to 150 µm, smaller to 50 µm. J. N. Norris has suggested (pers. comm.) that in the Gulf of California the two taxa cannot be separated, but the taxonomic combination has not been formally published. Because both species are widely distributed in other parts of the world, the decision to combine them requires a more comprehensive study than Norris or I have attempted.

Dawson's Checklist reported two species of *Jania* present in San Diego; assuming one of these to be *J. crassa*, it appears likely that he recognized a single taxon for the forms we designate here, although these were not the specific names he mentioned.

Jania crassa Lamour.

418

Thalli dichotomously branched; conceptacles at the tips of branches (as for genus); individual clumps can be to 7 cm high, with intergenicula (150) 200–300 (400) µm diameter, of variable length, but always much longer than broad.

Distribution records for the eastern Pacific suggest that this is a warm-water species. We find it in winter as well as summer on most intertidal beaches, although our records indicate it is most abundant in late summer–fall months. It often is relatively common, and easily recognized by the bright pinkish-lavender color and white tips on regularly spaced dichotomies. Once the species has been compared directly with *Jania adhaerens/tenella*, the size difference is clear, and they cannot be confused. These are the only calcified taxa so distinctly and strictly dichotomously branched with axial conceptacles. Branching in *Amphiroa* resembles this pattern, but conceptacles are usually present and clearly lateral.

Dawson (1953b, as *J. natalensis*) noted that *J. crassa* is confined to the "warmest intertidal localities along the southern California and northwestern Baja California coasts."

**Lithothrix aspergillum* Gray
401

Thallus with a characteristic lavender-pink color; branches and axes mostly terete with branching irregular around the axes; 3–10 cm high, about 1 mm in diameter in most branches and axes; segments usually somewhat shorter than wide. Crustose base attached to thalli of *Corallina* species in algal turf or on rock surfaces; most abundant in the midtidal zone; less often found, but present, in other habitats. Small and large thalli can be found at all times of the year, although individual clumps probably do not persist more than several months (Stewart 1989b). In some respects the thallus size and shape resemble *Corallina vancouveriensis*, but the conceptacles are easily seen on the sides of the axes, appearing as small whitish mounds.

Dawson *et al.* (1960) record it to 13 m in kelp beds.

ENDOCLADIACEAE

**Endocladia muricata* (Post. and Rupr.) J. Ag.
422

Thalli densely bushy, 4–8 cm tall, dark red to nearly black, branches ± 0.5 mm diameter, cylindrical throughout, covered with spines to 0.5 mm long, giving thallus a harsh, rough texture.

Where present, abundant on rocks very high in the intertidal, often above all other algae on seawalls or large rocks, associated with *Pelvetia*.

Locally, there are many beaches where it is not found (i.e., between Sunset Cliffs and Pt. Loma), but on the seaward wall of the Casa Breakwater in La Jolla, or along the vertical wall between residences and the rocky beach south of La Jolla Shores Beach, it is always present, usually abundant and conspicuous, seldom more than 4 cm high. It always is found in small discrete patches, seldom mixed with other algae (except *Pelvetia*).

The rough texture of this alga and the restriction to a particular habitat identifies the species.

Dawson collected specimens south only to Punta Santo Tomás, 30 km south of Ensenada, suggesting (1953b) that on the coast of Baja California it was limited to a few northern sites by increasing desiccation in its high intertidal habitat.

HALYMENIACEAE

**Carpopeltis bushiae* (Farl.) Kyl.

442

Thalli deep red to orange-red, to 10 cm high, with crowded dichotomous branching, giving a dense, bushy appearance to the specimen. Upper axes and branches flattened, 3–4 mm wide, narrower below, with the tips of all branches curled or undulate at the margins, with blunt tips. Reported (MAC) for the coast of southern California and offshore islands south to San Benitos Island, Baja California. Occasional, but easily recognized in very low intertidal to shallow subtidal habitats, to 13 m. Most collections have been in summer and fall months. In some sites, along walls of vertical channels, it is seasonally abundant with *Gelidium nudifrons*, *G. robustum*, *Pterocladia capillacea*, articulated corallines, and sparse *Phyllospadix*. Plants are occasionally heavily encrusted with a sponge (often *Hymeniacidon ungodon*).

Cryptonemia angustata (Setch. and Gardn.) Daws.

437

"Uncommon. . .subtidal. . .La Jolla," noted in MAC. Dawson's (1958) records include a citation of an early report of drift specimens at Mission Beach and a plant collected in a La Jolla kelp bed. When treating Mexican specimens (PMR 2, 1954) he described the blades as very thin, to 14 cm high, relatively narrow (2 cm; MAC states to 6 cm wide), membranous, rose red, simple or dichotomously divided, proliferating from torn edges, on short flattened slender stipes. Compared with the more common *C. obovata*, thinner, narrower, more delicate (Dawson *et al.* 1960).

Cryptonemia borealis Kyl.

438

Abbott identified as this species specimens collected by C. Limbaugh in 1954 and by W. J. North in 1961, from La Jolla Submarine Canyon. This is another of the irregularly divided, proliferous, deep-water red blades that must be sectioned and carefully compared with other species for even a tentative identification.

**Cryptonemia obovata* J. Ag.

438

Thallus a lobed, divided blade, reddish brown in color, often without a stipe, with one or several blades arising from minute disc. San Diego specimens are mostly 10–25 cm tall (largest is 30+ cm), seldom more than 15 cm wide; many

appear to have divided when small into two evenly developed blades, but larger blades are often torn and rebranched secondarily. A thickened rim is often seen, perhaps a consequence of growth in the central part of the blade exceeding marginal expansion. Young, entire blades and large lacerated blades often are part of the same clump, suggesting that these are perennial and that much of the variation (Figure 6) represents combinations of several growth cycles.



Figure 6. *Cryptonemia obovata*. Characteristic blade morphology.

In San Diego County this is a very common red blade, scattered under *Pterygophora* within kelp beds. We have collected it as deep as 50 m in canyons as well as 5–10 m deep off La Jolla beaches. Abbott, writing in **MAC**, notes that this species is comparatively easily identified by color, size, and thickness. Other blades with similar external morphology may represent *Kallymenia pacifica* or species of *Halymenia* and *Cryptonemia*. All of these, except for *C. obovata*, are rare in San Diego County collections. *C. obovata* is the only one of these externally similar species listed by Dawson in the Checklist.

Cryptonemia ovalifolia Kyl.

438

Blades are oval, simple, and rarely divided or lobed in any way; small, to 8 cm, some specimens with a bluish sheen to the otherwise clear pink color.

This species is described as occurring in often dense clusters in shaded overhanging habitats (presumably intertidal) in California north of Monterey County. We have found blades that we provisionally refer to the species in several very low intertidal and subtidal sites.

Dermocorynus occidentalis Hollenb.

441

This is a non-calcified crust (see preceding discussion of such crusts), 1–3 cm in diameter, with erect cylindrical to flattened branches to 2 mm tall on which reproductive structures develop. The type collection was from Laguna Beach, Orange County. A specimen from Punta Banda (Ensenada, Baja California) was later given to Hollenberg for study. No further records are known. If fertile specimens are found, they should be easily recognized. We list it here because the two known collection sites are approximately the same distance north and south of San Diego.

Grateloupia prolongata J. Ag., **G. doryphora* (Mont.) Howe

432, 435

The geographic ranges of two species of *Grateloupia* include sites north and south of San Diego County. Thalli of both taxa are bladelike, narrow, and longer than wide. *G. prolongata* is described as mostly 8–20 cm high, with slender proliferations scattered from all parts of the thallus, growing in low intertidal tidepools. *G. doryphora* specimens are to 2 m tall, with short spine-like proliferations on margins of blades, extremely variable in morphology and habitat.

Dawson's Checklist recognized 3 species (*G. californica*, *G. maxima*, *G. abbreviata*) that later were combined with *G. doryphora*. One, *G. abbreviata*, had been typified by a specimen from La Jolla. *G. doryphora* (widely distributed between Puget Sound and Peru) is distinguished from *G. prolongata* by having distichous rather than radially arranged proliferations. Dawson wrote about *G. doryphora* (as *G. schizophylla*, Dawson 1954) that this highly variable species was rare off the northern coast of Baja California, the southern part of its range, and there confined to regions of upwelling, suggesting it is a species more likely to occur in cool-water localities than in most parts of southern California. We have not found any intertidal *Grateloupia* specimens in San Diego County; several collections from subtidal sites resemble material from Punta Banda that Dawson referred to as *G. abbreviata*. We believe that the taxon now known as *G. doryphora*, if presently occurring in San Diego, will be rarely found and only in deeper colder water.

Dawson's Checklist recorded *G. prolongata* from tidepools of La Jolla (see *Prionitis lanceolata*), and later (PMR I, 1953b) listed it from Pacific and Gulf coasts of Baja California. His extensive collections indicated that the species was most abundant and common in subtidal waters in the Gulf of California.

Other species of *Grateloupia* are known from subtropical and tropical Mexican localities. The absence or rarity of San Diego County specimens suggests that local habitats are not favorable either to the warm-water species or to the cold-water northern taxa. We consider most of the high tidepool thalli that superficially resemble *Grateloupia prolongata* probably to be either *Prionitis lanceolata* or *Rhodoglossum affine*; further study is needed to resolve this question. Species of "*Grateloupia*" have been listed on survey reports for beaches throughout southern California in recent years, but we question this identification for local plants.

Halymenia californica Smith and Hollenb.

425

We have no records of recently collected, confirmed San Diego specimens, although the species may be represented in collections of large red blades that are not easily identified. MAC states it is a common subtidal species along the entire Pacific coast south of British Columbia and into the Gulf of California.

Halymenia gardneri (Kylin) Parkinson

(see Lindstrom 1986)

Halymenia coccinea (Harv.) Abb., 425

Thalli of large, single, usually undivided blades with ruffled margins, 15–40 cm wide and 30–45 (110) cm long, bright cherry red when fresh, with soft slippery texture, drying to a brownish red; subtidal.

We have identified as *H. coccinea* one collection of several blades to 20 cm high and 15 cm wide, from 37 m in the north branch of Scripps Submarine Canyon, December.

The distinctive texture of the blades is said to be diagnostic, but without considerable experience with freshly collected specimens of similar species that occur in the same habitats, the feature probably is of little assistance. Microscopic comparison of internal cell arrangements is necessary for identification.

Halymenia hollenbergii Abb.

429

Thalli of often large, entire to lobed blades, pink to rose-brown in color, longer than broad, with margins ruffled or lacerated in various ways; to 60–70 cm high, 16–18 cm broad.

Species of *Halymenia* characteristically have thin, smooth-feeling blades that must be sectioned and studied with the aid of a compound microscope for identification.

The type specimens were collected by divers 11–13 m off Imperial Beach. We have found similar thalli washed ashore on Imperial Beach after winter storms, and additional similar specimens have been collected subtidally nearby, although identification of many of these collections is tentative.

“*Lobocolax*”

see Smith 1944, p. 248, *L. deformans* Howe

For many years this name was applied to a small growth that was observed on species of *Prionitis* and thought to represent another of the parasitic-epiphytic red algae that are restricted to closely related host species. Dawson found these “peculiar” structures along northern Pacific Baja California and suggested (1953b) that they were not an independent organism, but a “malformation resulting from a . . . bacterial (?) infection.” McBride *et al.* (1974) showed that *L. deformans* was indeed a gall, or outgrowth of cells from the host plant that contained intercellular rod-shaped bacteria, and for this reason it was omitted from MAC. These anomalous structures have been noted locally on *Prionitis australia/linearis/corneum* from Imperial Beach.

Prionitis angusta (Harv.) Okam.

444.

In one of our collections from a La Jolla low intertidal site, a plant with narrow, flat, mostly dichotomous branching has been identified tentatively by Abbott as *P. angusta*.

Prionitis australis (J. Ag.) J. Ag./ *P. cornea* (Okam.) Daws./ **P.*

linearis Kyl.

445, 448

Thalli of these three species consist of flattened axes and branches, mostly more than 2.5 cm broad, regularly dichotomous branching in one plane, sparse or dense with the distance between successive branches and the angle between the forks of a dichotomy variable. As is true for species of *Prionitis*, all major branches are approximately the same breadth throughout any single thallus, but thalli from the same collection can vary in this dimension. The lateral margins of many branches develop short peg-like or nearly leafy proliferations in various numbers and arrangements; surfaces of all branches and axes are otherwise smooth; height is similar for the three taxa we are treating together here.

Illustrations in MAC (Figures 394, 395, 398) show rather distinctive thalli, but San Diego County specimens from low intertidal and shallow to 20 m subtidal rocky sites completely intergrade in every feature, and we cannot separate our material into one or another of these species. In order to evaluate these local collections, we examined large collections in the Herbarium at Allan Hancock Foundation, now LAM, (including Dawson material), and found similar overlap and variability in other southern California thalli. At present, we refer to local specimens as representing a complex that includes the three species as treated in MAC, pending a formal taxonomic resolution of the problem.

Dawson applied *P. cornea* to subtidal kelp-bed specimens (Dawson *et al.* 1960) and listed *P. linearis* (as *Zanardinula*) from low intertidal habitats in his Checklist. The type specimen of this latter taxon was collected in La Jolla.

Prionitis lanceolata (Harv.) Harv.

447

Stipes several to numerous, or single, arising from discoid holdfasts, thalli mostly less than 15 cm high (larger specimens elsewhere), branches mostly less than 5 mm, occasionally to 10 mm wide; 2–3 times irregularly dichotomously divided, the ultimate dichotomy usually forked near the tip of the branch; proliferations along the edges of the compressed branches pinnately arranged, often longer near the base or in middle portions; plants reddish to yellowish green, or pinkish tan.

This summary description, modified from MAC, is based on intertidal plants in our collections and differs in several respects from the information compared there for high and low intertidal forms. San Diego thalli are smaller, with mostly broader axes that taper to narrow, often long, unbranched tips. Dawson mentions irregular primary branching as a distinctive character (PMR 2, 1954). Abbott's comments point to the extensive variability found in central California habitats. The species is not common in San Diego, and specimens have been confused with *Grateloupia prolongata*, a less flattened alga where proliferous branches are not strictly pinnate. *Prionitis lanceolata* often grows in tidepools with *Rhodoglossum affine* and *Gigartina leptorhynchos*, which are greenish yellow or tan in this habitat. For each genus, the cross section is distinctive. In the low intertidal zone beneath *Phyllospadix*, thalli are deep red or purple.

Dawson *et al.* (1960) mention specimens to 0.7 m high, 13 m deep in kelp beds.

Dawson implies (1945d) that *P. lyallii* (as *Zanardinula andersoniana*) may be

found in San Diego, but no collections are cited. **MAC** refers to the variability of this species, which can include forms very similar to some specimens attributed to *P. lanceolata*.

KALLYMENIACEAE

**Callocolax fungiformis* Kyl.

469

This is one of the “parasitic” red algae that is apparently restricted to one or a few species of related larger red algae, in this case species of *Callophyllis*. Our recognition of *Callocolax* from San Diego County is based on thalli found on *C. flabellulata*, the most common host, that was attached to *Bossiella* in the Pt. Loma kelp beds.

Dawson’s Checklist records one collection on *Callophyllis* sp., dredged off Pt. Loma. His specimen was described as *Callocolax globulosis*, later combined with *C. fungiformis*. Aguilar and Pacheco (1985) recently found specimens in Bahía del Rosario, extending the range into Baja California.

Callophyllis firma (Kyl.) R. Norris

460

The single specimen we attribute to this species is very small, peltate, deep rose in color, with a crisp texture, bluish sheen, and slippery feel; medullary cells are visible in surface view, as described for the species (**MAC**). On this basis we recognize the taxon for San Diego County, where it is well within the subtidal range (**MAC**: British Columbia to Baja California) given for the species on the Pacific coast.

Very small peltate subtidal thalli most frequently represent germlings or juvenile thalli of *Callophyllis flabellulata* or species of Rhodymeniaceae (see note for *Kallymenia pacifica*, below).

**Callophyllis flabellulata* Harv.

461

Thalli to 15 cm high, with various branching patterns as illustrated in **MAC**, p. 462. In cross section, the small cells interspersed between large medullary cells are diagnostic. San Diego County records of *Callophyllis* include many small subtidal plants 1–2 cm high that are epiphytes on larger algae. This form is common and can also be collected from non-algal substrates. Thalli 10–15 cm high, less frequently found, occur on rocks.

Dawson’s Checklist listed the species as *C. marginifructa*.

Callophyllis thompsonii Setch.

464

As are most species of *Callophyllis*, these thalli are much and variously divided blades, arising from discoid holdfasts, without midribs or veins, with margins of variable appearances. The medulla is formed of large uncolored cells, as seen in a cross section under a compound microscope. Cystocarps form within the blade and often are numerous, giving a speckled appearance to the thallus. *C. thompsonii* is distinguished by having main branches mostly less than 2 cm broad, with broadly rounded, unnotched tips.

Of the several specimens in our collections that resemble this species, one, found among drift algae on Imperial Beach, was confirmed by I. A. Abbott.

**Callophyllis violacea* J. Ag.

464

San Diego thalli are mostly less than 12 cm high, dark red to purplish black, one to several branch-blades from a small discoid holdfast, with a distinctive smooth firm texture; intertidal plants grow in tufts, and we find all the forms shown in Figure 412, MAC.

Specimens have been found at all times of the year, mostly in the low intertidal, infrequently in shallow subtidal habitats (Dawson *et al.* 1960, list a collection from 25 m in kelp beds). Thalli are scattered under other larger thalli on rocks; the dark color is a consistent field characteristic. Dawson's Checklist also notes the presence of *C. dissecta*, a synonym of *C. violaceae*.

Kallymenia pacifica Kyl.

454

Species of *Kallymenia* are large, thin blades, sometimes divided but seldom branched, distinguished from other foliose taxa (*Callophyllis*, *Cryptonemia*, *Halymenia*) by examining cross sections with the aid of a compound microscope. Thalli are more firm, relatively thicker and often slippery, almost "waxy" when dry; but these features are helpful only after one has had considerable experience with the several taxa, all rare and subtidal in San Diego County. Of the several collections that we tentatively identified as *Kallymenia pacifica*, Abbott confirmed two from kelp beds along the Loma Sea Cliff. These specimens were to 25 cm long.

Type material for this species was collected in the 1890's from "San Diego" (as *Meredithia californica*); Abbott (1968) stated that many peltate specimens attributed to this species represent *Callophyllis firma*.

CHOREOCOLACACEAE

Gelidiocolax microsphaerica Gardn.

342

Thallus a smooth, more or less hemispherical mound, 0.18–0.23 mm diameter, found epiphytically on species of *Gelidium* from subtidal (*G. robustum*, *G. purpurascens*, *G. nudifrons*) or intertidal (*G. coulteri*) collections.

Collections of both reproductive phases have been recognized on San Diego *Gelidium* thalli, but detecting these minute epiphytes (or hemiparasites?) generally requires a microscope.

A study of parasitic species found on Gelidiaceae (Fan and Papenfuss 1959) stated. . . “it appears more likely that *Gelidiocolax* belongs in the Choreocolaceae.” This tentative assignment, not adopted in MAC, was recently supported by finding another species of the genus on a member of the Rhodomelaceae (Norris 1988).

Leachiella pacifica Kugrens

Kugrens 1982

Choreocolax polysiphoniae Reinsch, 470

Thalli on species of *Polysiphonia*, *Pterosiphonia*, or *Pterochondria*, forming small, pale-brownish, globose cushions 0.6–4 mm diameter.

In California the species has been recorded from Laguna Beach (Orange County). Dawson found cystocarpic thalli among collections of *Polysiphonia collinsii* (= *P. hendryi*) from Cabo Colnett in northern Baja California in March. Between these two localities, including the coast of San Diego County, specimens have not been found.

CRUORACEAE

Cruoria profunda Daws.

473

A non-calcified crustose species (see prior discussion); the type specimen was dredged at Cortez Bank, southwest of San Diego, where the algal vegetation is similar to that in subtidal sites near the mainland coast here. “Probably the tetrasporic life history stage of *Opuntia californica*” (Scagel *et al.* 1986). No other California records are known.

Haematocelis rubens J. Ag., *H. zonalis* Daws. and Neush.

474, 475

Both these non-calcified crustose species (see prior discussion) are recorded from "Southern California." San Diego specimens were recorded by Dawson (*H. rubens*) at the Caves, La Jolla, in January (PMR I, 1953b).

Petrocelis: See *Mastocarpus* (Petrocelidaceae)

NEMASTOMATACEAE

Schizymenia dawsonii Abb.

478

Thallus a blade, without veins, to 30 cm high, 25 cm broad, 250–300 μm thick, bluish rose, entire or deeply cleft 2 or 3 times, with mostly smooth margins; stipes 2–3 mm long; gland cells inconspicuous (compared with other species of the genus).

Punta Santo Tomás, south of Ensenada in Baja California, was the locality for the type collection of this species. Two collections from San Diego sites were treated in the original discussion of the species, one each from Bird Rock and Imperial Beach, subtidal or drift. We have found attached specimens that are very distinct and easily recognizable at 37 m in the north branch of the Scripps Submarine Canyon in winter months.

The species was described soon after the death of E. Y. Dawson in 1966 and named to commemorate his contribution to the study of marine algae of California and Mexico. This seems an appropriate place to insert a quotation from the introduction to MAC, initially planned with his participation: "with his untimely death. . . modern phycology was deprived of its most energetic and one of its most brilliant and productive taxonomists. . . Many more Pacific coast species would have borne his name but for the fact that it was he who had first discovered and described them." We are pleased to be able to report new records of *S. dawsonii*. Our material conforms to earlier descriptions; margins appear torn (grazed?), with a few very small adventitious proliferous blades.

Schizymenia epiphytica (Setch. and Laws.) Smith and Hollenb.

478

Thalli consist of entire, coarse, wrinkled blades without veins, somewhat broader in the lower portion, with crisped, rimlike marginal thickening in older plants; to 40 cm high, 150–300 μm thick; usually without stipe, developing directly from small fleshy holdfast; gland cells numerous, to 125 μm diam; blades bluish red when wet and fresh, darker when dry.

The surface texture of specimens from central California is quite distinctive

and we know of no collections from San Diego County that resemble these northern plants in this respect. During a period of winter storms, a specimen tentatively identified as *S. epiphytica* was found on the beach at Imperial Beach, a site where other “northern” species have been found in drift.

**Schizymenia pacifica* (Kyl.) Kyl.

481

Thalli consist of blades, often several in clumps, without veins, brownish red, slippery, with a characteristic rough surface; blades oval, wider or more narrow above a wide base, often deeply split or divided; without any apparent stipe in most cases, growing from small fleshy holdfast; 25–30 (70) cm high, 15–30 cm wide, 200–500 μm thick; gland cells small (compared with *S. epiphytica*) but often prominent in fresh material.

MAC states that this species is common on rocks in exposed locations in lower intertidal to subtidal habitats along the entire Pacific coast of North America. In contrast with the many species that are found in low intertidal habitats north of central California but only subtidally in southern California, we have collected this species in low intertidal and shallow-water habitats. The gland cells are often difficult to recognize. This is the only species of *Schizymenia* recorded by Dawson along the northern coast of Baja California. Aguilar *et al.* (1984) recently found it at several sites in Baja California throughout the year.

SOLIERIACEAE

Gardneriella tuberifera Kyl.

485

Whitish, or pink, hemispherical “parasite” (gall?) 2–6 mm diameter, on *Sarcodiotheca gaudichaudii*.

Reported from colder water localities both to the north and south but not from San Diego.

**Opuntiella californica* (Farl.) Kyl.

485

Thallus with single undivided primary blade arising from small base; secondary blades growing from the margin of primary blade, occasionally with additional branching; secondary blades 2–3 mm thick, commonly larger than primary blade; blades fan-shaped, broadest above the middle, dark red; thallus to 20 cm high, 30 cm broad; stipes 4–8 mm long.

The typical forms described above and illustrated (Figure 430) in MAC are rarely found in San Diego County. Several thalli from subtidal rocks that externally resemble less typical specimens of *O. californica* lack the large

distinctive gland cells that characterize this species. (These thalli alternatively may be identified as a smooth form of *Gigartina exasperata*.) Dawson's Checklist reports specimens from extreme lower intertidal habitats.

In 1984–85, M. Tegner found numerous thalli growing on the inner, shallow edge (8–10 m) of the Point Loma kelp bed in an area where the species had not previously been seen.

[*Reticulobotrys catalinae* Daws.

487

Nowhere in the submarine canyons or elsewhere subtidally off the coast of San Diego County, have we observed this easily recognized alga. Dawson and Neushul (1966) noted that a deep (32 m) collection resembling *Reticulobotrys* later "proved to be a deep-water *Botryocladia*." They do not specify the specimen, but we suggest it may well have been the La Jolla Canyon specimen referred to by MAC. If this is so, it invalidates the only record we know of for San Diego. We have collected the species from offshore Channel Islands where it is indeed conspicuous among other algae.]

Sarcodiotheca furcata (Setch. and Gardn.) Kyl.

488

San Diego thalli to 25 cm high, dull red, flat, dichotomously to irregularly branched in one plane, narrow below, arising from slender cylindrical stipes 1–2 cm long, with a very small discoid holdfast attached to shells or small rocks; primary blades to 3 cm broad, to 1 mm thick, margins entire or conspicuously proliferous; terminal divisions of blades sharply forked, but older eroded or damaged tips do not show this characteristic appearance; cystocarps distributed over blades, protuberant, present in most collections. Lateral branches are often large, with the proliferations developed into secondary blades from margins near the bases of the original primary blade. On other thalli the proliferations are regularly spaced and small, superficially appearing as *Prionitis* thalli.

We have found this species only near the edge of the head of La Jolla Canyon, where it is one of several large algae that form a unique assemblage of taxa. This particular site, visited regularly since the first SCUBA surveys of La Jolla Bay, is referred to locally as *Sarcodiotheca* Point. The population persisted, apparently unchanged in extent since first observed in 1958, until a storm in January 1988 left the area bare of vegetation. The area is between 18 and 23 m with sand, small cobbles, and scattered shells overlying the shale bedrock. *Stenogramma* and large *Sarcodiotheca* (*Neoagardhiella*) *gaudichaudii* thalli were usually associated with *S. furcata*, and seasonally *Desmarestia* was abundant.

Not recorded from the Pacific coast of Baja California. Distribution is apparently discontinuous between British Columbia and Costa Rica.

**Sarcodiotheca gaudichaudii* (Mont.) Gabrielson
Gabrielson 1982

Neogardhiella baileyi (Kütz.) Wynne and Tayl., 483.

Thalli of clumps of cylindrical axes branched near the base, as well as in various irregular patterns along upper parts of the axes, to 4 mm in diameter; the dimensions of the axes vary in diameter and height; characteristically the tips are acute and often there is a noticeable constriction or narrow portion at the base of branches where they join the main axis; dark red in color, or purple, or nearly black. Individual thalli are occasionally found from low intertidal rocks to deep in the submarine canyons off La Jolla. Specimens vary so much as to appear completely dissimilar when extremes are compared. The identification can be confirmed by examining a cross section. A compound microscope shows a core of small filaments intertwined in the center, surrounded by large cells that grade into an outer layer of small pigmented cortical cells. No other local alga, with similar external form, shows this internal anatomy.

Small specimens, mostly less than 10 cm high, are associated with *Phyllospadix* beds. These often do not appear as strikingly cylindrical as do the subtidal larger thalli that can reach 50+ cm high and are comparatively sparsely branched. In La Jolla Bay they grow on shells and small rocks on a sandy bottom and have been confused with cylindrical *Gracilaria* species. These subtidal specimens are often basiphytes for *Ceramium californica* and species of *Polysiphonia* and *Antithamnion*.

This California species has been the subject of numerous taxonomic and nomenclatural studies. Earlier nomenclature included *Agardhiella tenera*, used by Dawson in several lists, and *A. coulteri* (in Smith 1944; Dawson 1945d). Abbott (1978) showed that *N. baileyi*, the name cited in MAC, was incorrectly applied to eastern Pacific plants which she combined with *N. gaudichaudii*. Silva (1979) proposed the retention of *Agardhiella* for the genus. Gabrielson (1982) transferred the species to *Sarcodiotheca* on the basis of reproductive structures and development. Vegetatively, however, the two *Sarcodiotheca* species in California are very different.

HYPNEACEAE

Hypnea johnstonii Setch. and Gardn.

489

This species, although recorded from "Orange County to Mexico" in warm-water localities, has not been found in San Diego County. It is described as forming coarse thick mats in intertidal habitats.

H. valentiae var. *gardneri* Hollenb.

490

Thalli virtually the same as those of var. *valentiae* (MAC notes smaller diameter) but showing strikingly different clusters of tetrasporangia that resemble "parasitic" red algal species. Indeed, the reproductive branchlets on older collections had been referred to *Hypneocolax stellaris* and thought to be a separate species of alga growing on *Hypnea*. Subsequent investigation convinced Hollenberg (1972) that California specimens were actually *Hypnea* branches with distinctive clumps of tetrasporangial stichidia. Such thalli in California are presently treated as a variety of *H. valentiae*. We have collected specimens from low intertidal habitats on La Jolla beaches October–December.

**Hypnea valentiae* (Turn.) Mont. var. *valentiae*

490

Thalli radially branched, typically cylindrical, with numerous short spiny branches; a single distinct apical cell is seen with a compound microscope, and this feature often proves useful to recognize this and other *Hypnea* species; zonate tetrasporangia occur on short terminal branchlets termed stichidia; the species is highly variable in morphology and color; branches tend to be twisted or entangled with one another or with other algae, larger in diameter toward the base, and distinctly tapering above.

Hypnea valentiae var. *valentiae* is found at all seasons of the year, in large and small clumps, but becomes very abundant in most midtidal or lower sites between June and October. It is characteristically yellowish tan to greenish in color when lying on top of algal turf or rocks exposed to bright light. Under other algae or *Phyllospadix* the color is darker, less yellow. Axes may creep among other thalli; because there is no clear branching pattern by which to distinguish the species in the field, it is useful to gather several plants for comparison and identification. Tetrasporangial stichidia are not common, but conspicuous when present.

Dawson's observations led him to believe that this is a warm-water species, occurring only in areas in Baja California where cold-water upwelling is reduced or absent. For San Diego, he recorded the species (1945d) as *H. californica* and *H. adunca*.

Hypnea variabilis Okam.

490

Axes and main branches slightly to strongly compressed, in contrast to other California species of the genus; thalli are large and bushy, to 10 cm high, 1.2–2 mm wide, 0.7–1 mm thick, with branching becoming cylindrical in ultimate

short (1.3 mm) branchlets. Apparently distributed from La Jolla south to Baja California, and in southern Japan (type locality). *Hypnea* species vary greatly in size and branching, and grow in a wide variety of habitats intertidally in southern California. Dawson (PMR 4, 1961) recognized as *H. variabilis* compressed forms in several localities north of Ensenada, Baja California. Earlier (1946) he recorded a few "imperfect specimens. . . (that could not be identified with any certainty) found in beach drift at La Jolla." This remains the only published record of this flattened species for San Diego County. I occasionally collect plants that can be tentatively referred to this species.

PLOCAMIACEAE

**Plocamiocolax pulvinata* Setch.

494

Thalli forming small, cushion-like mounds on *Plocamium cartilagineum*, perhaps living parasitically; to 5 mm diameter, white to light tan; the mounds consist of branched, radiating branches to 2.5 mm long, variously branched.

We have observed what appears to be this algal "parasite" on *Plocamium cartilagineum* from low intertidal collections (elsewhere it has also been found subtidally).

Dawson's mention (1945b) of this species on *Nienburgia andersonii*, in La Jolla, November, probably represents a finding of *Asterocolax gardneri*.

**Plocamium cartilagineum* (L.) Dix.

492

Thalli with erect axes growing from prostrate branches; erect axes and branches compressed to flattened; branching sympodial, alternately distichous, pectinate, with each of the pectinate branches bearing three to four branchlets; thalli to 25 cm high (subtidal specimens are often larger than intertidal), bright pink to deeper red; branches straight or curved out, or slightly inward; in each of the groups of pectinate branchlets the first, lowermost, is unbranched, while the others are successively pectinate.

Along the entire Pacific coast of North America this species is very common intertidally and subtidally to 40 m. The bright color and feathery branching pattern make it distinctive, and it is widely used in decorative crafts. Very finely branched, delicate-appearing forms grow in tide pools, where water temperature rises during summer months; this form is particularly conspicuous on the rocky beaches in the southern end of La Jolla Bay, and between La Jolla Cove and Pacific Beach. Germlings several mm high are often found

epiphytically on large brown and red seaweeds, although larger plants seldom occur as epiphytes.

**Plocamium violaceum* Farl.

494

Thalli mostly 4–5 cm high, reddish violet, often very dark, in densely branched small clumps; main axes 1–1.5 mm diameter, branches only slightly compressed; the alternately distichous pattern of *P. cartilagineum* is found in this species also, but here the unbranched lowermost branchlet of each group is distinctly longer (2–6 mm) than successive branchlets of the same group, and curved strongly toward the parent axis or branch.

This species is much less frequently found in San Diego County than to the north. In low intertidal habitats one or several clumps within a small area can be found September–June; the species is occasionally more abundant and reproductive December–March. In our experience it is restricted to low intertidal habitats and shallow subtidal zones. Where it occurs it is usually not abundant, suggesting that conditions in this southern part of the state are generally unfavorable for growth or maintenance of populations. Dawson recorded only tetrasporangia in Mexican collections.

GRACILARIACEAE

**Gracilaria lemaneiformis* (Bory) Weber-van Bosse

Abbott 1983

G. sjoestedtii Kyl., 498

Thalli cylindrical, often more than 30 cm high, branching variable, often but not necessarily on rocks partially buried in sand in mid- to low intertidal and subtidal habitats along the entire coast of Pacific North America.

Large beds of the species occur in the southern end of San Diego Bay and in Mission Bay on mud flats in shallow water. The thalli collected on cobbles or shells, subtidally on sandy beaches off Imperial Beach or in La Jolla Bay, probably represent *G. pacifica*, see ff.

Dawson's Checklist refers to plants in San Diego Bay as mostly *G. confervoides* (*G. verrucosa* in MAC; *G. pacifica* ff.) and to those on the open coast as *G. sjoestedtii*.

The genus *Gracilariopsis* was described (Dawson 1949b) to accommodate those cylindrical species of *Gracilaria* that lacked nutritive filaments in the cystocarps. The new genus was based on *G. sjoestedtii*; *G. robusta* and *G. andersonii* were also transferred to *Gracilariopsis* by Dawson. These three

taxa were retained in *Gracilaria* in MAC. Fredericq and Hommersand (1989) have compared reproductive processes in species of *Gracilaria* and believe it is necessary to resurrect the genus *Gracilariopsis*. Nomenclature of California species will need revision accordingly.

**Gracilaria pacifica* Abb.

Abbott 1985

G. verrucosa (Huds.) Papenf., 500

Thallus sparingly irregularly branched or unbranched, from percurrent axes 1–2.5 mm thick in sheltered bays, 1.5–3.5 mm thick in open coastal situations. Similar to *G. lemaneiformis* but commonly more robust.

We find tall specimens, to 1 meter and more, on sandy bottoms at 17 m near the submarine canyon heads where thalli are occasionally very abundant.

**Gracilaria papenfussii* Abb.

Abbott 1983.

G. andersonii (Grun.) Kyl., 495

Thalli mostly cylindrical throughout and less than 15 cm high; distinctly stiff and almost wiry; branching irregular in density and in length; color usually very dark red to black; apices often eroded and straw-colored near the tips.

Frequent on rocks that are embedded in sand on intertidal beaches. In San Diego this alga is restricted to a few beaches (or at least is easily found only in these several locations), where it is further limited to those months when the sand is moved away from the sides of rocks. Apparently, populations are maintained from year to year by basal parts that persist under sand and then produce erect thalli after the sand is moved away by heavy surf (in most years, late fall through spring). The appearance of the thalli varies, perhaps in part because of erosion by sand movement. Large patches, including fertile specimens, are found January–May. Several taxa of *Gracilaria* are known to produce dense coatings of colorless hairs (when nutrients become depleted?), and *G. papenfussii* has been found in June in this condition.

I can confirm no recent verified collections of other species of *Gracilaria*. *G. textori* var. *cunninghamii* and *G. turgida* occur both north and south of San Diego County. Dawson *et al.* (1960) refer to *G. cunninghamii* from kelp beds, and earlier (Dawson, 1945b) a La Jolla specimen was listed under this name [*G. (Tylotus) cunninghamii*]. Specimens of San Diego *Callophyllis violacea* could be misidentified as *G. textori* var. *cunninghamii*, and for this reason we

suggest that perhaps the occasional thalli that have been referred to this latter species should be re-evaluated. MAC's record for *G. veleroe* from La Jolla probably refers to specimens identified (Dawson 1946) on the basis of resembling the Gulf of California species. These were not discussed in his study of Northeast Pacific Gracillariaceae (1949b), nor were any Pacific Baja California or California localities cited in a later treatment of the family (1961), suggesting that his initial identification had not been supported by subsequent experience.

**Gracilariophila gardneri* Setch.

500; probably *G. oryzoides* Setch. and Wils., 502

A specimen attributed to this epiphytic/parasitic species was collected on *G. papenfussii* (as *Gracilaria andersonii*) at La Jolla in December (Dawson 1945b); no other records for San Diego County are known to us.

PHYLLOPHORACEAE

**Ahnfeltia gigartinoides* J. Ag.

503

Thalli of numerous, more-or-less cylindrical branches, repeatedly, often densely (10–15 times) dichotomously branched, rigid to wiry; deep red to nearly black, 10–30 cm high; branches 0.5–1.5 mm diameter, often short, tapering.

Rarely found throughout a wide north-south range that includes southern California. We have not collected the species nor does Dawson in **PMR 4** (1961) cite southern California or northwest Baja California specimens. Dawson's Checklist comment that the species is occasional in the San Diego region perhaps was based on a misidentification.

Ahnfeltia plicata (Huds.) Fries

503

Very similar to *A. gigartinoides*, but more wiry; smaller, to 14 cm high, and 0.25–0.5 mm in diameter, also stiff.

This species also has a wide north-south range that includes localities in Baja California (Bahía Colnett, Bahía San Quintín, to Bahía Vizcaino), but no San Diego records are known to us.

Maggs *et al.* (1989) attribute specimens previously referred to *A. plicata*, from central California and Baja California, to *A. fastigiata*. Numerous anatomical and reproductive differences between the two species are described; in particular, branching in *A. fastigiata* is more regularly dichotomous, and axis width is usually less than 0.5 mm compared with up to 1 mm in *A. plicata*. Another

study (Maggs and Pueschel 1989) of female and postfertilization reproductive development in *A. plicata* resulted in a proposal to establish a separate family and order based on this species.

**Gymnogongrus chiton* (Howe) Silva and DeCew
Silva 1979

Gymnogongrus platyphyllus Gardn., 508

Thalli stiff, compressed to flattened, dichotomous, with few erect branches in clump; to approximately 20 cm high, dull red to purplish; with "arching parallel fans of branches" forming a symmetrical and regular pattern of branching as a result of the upper wide dichotomies in each branch being similarly spaced; upper branches mostly 4–6 mm wide, less than 1 mm thick, with blunt, smooth apices; reproductive structures, when present, in prominent protruding mounds.

Our records for this species (mostly late spring–early fall) suggest that it is widespread in diverse habitats: Mission Bay and the Flood Control Channel, on Pt. Loma and La Jolla intertidal rocks, on subtidal rocks to 20 m. It is conspicuous occasionally in drift algae. Some thalli show tapered (not blunt) apices, and branch width is variable within a single thallus. Dawson (1945d) refers to drift specimens on the beach near the Scripps Pier.

**Gymnogongrus leptophyllus* J. Ag.
506

As are other *Gymnogongrus* species in California, thalli of this species are erect, attached to rock surfaces, with several main axes arising from small discs; easily recognized by the rigidity and strictly dichotomous branches mostly in one plane and compressed. *G. leptophyllus* is distinguished by the narrow (0.5–1 mm) upper branch width; most specimens are under 9 cm high, dull red-brown in color, with conspicuously forked apices.

In central California the plants are frequently abundant on sand-swept rocks; in San Diego County they are rare and not restricted to this habitat. *G. linearis* and *G. chiton*, larger plants with wider branches, are similarly uncommon and often it is difficult to identify single specimens from San Diego collections. Very narrow specimens, identified as *G. leptophyllus*, have been found on rocks near Coronado, in crevices south of Ocean Beach, and on rocks in 10 m deep water near the Loma Sea Cliff. Other specimens have been picked from drift algae washed onto La Jolla beaches. In these specimens the branching tends to be dense above, with shorter intervals between dichotomies. Subtidal specimens have been somewhat larger than the 9 cm height reported by MAC.

**Ozophora clevelandii* (Farl.) Abb. (? *O. latifolia* Abb.)

512

Thalli of erect, branched, flattened blades, to 30 cm high, dull red, with or without short cylindrical stipes less than 2 cm long; main axes to 3 cm broad, irregularly to regularly dichotomously branched in fan-shaped arrangement, ultimate bladelets rounded, some with proliferous branchlets, 7–10 cm long, 1–2 cm broad; reproductive structures on small leaf-like proliferations on the blade surfaces or along margins, or in blister-like spots on blade surfaces.

In San Luis Obispo County, in central California, Sparling (1977) described numerous *Ozophora* specimens that could not be separated into the two species described in MAC and suggested that these collections be identified as *O. clevelandii* (typified by a San Diego collection) until further study clarifies the limits of the species. In southern California thalli are rare, and found only in deep water. We have found thalli tentatively identified as *Ozophora* in several collections from 17–37 m, branches mostly but not always as broad as in *O. clevelandii* (to 2 cm) and to 20–25 cm high, often fertile, and often heavily encrusted or entirely encased in invertebrate (worm and bryozoan) cases, suggesting that thalli are several years old. Abbott (pers. comm.) requires fertile specimens for identification of species and doubts that *O. latifolia* occurs in southern California.

Dawson (PMR 4, 1961) remarked that *O. clevelandii*, "frequently observed by divers at La Jolla," was recognized by the distinctive broad, flattened branch tips. He also wrote (Dawson *et al.* 1960) that the species was found under the kelp canopy at depths of 17 m and on dimly lighted bottoms of 33 m or more.

Dawson's Checklist includes the species (as *Phyllophora clevelandii*) on the basis of large plants washed ashore at Pacific Beach.

Petroglossum parvum Hollenb.

511

Thalli with mostly single erect blades to 10 (15) mm high, arising from spreading prostrate axes on short stipes, once or twice dichotomous; blades narrow, to 2 (3) mm wide, often with adventitious new blades from torn or damaged edges; several cell layers in cross section, with large inner cells and smaller outer, cortical cells.

These small blades often occur under *Phyllospadix* with *Anisocladella pacifica* and *Nienburgia andersoniana*. *Petroglossum* and *Anisocladella* blades have the same shape and external morphology but *Petroglossum* blades lack mid-ribs and venation and are thicker than those of *Anisocladella*. In some years *Petroglossum* is more abundant than in others; it is seldom easily found, and

probably is more often present during winter and spring months than later in the year, although we have found it throughout the summer and fall in some years. We have collected tetrasporangial and gametangial specimens November–February both intertidally and subtidally.

P. pacificum Hollenb. (508) is a larger, more branched species which I have not found, although La Jolla is included in distribution records according to MAC. Dawson did not find it in Mexican collections; in the Checklist the plants he lists as *P. pacificum*, growing under *Phyllospadix*, probably represent the species recognized as *P. parvum*.

**Stenogramma interrupta* (C. Ag.) Mont.

514

Thalli with several erect branches arising from discoid holdfast; flattened, in one plane, dichotomously divided, light or deep red, to 20 cm high; branches 5–10 (18) mm broad, linear, with slightly broader apices; occasionally with proliferous terminal blades; on rocks in low intertidal to subtidal sites along the entire Pacific coast of U.S. and Mexico, and on the Atlantic shores of Europe. Cystocarpic development produces the appearance of an interrupted midrib, a feature unique to this species among California algae.

This summary description, based on MAC, needs modification or expansion to encompass the forms from submarine canyons in San Diego County that we attribute to the species. We have collected cystocarpic plants January–June among thalli of *Sarcodiatheca furcata* near the edge of the canyon in La Jolla Bay. Nonreproductive plants that resemble these cystocarpic thalli are so irregularly branched that they might, if collected separately, be treated as forms of *Ozophora*. The variability in this particular population may be partly related to the longevity of individual thalli. The site is within La Jolla Bay and beneath depths of heavy surge, possibly allowing thalli to persist and grow over several years. It is also a sandy area, removed from rock outcroppings inhabited by fish or large invertebrate grazers. We find very small thalli February–June, with pale clear pink blades. These “new” thalli grow to 10 cm high by the end of summer, with ultimate dichotomies 1 cm wide. Simultaneously we find (older) blades to 15 cm high, thicker, usually eroded or torn, darker colored, and often fertile. If these were found apart from the “new” thalli, they would initially be considered a different species. From many of these “old” thalli, thin new blades, with the bright color and regular dichotomous branching of the first-year growth, develop along old margins or apices.

This is the only site where this species has been found off San Diego County. Since a January storm in 1988 (see *Sarcodiatheca furcata*) disturbed substrates here, algal thalli of these larger species have not been found.

GIGARTINACEAE

**Gigartina canaliculata* Harv.

518

Thalli with cylindrical axes and branchlets, all of similar dimension (2–4 mm wide); papillae not apparent in nonreproductive plants that therefore, in this feature, do not resemble thalli of other common species of *Gigartina*; San Diego specimens mostly less than 15 cm high, often greenish yellow to dark green in shaded habitats; in clumps or dispersed over or among thalli of other turf algae; branching irregular, mostly sparse; fertile thalli are densely branched with short branchlets.

The most common midintertidal form of this species is often not at first recognized by workers familiar with the larger, discrete clumps found in central California and northward. The branch diameter varies in different habitats; more loosely branched, coarser (more than 2 mm diameter), and taller plants were formerly treated as *G. serrata*. Specimens growing under *Phyllospadix* and in similarly protected habitats are more purple, darker, and often larger and more erect, while the specimens that are common, although inconspicuous in mats of intertidal vegetation, are yellowish and generally mostly prostrate. Branches become secondarily attached to other algae, or thalli are entirely epiphytic. The smooth, narrow, tapering branches distinguish thalli from other species in the field. Fertile plants are misleadingly different due to the development of papillae and short dense branches along the upper axes. We find specimens in shallow subtidal habitats as well as intertidally.

**Gigartina exasperata* Harv. and Bail.

521

Thalli are large blades, little branched, mostly less than 30 cm high, but occasionally to 60 cm; papillae short (to 1 mm), hemispherical, and closely spaced when present (see below); 1 to several blades growing from single small discoid holdfast with short stipes; margins smooth, ruffled, or dentate; apices blunt to pointed; shape of blade from nearly circular to narrow, symmetrical or curved.

We include in this highly variable species various large *Gigartina* blades from subtidal sites, rather than attempting to divide single collections between *G. exasperata* and *G. corymbifera*. On none of these specimens have we seen papillae that correspond to those described for *G. corymbifera*. The two species are contrasted largely on the basis of collections from central California, and our San Diego County material is difficult to interpret by the criteria summarized in MAC. Thalli of *G. exasperata* have been found in most subtidal areas, including depths greater than 33 m in the La Jolla canyons.

Occasional thalli are nearly smooth, with few or undeveloped papillae. These blades resemble specimens referred to *Rhodoglossum roseum*; alternatively, if gland cells were present, some forms could be treated as *Opuntiella* thalli.

Dawson distinguished this taxon (as *G. californica*) from *G. corymbifera* as having more acute tips and by showing basal branching from and just above the stipe, but these features also vary when northern thalli are included in the comparison.

Dawson's Checklist lists *G. corymbifera* (as *G. binghamiae*) from San Diego, represented by thalli cast ashore in June–November. At that time *G. exasperata* was considered a more northern species that was otherwise difficult to distinguish from southern California thalli.

**Gigartina harveyana* (Kütz.) Setch. and Gardn.

521

Thalli formed of broad [1.5–3 (7) cm], divided, very long (30–40+ cm) blades, narrowing toward the pointed tips, with numerous soft papillae of various sizes and shapes along blade margins and over the surfaces.

The length/width proportion separates this *Gigartina* from other species, and such thalli have been recognized only rarely in shallow (to 7 m) subtidal habitats on rocks off La Jolla beaches or in drift material in several parts of San Diego County. According to Dawson's observations of plants in areas south of San Diego, the papillae on and near the margins can grow out to form narrow bladelets 3–6 cm long when they are grazed or otherwise damaged.

**Gigartina leptorhynchos* J. Ag.

523

Thalli dark brown to black or pale yellowish green in high intertidal pools; typically to 20 cm high, to 30 cm in Mission Bay Channel on jetties; axes narrow, much branched with variable widths throughout single thalli; small but dense and conspicuous papillae that are mostly 1–3 mm long, soft, not stiff, and almost rodlike in some specimens; the combination of numerous small branchlets and long dense papillae gives the soft, often limp thalli a characteristic "fuzzy" appearance.

Plants occasionally found in high intertidal pools may not be immediately recognized because of the pale yellowish color and sparsely branched main axes. Low intertidal specimens under or near *Phyllospadix* are dark to nearly black, but the typical morphology is easily recognized. Thalli are usually separate and scattered rather than aggregated into extensive patches or clumps as they often are in central California.

**Gigartina ornithorhynchos* J. Ag.

Silva 1979

Gigartina spinosa (Kütz.) Harv., 525

Thalli coarse, purplish to black; in isolated clumps to 30+ cm high, frequently divided near the base as well as above, or remaining as a simple undivided blade; occasionally with small marginal bladelets; numerous short (1–3 mm), wide, stiff papillae over all surfaces.

This species presently includes several taxa previously considered as separate species and varieties in southern California. Treated as a single entity (MAC), *G. (spinosa) ornithorhynchos* occurs in low intertidal areas exposed to surf south of Monterey, California. One-to-few specimens recognizable by the rough dark blades usually can be found in any short search in the appropriate habitat. Many San Diego specimens are wider (to 10 cm) than the 4–6 cm width noted for northern specimens, and occasional large thalli might be considered as *G. exasperata* if they were collected in deep subtidal habitats. *G. ornithorhynchos* grows only to approximately 10 m and is most often found in shallower water and low intertidal sites.

Dawson also concluded that this was the common blade-like intertidal *Gigartina* species of San Diego County. It is allied with warm-water associations, less common or lacking in areas to the south in Baja California with cold upwelled water.

Dawson's Checklist lists *G. echinata*, *G. eatoniana*, and *G. armata*, all species included with *G. spinosa* in MAC, and *G. farlowiana*, probably also a form of the same species (the epithet is omitted from MAC).

Gigartina tepida Hollenb.

527

Branches mostly less than 1 mm wide, evenly compressed to flattened, of similar width throughout; thalli 2–4 (10) cm high, purplish, loosely tufted, with clumped, often sparse branches arranged irregularly; some branchlets near upper portions sharply pointed; papillae usually few.

MAC describes the habitat as apparently restricted to sheltered water and lists only a few collections, none south of Newport Bay in Orange County. We have collected *G. tepida* in San Diego County from quiet water areas as well as beaches exposed to rather heavy surf. Cystocarpic plants have been found in Mission Bay Channel, and 10–13 m subtidally on the Loma Sea Cliff. G. J. Hollenberg, who described the species, confirmed an identification of a plant from Mission Bay. It is probably a rare alga, in addition to being inconspicuous.

Gigartina volans (C. Ag.) J. Ag.

527

Thick, narrow blades, to 40 cm high, branched, often with many small marginal blades, and few or no papillae; thalli in clumps with several blades from a common holdfast; dark purple to brown; blade shape and branching may vary with reproductive phase.

“Oregon to Baja California on sand-covered rocks.” We have not collected the species in San Diego County. Dawson (1945d) refers to specimens in La Jolla, and (Dawson *et al.* 1960) mention specimens from kelp beds to 10 m. These records may represent thalli of other morphologically variable taxa rather than *G. volans*, which is distinctive to the north, and as presently circumscribed, easily recognized.

**Rhodoglossum affine* (Harv.) Kyl.

539

Thalli in bushy, erect clumps, mostly less than 5 cm high, greenish olive or reddish purple to blackish; blades usually smooth, concave/convex; thalli in the high midtidal zone often appearing quite different from those in low intertidal habitats; blades of some forms mostly less than 2 cm wide, repeatedly dichotomously branched, with final dichotomies close together and congested above; other thalli of similar height are mostly less than 1 cm wide and more sparsely branched, occasionally with a few lateral proliferations, darker in color.

These forms identified from San Diego County do not correspond to the descriptions provided for northern populations (MAC). In San Diego, thalli are found in two very different habitats; high intertidal plants often are on rocks or in tide pools with *Prionitis lanceolata*. In localities outside San Diego, forms of *Grateloupia doryphora* may resemble *P. lanceolata* or forms of *Rhodoglossum affine* that co-occur in the same habitat. *Rhodoglossum affine* has large tetrasporangial sori, while species of the other two genera have scattered tetrasporangia. Our records suggest that plants begin to grow in the early spring and are most often collected in the summer–fall. Low intertidal forms are widely scattered and easily overlooked in shaded crevices, under larger algae, or in *Phyllospadix* beds. These are very dark purple, but otherwise resemble high intertidal thalli. We have not found larger specimens such as are mentioned in MAC. Figure 7 illustrates the plant Dawson described from several localities as a narrow form with branches terminally curled or twisted—a form that is locally characteristic of high intertidal pools in summer.

Parkinson (1981) has proposed that the removal of this species to the genus *Gigartina* (Kim 1976) be accepted and states that the necessary new epithet is *G. montereiensis*. The Parkinson study is obscurely published and not generally available. If this species is indeed correctly referred to the genus *Gigartina*, the specific name change becomes necessary. Until other workers have evaluated the generic status of the California taxon, however, I prefer to retain *Rhodoglossum affine* for this common, widespread, and well-known species.

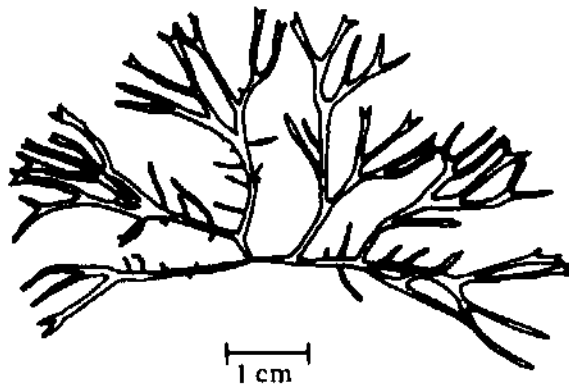


Figure 7. *Rhodoglossum affine*. Form commonly found in high tide pools in San Diego County.

**Rhodoglossum californicum* (J. Ag.) Abb.

539

Dawson's Checklist notes that this species (as *R. americanum*) is recorded for San Diego only on the basis of specimens collected in 1901 near Coronado (P.B.-A. #538). The species is known from cold-water sites in Baja California as well as in northern California, but probably is best excluded at this time from the San Diego algal flora.

The same study cited for *R. affine* (Parkinson 1981) supports the return of *R. californicum* to *Iridea*, following Kylin's 1941 opinion. At present it seems preferable to follow the nomenclature of MAC for the reasons given above (for *R. affine*).

Rhodoglossum roseum (Kyl.) Smith

541

Thalli with one or more erect blades arising from small discoid holdfasts, 8–15 cm high, oval or wider below; blades with rounded apices, occasionally with stipes 2–3 mm long; cystocarps large (more than 1 mm diameter) and conspicuous when present; blade surfaces otherwise smooth, not markedly thin or slippery.

The collections we have tentatively referred to this species include several thalli found on the beach at Imperial Beach and Mission Beach. Additional

material with cystocarpic plants and observations of attached plants are necessary to confirm the presence of the species in subtidal habitats.

Specimens initially referred to *Gigartina exasperata* as a form essentially lacking papillae, may prove to represent a *Rhodoglossum* species. Some are 20–45 cm high, which is considerably larger than noted for *R. roseum* from central California. Dawson recorded thalli to 30 cm, with ruffled margins, from northern Baja California.

PETROCELIDACEAE

[*Mastocarpus papillatus* (C. Ag.) Kütz.

Guiry *et al.* 1984

Gigartina papillata (C. Ag.) J. Ag., 523

This species does not occur in San Diego County and is listed here only because its presence/absence is frequently questioned. It is one of the most striking examples of the taxa that skip from central California to the localities of northern Baja California where cold water is brought to the shore by strong upwelling currents. In these southern areas and north of Santa Barbara, it is often an exceedingly abundant, dominant alga over high to mid-intertidal rocks.

West *et al.* 1978 established a crustose *Petrocelis* phase in the life history of *Gigartina agardhii*, which was placed in synonymy with *G. jardinii*. The species was later transferred to *Mastocarpus* (Guiry *et al.* 1984); the disjunct distribution is similar to that of *M. papillatus*. Although Dawson mentions the species as *Gigartina agardhii* in the Checklist, the record probably refers to forms of *G. spinosa*.]

[**Petrocelis franciscana* Setch. and Gardn., **P. haematis* Hollenb.

476

'*Petrocelis franciscana*' is found in areas of cold-water upwelling (e.g., Cabo Colnett) in Baja California but is absent from most of southern California and from San Diego County. The species (as *P. middendorffii*) was found to be the tetrasporangial phase of *Mastocarpus papillatus* (Polanshek and West 1977), an alga also absent from San Diego County.

Type locality and only record for *P. haematis* is Orange County.]

RHODYMENIACEAE

Botryocladia neushulii Daws.

551

Thalli 8–20 cm high, several axes growing from small basal attachment; branching irregular, often sparse, with small bulbs (sacs), filled with viscous

fluid, scattered along all axes and branches. We have found this very distinctive alga only on rocks at 17–20 m between the tip of Pt. Loma and Imperial Beach.

This rare species has been recorded from the California Channel Islands and south to Bahía San Quintín in Baja California. The type collection came from 16 m, in the La Jolla Cove kelp bed in 1956. Recently, one small specimen that resembles the species was found in drift on a beach near the Cove, suggesting that thalli may still grow in this locality. It is too conspicuous an alga to be overlooked by divers if present.

**Botryocladia pseudodichotoma* (Farl.) Kyl.

551

Thalli consist of divergently branched, solid cylindrical axes to 15 cm high, bearing numerous, large fluid-filled sacs up to 4, rarely 7, cm long, and 0.5–2 cm in diameter.

Thalli are infrequently collected subtidally 5–33 m along the entire coast of San Diego County, never abundantly, but throughout the year. It is one of the most easily identified algae, and in popular “guide to seaweed” booklets is sometimes given a common name of “seagrapes.”

Beach drift specimens that Dawson referred to *Halosaccion* in the Checklist were probably individual sacs from this *Botryocladia* species. (See *Reticulobotrys*, SOLIERIACEAE.)

Fauchea laciniata J. Ag.

544

Thalli mostly less than 3 cm tall, single or several together, pale clear pink and often with bluish sheen; the blades appear sessile or with a short narrow portion that is either rolled or developed as a stalk bearing a nearly peltate blade portion; medulla of large cells that can be easily seen with low magnification within the small-celled cortex or by holding the thallus against a bright light. Cystocarps on the surface of the blades often show an encircling flared margin (= coronate).

The species, as treated in MAC, includes large forms in clusters to 12 cm high in central California, as well as collections previously distinguished as a “pygmy” form or species. In subtidal collections throughout the year, from most rocky bottoms 8–33+ m deep, the very small algae described here are easily found on various substrates with all reproductive phases frequently seen.

Larger specimens have been shown to us by other divers as perhaps represent-

ing *Fryeella* because of the blue color that is so striking underwater, but this character that has made *Fryeella* a well-known alga to the north is not restricted to that genus. *Fryeella* is rare or absent south of Morro Bay in San Luis Obispo County. I have not been able to locate the specimen from Papalote Bay, near Punta Banda, Baja California that was cited by MAC. Very small specimens develop a nearly peltate morphology, but this feature also develops in related genera.

The internal structure and the conspicuous form of the cystocarps characterize *Faucheia* species, while the cortical anatomy and position and shape of cystocarps separate *Faucheia* species from *Leptofaucheia*. Some of the thalli in our *F. laciniata* (f. *pygmaea*) collections would perhaps be attributed to *Leptofaucheia* if we did not have such a large series of thalli that all appear to represent a single entity. The blades tend to be irregularly branched and shaped and secondarily reattached to substrates. The type collection of f. *pygmaea* was from articulated corallines in Los Angeles County. Dawson (1950) recognized the taxon from 14–16 m near the Coronados Islands.

Fryeella gardneri (Setch.) Kyl.

549

Thalli are hollow, but not conspicuously so, as the median cavity is crossed by arched septa that are seen from the outside as curved bands. Underwater (this is strictly a subtidal species) the thalli appear as blades with generally dichotomous divisions. MAC records the size to 16 cm high, stating that the plants are often found lying flat on the surfaces of rocks rather than being erect in the water. Cystocarps are relatively large (1+ mm diameter) and prominent on the surfaces of blades. We have found no erect forms that resemble this species, and most of the small, fragmented, prostrate specimens with tetrasporangia that others have identified as *Fryeella*, we would treat as *Faucheia laciniata*. Dawson does not record *Fryeella* from Baja California and MAC records no collections south of Morro Bay in central California. R. McPeak has a single specimen collected from south of Pt. Loma, June 1982, at a depth of 23 m that resembles typical northern thalli of this species. (K. Miller has recently collected plants she identifies as *Fryeella* from the Coronados Islands.)

Maripelta rotata (Daws.) Daws.

548

Thallus bright rosy pink, peltate, with a vivid blue sheen when alive; thin, smooth, slippery-feeling circular blades develop singly on top of stipes, probably annually, and when shed leave small ridges or scars; stipes are to 4.5 cm high and blades of San Diego plants are mostly 3–7 cm broad.

The note in MAC referring to this species as frequent under kelp canopy is misleading for San Diego sites; the thalli commonly found in relatively shallow-water kelp beds are young, smooth-margined *Sciadophycus* specimens. *Maripelta* is everywhere a deep-water alga and off San Diego is found either very deep under *Pelagophycus* blades outside *Macrocystis* beds, or in the La Jolla submarine canyons below 28 m and at least as deep as 60 m. It has been observed at 82 m from submersibles near Anacapa Island. At these depths it shows little color but was recognized by the circular shape and bluish glow.

Rhodymenia arborescens Daws.

553

Blades with distinct branched stipe growing from a simple prominent cone-shaped or disc holdfast 5–10 mm wide; without stolons; blade segments 3–4 (6) mm broad, thalli 10–15 (24) cm high, 6–10 (16) cm broad.

Dawson *et al.* (1960) referred to the species as being common under kelp canopies between Los Angeles County and the southern tip of Baja California, with the woody, conical holdfast being distinctive. We have collected thalli that match descriptions of this alga, but the presence or absence of stolons and the morphology of the holdfast are not always easily interpreted.

**Rhodymenia californica* Kyl./ **R. pacifica* Kyl.

554, 557

Thalli dichotomously branched, flattened, growing from cylindrical axes that often are densely pigmented; erect blades often firm to very stiff; divisions of blade less than 3 mm broad and thalli to 7 cm high (*R. californica*) or 8–13 cm high, with branches 4–19 mm broad (*R. pacifica*); blades typically broadened and blunt at apices, in many forms more narrow and attenuate. With low magnification, large medullary cells can be seen between the outer cortex of very small cells; this characteristic is useful in recognizing this and related genera when the thalli are small and lack the branching pattern typical of older plants. Plants with narrow blades such as distinguish *R. californica* can be found in shaded low intertidal to subtidal rocky habitats where they often are abundant. Basal, prostrate axes (stolons) may be buried in sediment or covered by sessile invertebrates. Growing amongst these larger plants are small thalli of various shapes, including occasional very small peltate blades that presumably are juveniles of the same species. Very broad specimens, characteristic of *R. pacifica*, can occur in similar habitats. Intermediate forms are common, and by relying only on height and branch width, many collections cannot be clearly distinguished as one or the other species. Some very small thalli are broad, but as the divisions increase in number they become successively

narrow. Large typical *R. pacifica* are mostly found subtidally, but narrow *R. californica* forms can also be found in the same habitats.

**Rhodymenia rhizoides* Daws.

559

Type locality for this species was San Diego (Dawson 1941). He later (1963a) wrote, "one is led to wonder whether *R. rhizoides* might represent a variation of *R. pacifica* with prominently branched stipes and stolons."

**Rhodymeniocolax botryoides* Setch.

562

Thallus whitish, 3–4 mm in diameter, with many short, thick branches to 0.75 mm long. Occasional "parasite" on *Rhodymenia* species.

Dawson (1945d) reported finding abundant material on old specimens of *Rhodymenia* in beach drift at La Jolla throughout the winter and spring of 1944–45.

Sciadophycus stellatus Daws.

547

Thalli consist of bright rosy pink peltate blades, with a bluish color when wet and alive; single blades, to 4–6 cm diameter, grow on stipes to 0.5–1.5 cm high; young undamaged blades develop several to 12 points along the periphery, evenly spaced and of similar size and shape, giving the thallus a symmetrically stellate shape.

Blades grow first as simple circular discs, then, as growth proceeds, the star morphology develops as points grow out from the margin. These points can secondarily attach to the substrate and initiate new blades. Older plants develop various irregular shapes as the margin becomes damaged or reattached; short-stiped plants often appear to be prostrate. Entire blades with symmetrical radiating points, such as are shown in Figure 491 of **MAC**, are seldom found. Once one becomes familiar with these thalli they are recognized in most of the rocky subtidal areas of moderate water movement. We do not find them within La Jolla Bay or in the canyons, and believe that most of the peltate plants observed under the kelp canopy and nearby are *Sciadophycus*, with *Maripelta* restricted to deeper sites.

CHAMPIACEAE

Binghamia forkii (Daws.) Silva

564

Thalli strongly flattened, distichously branched; main axes at first solid but

becoming progressively more hollow, finally with central cavity essentially hollow, with regular septa dividing hollow parts into segments; to 2 mm wide at broader upper branches, pinnate branches 1–5 mm long, narrow at base. Branching is often strikingly opposite and regular above the primary dichotomies. Characteristic forms are shown in Figure 8.

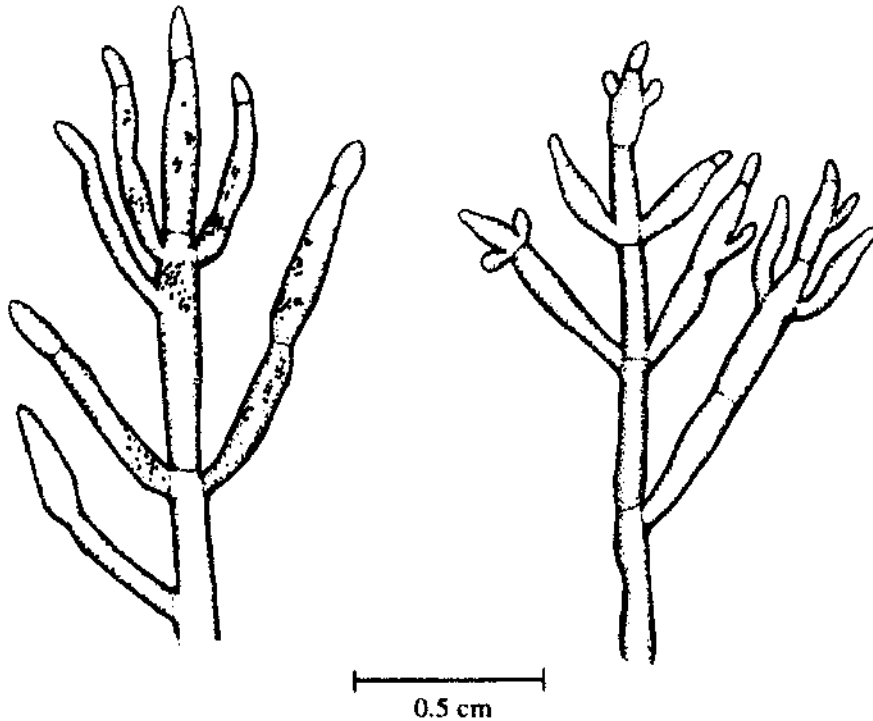


Figure 8. *Binghamia forkii*. Whole thalli.

This species is easily found May–November on the platform rock beaches between Ocean Beach and Pt. Loma, where thalli form a yellowish or greenish mat of repent epiphytic thalli over algal turf. It usually is less abundant but seasonally occurs on beaches north of Mission Bay. All reproductive phases are present wherever thalli are collected.

The species was typified by thalli epiphytic on *Pterocladia capillacea* and *Hypnea valentiae* in drift at La Jolla (Dawson 1945a) and has subsequently been recorded from the California Channel Islands, other sites in southern California, and south to Bahía San Hipólito in Baja California. Specimens were reported (Dawson *et al.* 1960) from 8–13 m in kelp beds.

Thalli from three localities in northwest Baja California that I believe to represent this very common (in San Diego County) species, have recently been studied (Lee *et al.* 1988) and removed to a new genus and species, *Binghamiopsis caespitosa*. Both *Binghamia* and *Binghamiopsis* are allied with *Lomentaria* in Lomentariaceae by these authors.

Champia parvula (C. Ag.) Harv.

565

Thalli 1–2 cm high, branched, cylindrical or occasionally somewhat compressed, often low and creeping and reattached to other algae in algal turf, branching irregular; segments mostly 0.7–1.2 mm diameter, hollow throughout, but with regular diaphragms partitioning the axes and branches into segments 0.5–1 mm long; segments slightly constricted at each septum.

This is an alga found worldwide in tropical to subtropical localities; I have never collected it in, or seen specimens from, San Diego County. Most, or all, of the occurrences recorded by Dawson were from localities in the Gulf of California rather than on the Pacific coast of Baja California. The La Jolla record mentioned in MAC refers to a specimen growing on *Codium fragile* at Bird Rock, La Jolla (Abbott, pers. comm.). ‘*Champia*’ specimens from San Diego County that I have seen were misidentified *Binghamia* or *Coeloseira* thalli.

**Gastroclonium compressum* (Hollenb.) Chang and Xia, **G. parvum* (Hollenb.) Chang and Xia

Chang and Xia 1978

Coeloseira compressa Hollenb., *C. parva* Hollenb., 566

The two species are small septate intertidal epiphytes; they are separated by the number of cells in branch walls, and by whether thalli are erect or spreading. Polysporangia (in place of tetrasporangia) are a generic character. *G. compressum* axes are described as up to 3–7 cm high, more compressed, and secondarily attached to substrates from downward-curving apices. *G. parvum* is distinguished as being mostly erect and less than 3 cm high.

Several variants, including forms typical of both species, are common, scattered in algal turf where branches are entangled over and within *Corallina* or mixed with other epiphytes. These two small species are relatively conspicuous because of the tube-with-constriction morphology, frequently with an iridescent sheen. Most axes are 3 cm or less in height and creeping, with reattached branches that are similar to erect axes. We have tried unsuccessfully to consistently separate plants in the field into one or the other entity. Both were described originally from southern California (Redondo Beach and Corona del Mar) and subsequently found in Pacific Baja California. Dawson referred intertidal thalli and subtidal thalli to both species.

The Checklist notes that the two species often occur together.

**Gastroclonium subarticulatum* (Turner) Kütz.

Hawkes 1986

Gastroclonium coulteri (Harv.) Kyl., 567

Thalli often to 26+ cm high, with the ultimate branchlets hollow and septate; main axes solid, 1–2.5 mm in diameter, cylindrical; irregularly branched; with tetrasporangia or polysporangia; lower parts of the branches are often dark red to black, while above the color can be more greenish.

As it is along the entire California coast, in San Diego County the species is common, but here only in shaded low intertidal habitats or in shallow subtidal areas. Axes and branches frequently appear to have been bitten off several cm above the substrate, suggesting fish grazing.

It is found in similar habitats south to Punta Abreojos in Pacific Baja California.

LOMENTARIACEAE

Lomentaria caseae Daws.

567

This species is known from only two collections, one being type material attached to *Phyllospadix* leaves cast up on the beach at Del Mar (Dawson 1946). The second, also identified by Dawson, consisted of specimens attached to *Zostera* at Guadalupe Island.

Lomentaria hakodatensis Yendo

569

Thalli formed of narrow, hollow, somewhat compressed tubes without septa, mostly less than 1 mm wide; these are branched in an irregular pattern, and typically taper to curved (uncinate) apices. Cystocarps are described as "prominently rostrate"; I have found only tetrasporangial reproduction in the few San Diego collections I have seen.

This is a small inconspicuous alga that grows as an epiphyte mixed with other entangled algae from low intertidal habitats. One small specimen was found in a collection from 27 m.

The species is probably usually rare as well as being inconspicuous in San Diego. The irregular branching and uncinat apical growth are maintained under culture conditions and are useful diagnostic features. The hollow undivided morphology is easily seen under low magnification where edges appear as dark borders outside the paler central region.