A FLORISTIC ANALYSIS OF THE MARINE ALGAE AND SEAGRASSES BETWEEN CAPE MENDOCINO, CALIFORNIA AND CAPE BLANCO, OREGON

By

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We certify that we have read this study and that it conforms to acceptable standards of scholarly presentation and is fully acceptable, in scope and quality, as a thesis for the degree of Master of Arts.

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ABSTRACT

A FLORISTIC ANALYSIS OF THE MARINE ALGAE AND SEAGRASSES BETWEEN CAPE MENDOCINO, CALIFORNIA AND CAPE BLANCO, OREGON

Simona Augytė

The biogeographic area between Cape Mendocino, California and Cape Blanco, Oregon spans over 320 km and is characterized by prominent coastal headlands that act as genetic and species barriers for marine organisms. Because of a lack of a current macroalgal species list for this area, this study aimed to (i) compare patterns of intertidal macroalgal species composition for the poorly described coastline at four sites, and to (ii) compile a macroalgal and seagrass flora based on current findings and historical records. Collections were made in the spring and summers of 2010 and basic ecological habitat attributes for each species were recorded. Similarities in the macroalgal composition across the four sites were investigated using hierarchical clustering based on a presence/absence matrix for each species. A total of 162 species of marine macroalgae (103 Rhodophyta, 33 Heterokontophyta, Phaeophyceae, and 26 Chlorophyta) and 2 species of seagrasses (Anthophyta) were identified. The sites formed a latitudinal gradient of similarity; the two northern sites clustered together as did the two southern sites. Across all four sites, more than half of the taxa were found in the low intertidal. The within site comparison of taxa based on zonation revealed that Crescent City differered from the other three sites. One near-endemic species, *Cumathamnion sympodophyllum* M.J. Wynne & K. Daniels, and one invasive species, *Sargassum muticum* (Yendo) Fensholt were found. Combined with historical accounts, the macroalgal flora between the Capes consists of 322 macroalgal taxa (201 Rhodophyta, 70 Heterokontophyta, Phaeophyceae, and 51 Chlorophyta) and 4 species of seagrasses. The results indicate a relatively high area of biodiversity of 134 species per degree latitude. The Cheney ratio designation is a cold-temperate flora with closer affinities to Oregon and Washington than to southern California. In comparison to historical records by Dawson and Doty, seven new records were found. Furthermore, Dawson and Doty's floras list 87 species that were not found, the discrepancy laying either in sampling efficiency or recent range shifts. This study was a first attempt to characterize the marine flora between Cape Mendocino and Cape Blanco and suggests that the capes act as a biogeographic barrier and important transition zone for some species of macroalgae in the Northeast Pacific.

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INTRODUCTION

Marine biogeographic classifications are derived primarily from descriptions of benthic seaweeds and macroinvertebrates. These classifications, and the floristic and faunistic data underpinning them, are in turn necessary for understanding factors that have influenced the speciation of marine biotas (Tuya and Haroun 2009, Jose Cruz-Motta et al. 2010). The radiation of a distinct benthic marine biota is gradual along a coastline where formerly continuous populations undergo reproductive isolation and their distribution becomes limited by geographic or oceanographic barriers (Adey and Steneck, 2001, Lindstrom 2001, Hommersand et al. 2004). Historically, two main patterns of radiation have been exhibited by macroalgae; either divergence into many species from one genera or a lack of radiation that leaves persistent genera (Coyer 2007, Coyer et al. 2011). Before the beginning of the Pleistocene glaciation (1.6 million to 11,000 years ago), at least eight times more species of seaweeds and invertebrates migrated from the North Pacific to the North Atlantic via the opening of the Bering Strait and Arctic Ocean, than vice versa with different patterns of speciation. For example, the rockweed *Fucus* Linnaeus evolved in Australia, migrated into the North Pacific and then to the North Atlantic where it radiated into numerous species and a wide range of habitats including a few relic southern refugia in the Mediterranean Sea (Coyer et al. 2011). In contrast, several of the economically important intertidal *Chondrus* Stackhouse species are found in the North Pacific, but only one is found in the North Atlantic (Coyer 2007).

It is assumed that the selective forces operating at evolutionary time scales are also observable on ecological timescales. Macroalgal richness is affected by dispersal abilities of species and, following attachment to rocky reefs, abiotic factors and biotic interactions (Dudgeon and Petraitis 2001, Broitman and Kinlan 2006). With respect to dispersal, seaweed spores are released as patches or propagule clouds (Bobadilla and Santelices 2005). Most spores fall a few meters to hundreds of meters from their parent; however some species disperse propagules as far as a few kilometers (Gaylord et al. 2002).

Following recruitment, there are a number of abiotic factors that structure rocky intertidal communities. Wind and coastal geomorphology drive ocean currents and upwelling events which in turn affect sea surface temperatures (SST) and nutrient concentrations (Navarrete et al. 2008, Largier et al. 2010). Higher upwelling intensity on the Chilean coast is associated with an increased abundance of corticated algae (i.e., structurally complex) and is negatively associated with ephemeral species (Nielsen and Navarette 2004). Hydrodynamic forces imposed by breaking waves may also affect macroalgal composition (Denny 2006). For example, in Japan increasing wave exposure is correlated to a decrease in species richness of both the green (Chlorophyta) and red (Rhodophyta) algae and an increase in brown algae (Heterokontophyta, Phaeophyceae; Nishihara & Terada 2006). Certain species of brown seaweeds such as *Postelsia palmaeformis* Ruprecht, *Lessoniopsis littoralis* (Farlow et Setchell ex Tilden) Reinke, and *Pelvetiopsis limitata* (Setchell) N.L. Gardener occur only on the exposed outer coasts where high wave action is common (Waaland 1977). Other physical parameters include sand disturbance and desiccation stress (Littler et al. 1983). For example, numerous northern California rivers deliver large sediment loads directly to the rocky intertidal as sand and woody debris (Borgeld et al. 2007, McGary et al. in prep.), which potentially abrades and buries rocky intertidal and subtidal species. Desiccation is another abiotic factor that can affect species distribution. Upper mid intertidal seaweeds like *Endocladia muricata* (Endlichter) J. Agardh and *Fucus gardneri* Linnaeus can tolerate direct exposure to full sunlight for many hours at a time (Waaland 1977) whereas other seaweeds, such as *Delesseria decipiens* (Hudson) J.V. Lamouroux, have delicate blades that can easily be damaged by the high intensity sunlight and are usually found in the low intertidal. In the Northeast Pacific it has been suggested that desiccation and overheating is ameliorated by the thick fog that forms during the summer (Foster et al. 1988).

When abiotic physical disturbance is diminished, such as on low wave-energy shores, biodiversity tends to increase over time (Odum 1969, Sousa 1979) and biotic interactions such as predation and competition become important in determining community structure (Gaines and Lubchenco 1982). On the coast of New Zealand, top down control by grazers was the primary determinant in algal community structure (Menge and Guerry 2009). Similarly, a study along the Oregon coast found that the impact of grazers on early successional algae varied at all scales, and was not always the most important factor driving the assemblage (Freidenburg et al. 2007). At their study site at Cape Blanco, top-down effects were strong in the mid zone, but weaker in the low zone where bottom-up effects were more prevalent. The intermediate disturbance hypothesis proposes that species richness and diversity peak at intermediate stages of disturbance when competitively dominant species are partially removed (Connell 1978). For example, the early establishing alga *Ulva* inhibits recruitment of perennial algae and only when it is selectively grazed by limpets and crabs does the community change to a combination of ulvoid and perennial algal species (Sousa 1979).

In addition to providing information about how seaweed floras evolve, marine biogeographic information is necessary for detecting changes in the coastal community composition due to climate and SST change (Spalding et al. 2007). There are several ways that climate variability can impact near shore marine flora and fauna. Water temperature driven by the effect of winds and coastal geomorphology on ocean currents may limit algal growth and reproduction, and thus geographic distribution (Abbott & Hollenberg 1976, Lüning 1990, Druehl 2000). Long-term coastal ecosystem studies have shown that warming and cooling SST can shift the timing and strength of nutrient and carbon fluxes (Barth et al. 2007), consequently moving the distributional ranges of benthic marine organisms by either dividing biogeographic regions or homogenizing larger regions (Silva 1992, Sagarin et al. 1999, Blanchette et al 2008). A 61 year study (1933 -1994) in the rocky intertidal community in central California found that as the mean SST increased by 0.75°C the overall invertebrate species' ranges shifted northward. Additionally, as abundances of southern species increased, northern species decreased and cosmopolitan species showed no trend (Berry et al. 1995).

Species identification is critical to managers of complex ecosystems (Hofmann et al. 2008). Knowing patterns of algal species composition and diversity can be useful for the selection and monitoring of marine protected areas (MPAs) and the process of ecosystem based management (EBM). MPAs are a management tool to reduce, prevent and/or reverse declines in marine biodiversity and increase the productivity of near shore marine ecosystems (Lubchenco et al. 2003, Spalding 2008). The choice of sites for MPAs is based on biological, social, and economic criteria. Biological criteria include biogeographic representation, habitat heterogeneity, and endemism (Roberts et al. 2003). The California Fish and Wildlife Department has selected areas for MPA's for the coast of California. The EBM process is a management strategy with a similar end goal as the MPA's, but EBM is not restricted to focusing on protected areas. It strives to maintain and improve the health of all organisms, including humans, in an ecosystem by focusing on the entire system rather than on one particular species or the jurisdiction of just one agency. Floristic data are part of the information used by MPA's and the EBM process to identify potentially sensitive habitats, the distribution on non-native taxa, and species composition, all of which can be indicative of whether a given system is robust and resilient enough to maintain its function in the face of disturbance (Levin et al. 2008).

The headlands of Cape Blanco, Oregon south to Cape Mendocino, California bracket approximately 320 km of shoreline that potentially form either a discrete biogeographic unit or possibly a transition region between northern and southern seaweed floras. Existing biogeographic schemes place this segment of coastline within a bioregion called the Mendocinian Province that is nested within a larger designation called the Cold Temperate Northeast Pacific coast (Valentine 1966, Spalding 2007, Blanchette et al. 2008). The effects of the Cape headlands on ocean currents in combination with the watershed effects on the nearshore disturbance regime suggest that the physical setting of this region could affect gene-flow and speciation of benthic marine organisms.

The California Current System is an eastern boundary current that originates at higher latitudes and, in the summer, transports cold nutrient rich waters south over the North Pacific shores consequently sustaining a diverse and productive ecosystem (Foster et al. 1988, Lüning 1990, Blanchette 2009). The other primary ocean current in this region is the Davidson Current that brings warm water north during the winter. Between the capes, the seawater temperature range is roughly 10°-13°C (Blanchette 2008). The headlands of both capes are characterized by seasonal upwelling during the spring and early summer which brings cold nutrient rich waters to the surface (Magnell et al. 1990, Tweddle et al. 2010). The upwelling center on the south side of Cape Blanco can extend to just north of Crescent City, California. There is a much smaller upwelling center on the south side of Trinidad head. The currents around the Capes may form potential dispersal barriers and lead to species-level and genetic structuring effects for some intertidal populations (Magnell et al. 1990, Barth et al. 2000). An invertebrate genetics study along the Pacific coast of North America revealed that there are strong regional patterns of genetic change at Cape Mendocino for some species with planktonic larvae (Kelly and

Palumbi 2010). These genetic patterns suggest that Cape Mendocino may be almost as important a distributional barrier as Pt. Conception, California, which is recognized as major boundary for tropical and temperate marine floras (Murray and Littler 1981, Gabrielson et al 2004). Marine communities between the two Capes are also heavily impacted by terrestrial sediment carried to the shoreline by nine rivers and numerous streams (McGary et al. in prep). The intensity of sand disturbance may affect not only the quantity but also the types of algae that are present in any given site as sand will select for sand-loving species such as *Phaeostrophion irregulare* (Setchell) N. L. Gardner.

Comparative floristic analyses of the near shore marine biota from the NE Pacific have not yet raised Cape Blanco or Cape Mendocino to the level of importance attributed to Point Conception. It is presently difficult to determine whether the lack of importance ascribed to these two capes is realistic or reflective of inadequate sampling. The transitional warm-cool temperate climate of the Northeast Pacific has at least 1000 macroalgal species (Silva 1992). Some local seaweed floras are available, such as site surveys within Redwood National State Park (Boyd and DeMartini 1977), Dawson's (1965) flora from Cape Mendocino to the California-Oregon border, and Doty's (1947a, 1947b) flora for the taxa of southern Oregon that also includes taxa north of Cape Blanco. Hansen's (1997) comprehensive floristic analysis for the state of Oregon comprises 387 taxa. Gabrielson et al. (2006) lists a total of 567 species (including subspecies and varieties) for the states of Oregon and California, north of Pt. Conception. Abbott and Hollenberg (1976) describe about 732 species (Hansen 1997) for the entire state of

California. Large scale floristic trends show that mid-northern latitudes from 45-60°N have the most macroalgal species and biomass as compared to latitudes closer to either the equator or the Arctic (Konar 2010). My area of study (40°-42°N) is expected to have intermediate values of taxon richness relative to the tropical and Arctic values.

The level of floristic description between the capes is low relative to other shores along the NE Pacific. Previous studies (e.g., Abbott and Hollenberg 1967, Hansen 1997) have focused on one of the two states, but not exclusively on this region. It is therefore difficult to assess both the importance of this region to the evolution of benthic marine organisms and whether or not any climate induced floristic shifts are occurring. Additionally, monitoring the efficacy of MPA's is compromised by the low level of floristic description. Given the significance of marine floristic baseline data and a lack of a current and focused species list for my area of interest, the main purpose of this study is to update the taxonomic inventory of intertidal marine macroalgae from Cape Mendocino, California to Cape Blanco, Oregon and to provide detail on the basic habitat attributes of each species. Specifically, the objectives of this study are (i) to assess the intertidal marine macroalgal and seagrass community structure among four sites (one in Oregon - Cape Blanco, and three in California - Crescent City, Trinidad, and Cape Mendocino), and (ii) to produce a list of algal taxa from cape-to-cape based on my field collections, as well as Dawson's (1965), Doty's (1947a, 1947b), and DeCew and Silva's (1985) floras, and collections in the Humboldt State University's Cryptogamic Herbarium. The first objective of the study was met by sampling in the four locations of interest during the spring and summers of 2009 and 2010. An inventory of the Cryptogamic Herbarium, an updated version of Dawson’s (1965), Doty’s (1947a, 1947b), and DeCew and Silva’s (1985) flora were used for the second objective.

METHODS AND MATERIALS

Site description

Four sites spanning 320 km of linear coastline (2.5 degrees latitude) in northern California and southern Oregon (Figure 1) were surveyed during the spring and summer of 2010. Although preliminary sampling was done in 2009, the data was not included in the statistical analysis. The sites were selected based upon accessibility by foot as well as representation of different headland features and between-cape habitats. All sites were exposed to open ocean swells. Sampling was restricted to rocky intertidal and shallow subtidal areas composed of bedrock and boulders. Sandy beaches were excluded from sampling as they do not provide a suitable habitat for many macroalgal species. In addition, embayments with freshwater inputs and the subtidal were not sampled. Collecting was done during low tides ranging from -0.1 to -0.6 MLLW.

The northernmost sampling point at Cape Blanco (42° 50′ 15.39″ N, 124° 33′ 50.4″ W) in Curry County is a prominent headland, and is the westernmost point in the state of Oregon. The intertidal is composed of large boulder fields and bedrock and high cliffs intermixed with sandy patches. The relative wave energy is very high. This area experiences early summer upwelling and has been identified as a major biogeographic break for many species of zooplankton and benthic invertebrate larvae (Broitman 2008). The southernmost sampling location at Cape Mendocino, (40° 26′ 24.36″ N, 124° 24′ 34.2″ W) in southern Humboldt County is the westernmost point in the state of California and also a prominent headland with a large upwelling center on its south side. The Mattole River provides high sediment loads to shores on the north side of this cape. The hard bottom habitat in this area is characterized by large expanses of rocky bench composed of bedrock and boulder fields, surge channels, and tidepools intermixed with long stretches of coarse sandy beaches. Mussel Rock is a specific site exposed to high ocean swells.

The two sites surveyed in between the two Capes are Trinidad (41° 3′ 33″ N, 124° 8′ 35″ W) and Crescent City (41° 45′ 21″ N, 124° 12′ 6″ W) located in Humboldt and Del Norte county, respectively. The beaches are composed of sand intermixed with rocky boulder fields. Surge channels are common for sites exposed to strong ocean swells, although some areas are protected by coves. Trinidad head protects beaches to the south from northern swells. The estuary, Humboldt Bay, is located about 24 km south of Trinidad. Both Trinidad and Crescent City have boat Harbors. Trinidad is located north of the large Eel River and Crescent City to the north of the Klamath River.

Survey Technique

Intertidal marine algae and seagrasses were sampled at the four sites during the low tides of the spring and summer of 2010. Ten Geographical Positioning System (GPS) coordinates (NAD83 UTM zone 10N) were randomly chosen within 13 km stretches of coastline around each site, and five of these were surveyed based on accessibility (Table 1). A Garmin hand held device was used to place a 30 meter transect line at the chosen GPS point, at the highest tidal height heading west towards the shallow subtidal. The presence of every species within 1.5 meters on each side of the transect was recorded. The sampling intensity was consistent across all four sites and each transect extended to the MLLW or lower (Table 1). Each site was only visited once per season. Basic ecological habitat attributes were recorded for each species; intertidal zone (high, mid, low, and shallow subtidal), substrate type (epibenthic, epilithic, epiphytic and epizoic), presence of sand, and if the seaweed or seagrass was growing in a tidepool.

Identifications were made in the field or in the lab when necessary. Vouchers were pressed onto acid-free herbarium paper, labeled and deposited in the HSU Cryptogamic Herbarium. Coralline species were decalcified in a mixture of 27 mL of nitric acid in 1 L of water. This mixture was changed every ten minutes until no bubbles were leaving the sample, then cross sections were made for identification (Riosmena-Rodriquez et al. 1999). Cryptic species were photographed (Canon Power Shot S3 IS). Several taxonomic guides were used to identify specimens including Dawson (1966), Abbott and Hollenberg (1976), Gabrielson et al. (2004, 2006), Mondragon and Mondragon (2003), Lindstrom (2010), and Guiry and Guiry (2009). Gabrielson et al. (2004, 2006) and Guiry and Guiry (2009) were used as sources for current species names and their conventions for names were followed.

Patterns of algal composition

A species list comparing the presence/absence of intertidal macroalgae and seagrasses at the four sites was created (Appendix A). Statistical analyses were done with R and Minitab. Only the collections made in 2010 were analyzed as the sampling protocol was modified after the 2009 field season. Patterns of richness were compared by constructing a presence/absence matrix for each species across the four sites. For each pair of sites, Jaccard's similarity coefficient was used to calculate the similarity of that pair, defined by a/(a+b+c), where a = number of species found at both sites, b = number of species found only at site 1, and c = number of species found only at site 2. These similarities were then subtracted from 1 to obtain dissimilarities. The dissimilarities were depicted using hierarchical cluster dendrograms created with the "hclust" command in R, using the nearest neighbor linkage method (R Development Core Team, 2010).

Additionally, the composition of the algal floras at these same four sites was evaluated using Cheney’s (1977) floristic ratio to identify their relative tropical and temperate affinities. The ratio is (R+C)/P, where R=the number of Rhodophyta, C=the number of Chlorophyta, and P=the number of Phaeophyceae, (or Heterokontophyta). A value of <3.0 indicates a temperate or cold-water flora, while values of >6.0 indicate a tropical flora; intermediate values represent a mixed (i.e. warm temperature) flora (Mathieson 2009). Furthermore, a comparison was made within the four sites based on the presence/absence of species in each zone (high, mid, low, shallow subtidal) and to see where species overlap in each zone.

Developing the macroalgal and seagrass flora

A comprehensive taxonomic list of species was produced from the current collection and historical records of marine macroalgae and seagrasses between Cape Mendocino, California and Cape Blanco, Oregon. Varieties and subspecies were collapsed to the level of species. The University of British Columbia has an algal database that includes location information, but its records cover mostly Washington, British Columbia, and Alaska. A database does not exist for the rest of the NE Pacific. A variety of sources were therefore used to derive a seaweed and seagrass flora from Cape Mendocino to Cape Blanco. Initially, the present study provided the flora described from the four sites (Cape Blanco, Crescent City, Trinidad, and Cape Mendocino). Furthermore, all of the seaweed specimens in the Humboldt State University Cryptogrammic herbarium with cape-to-cape distributions were recorded. As there are no published floras that treat this segment of the NE Pacific as a single, biogeographic unit several historical sources were used. Doty (1947a, 1947b) did an early description of the Oregon flora with site locations for each species thereby identifying what taxa occur from the tip of Cape Blanco south to the Oregon – California border. The more recent description of the Oregon flora by Hansen (1997) does not list site locations for each species and therefore was not used to identify which seaweeds occur in southern Oregon. Dawson (1965) described the seaweed and seagrass flora from just south of Cape Mendocino to the California – Oregon border, and also provided site locations for each taxon. DeCew and Silva's (1985) unpublished seaweed flora covers Baja California, Mexico to Alaska, U.S.A. and includes distribution records within biogeographic units defined by major capes and rivers. This information for marine chlorophytes and phaeophytes is available online through the UC Berkeley herbarium, but only a printed working copy is available for the rhodophytes. Records from DeCew and Silva (1985) were used only as a source for this Cape Mendocino to Cape Blanco flora when they were new collections to the area and accompanied by a cited voucher accession number; most of the DeCew and

Silva (1985) records are based on previously published studies, as is the case for most floristic compilations.

Several of the sources used to develop the cape to cape flora, specifically Doty (1947a, 1947b), Dawson (1965) and DeCew and Silva (1985), had to be taxonomically updated. Recent molecular studies have been used to compare morphologically cryptic taxa to type material, which has often resulted in almost 100% of the species in a clade being renamed. Multiple methods were therefore used to update the names found in the older floras. The flora from Point Conception, California to the Columbia River (Gabrielson et al. 2004) and the flora from the Columbia River to SE Alaska (Gabrielson et al. 2006) were the first sources used because they include older species names and the primary literature upon which synonymy decisions were based. Secondly, the online AlgaeBase (Guiry and Guiry 2009) was also used, as in addition to synonymy information and references, it often also includes recent primary literature. Several taxonomists were enlisted to review and further improve the taxonomic status of the flora. Dr. Paul Gabrielson, who specializes on rhodophytes, edited updates of the Dawson (1965) and Doty (1947a, 1947b) floras and reviewed the list of over 300 chlorophyte, phaeophyte, and rhodophyte taxa that had been identified between the capes. Dr. Charles O'Kelly, a specialist in marine chlorophytes (Friday Harbor Laboratories, University of Washington), reviewed all of the chlorophyte flora, and Dr. Sandra Lindstrom (Department of Botany, University of British Columbia) reviewed the numerous changes to the taxonomy within the rhodophyte genera *Bangia* Lyngbye, *Mastocarpus* Kützing and *Porphyra* C. Agardh.

The names used in the original floristic descriptions by Doty (1947a, 1947b) and Dawson (1965) are also presented in Appendix B in order to facilitate the cross referencing of different studies. The authorities presented for each current name follow the International Plant Names Index in all respects except that a space is inserted between an author's first name initials and surname, as is the practice in phycological journals. This cape-to-cape flora presents only species names and not varieties or forms as, in many cases, the taxonomic confidence at these ranks is so low (P. Gabrielson, pers. comm.). However, varieties noted by Doty (1947a, 1947b) and Dawson (1965) are listed with the species name. Since the southern Oregon portion of this flora is represented only by Doty and the Cape Blanco site used in the present study, the number of species from this section of coastline might increase when site information from Hansen's (1997) Oregon flora becomes available.

RESULTS

Among and within site comparisons

A total of 162 species/subspecific taxa of benthic marine algae and seagrasses were collected during this survey (103 red algae, 33 brown algae, and 26 green algae). Richness was similar across the four sites: Cape Mendocino with 90 species, followed by Cape Blanco with 89 species, and Trinidad with 83 species (Figure 2). Crescent City had the lowest number of species of only 76. Six additional species were found during the first field season. All of these were red algae; four of them were from Trinidad, and two from Cape Mendocino. Appendix A summarizes the macroalgae that were collected (in 2009 and 2010) at each of the four locations grouped by phylum and provides the habitat information for each species. Two species were found outside of the sampling season but are included in Appendix A; *Halochloroccocum porphyrae* (Setchell & Gardner) West, found in the early spring of 2010, and *Coilodesme californica* (Ruprecht) Kjellman found in the late summer of 2009. The Cheney (1977) floristic ratio (red + green)/brown algae) was 3.9 where values < 3 indicate a cold temperate flora and > 6 indicate a tropical flora. Only one known rare macroalgal species, *Cumathamnion sympodophyllum* M. J. Wynne & K. Daniels, was found in Trinidad. The invasive *Sargassum muticum* (Yendo) Fensholt occurred in Crescent City. There were seven new records: *Acrochaete wittrockii* (Wille) R. Nielsen, , *Acrochaetium densum (*K. M. Drew) Papenfuss, *Colaconema rhizoideum* (K. M. Drew) P. W. Gabrielson, *Endophyton ramosum* N.L. Gardener, *Lithophyllum impressum* Foslie, *Pseudolithophyllum muricatum* (Foslie) Steneck & R. T. Paine, and *Ralfsia pacifica* Hollenberg.

Across the four sites, only 35 species (22%) occurred at all four sites, 21 species (14%) in three of the four sites, 39 species (26%) in two of the sites, and 59 species (39%) were only observed at one of the sites. The cluster analysis based on species composition dissimilarity revealed that Crescent City and Cape Blanco were similar to each other as were Trinidad and Cape Mendocino (Figure 3). Species found exclusively at both northern sites, Cape Blanco and Crescent City, are *Farlowia conferta* (Setchell) Abbott, *Gloiosiphonia verticillaris* Farlow, *Janczewskia gardneri* Setchell et Guernsey, and *Smithora naiadum* (Anderson) Hollenberg. Species found exclusively at the two southern sites, Trinidad and Cape Mendocino, included *Ahnfeltia fastigiata* (Endlicher) Makienko, *Gastroclonium subarticulatum* (Turner) Kützing, *Halymenia schizymenioides* Hollenberg et Abbott, *Odonthalia washingtoniensis* Kylin, *Polysiphonia hendryi* var. *gardneri* (Kylin) Hollenberg and *Scytosiphon dotyi* Wynne. The above species are all red algae with the exception of the brown alga *S. dotyi*.

The zonation comparison across the four sites revealed that most taxa occupied the mid intertidal (35-56%), second only to the low intertidal (30-36%). The high intertidal (12-22%) and the shallow subtidal (1-14%) contained the lowest number of taxa (Figure 4). The highest percentage (14 %) of species in the shallow subtidal occurred in Crescent City. Clustering of species based on tidal zones shows similarities for both Capes and Trinidad; all three sites had many of the same species in the mid and low intertidal (Figure 5). Crescent City, however, had species overlapping in the subtidal and the low intertidal. Compared to historical records from Dawson (1965) and Doty's (1947a, 1947b) floras, I found 87 fewer species of macroalgae.

The cape to cape flora

The compilation of sources covering Cape Mendocino, California to Cape Blanco, Oregon yielded a total of 322 species (201 red algae, 70 brown algae 51 green algae) consisting of a total of 31 orders and 54 families. More than half (62%) of the flora were red algae, about a quarter (21%) were brown algae, and the remaining (15%) were green algae (Table 6). In addition, there were four taxa of seagrasses from one order and one family (Alistamales, Zosteraceae). Unlike my study of just the intertidal, this flora included records for estuarine and subtidal habitats (Appendix B). Species variations were collapsed to the species level. Appendix B summarizes all current and historical records of macroalgae and seagrasses found in the area between the two Capes. When normalized over degree latitude, the flora had 134 taxa per degree of latitude (Table 2). The Cheney (1977) floristic ratio for this area was 3.7.

DISCUSSION

The present study provides the first marine floristic synthesis for the meaningful biogeographic unit extending from Cape Blanco to Cape Mendocino. This study used relatively intensive sampling to produce a seaweed and seagrass species list, with basic habitat information for each species, at four rocky intertidal sites. The development of a floristic list for particular sites has rarely been undertaken between the capes (but see Boyd and DeMartini 1977, PISCO Coastal Biodiversity Surveys) and this study includes numerous microseaweeds oftentimes overlooked in macroseaweed-oriented surveys. This work provides some of the fundamental information necessary for understanding the evolution of these marine organisms since it can be incorporated into coastal conservation and management, and it can be a tool for monitoring the effects of climate change and more localized factors on marine biotas.

The four sites demonstrated a latitudinal gradient in species similarity rather than a cape versus non-cape clustering. This pattern was also identified by a larger marine biogeographic study of the NE Pacific (Blanchette et al. 2008) that was based on much more restricted sampling per site. My analysis showed that the two northern sites of Cape Blanco and Crescent City and the two southern sites of Trinidad and Cape Mendocino were similar in their species composition. Although Blanchette et al.’s (2008) study extended from Alaska to Baja, Mexico, the cluster dendrogram shows that the two sites in northern California (Cape Mendocino and Damnation Creek) were sister as were two sites in southern Oregon (Burnt Hill and Cape Arago). If the species were lumped together according to functional groups, perhaps the two capes would show affinities as was the case in Chile where late-successional, corticated algae (i.e., structurally complex) were prominent at sites with high upwelling intensity compared to ephemeral species (Nielsen and Navarrette 2004).

The sampling of the marine macrophyte species at the four sites was intensive relative to existing studies from the region, yet further analysis could be done to identify microseaweeds. One hundred and sixty-two species were identified among the rocky intertidal sites, which is 50% of the 322 species occurring in all marine habitats between the capes (Appendix B). Partly this is because the field portion of this study was restricted to rocky intertidal habitats whereas the larger flora also includes species from subtidal and estuarine habitats. Furthermore, the sampling was done starting in the late spring by which time many of the winter ephemeral species have disappeared. Microseaweeds such as endophytes, epiphytes and parasites are also the first taxa to be overlooked on surveys. For example, it has been shown that they made up the majority of taxa that 'skip' Oregon but were found north and south of that state's borders (Hansen 1997). However, some of the species that were found in this study to be unique to the two northern sites have been found at the southern sites (F. Shaughnessy, pers. comm.). Since these species are moderately large, this suggests that further sampling would uncover large as well as cryptic species..

Within each site, the two capes and Trinidad were similar by having many of the same species in the mid and low zones even though the particular species making up these similarities differed among sites. For example, *Calliarthron tuberculosum* (Postels & Ruprecht) E. Y. Dawson and *Mazzaella splendens* (Setchell & N. L. Gardner) Fredericq were found in both these zones at Cape Blanco but two of the common species at Cape Mendocino were *Plocamium violaceum* Farlow and *Ptilota filicina* J. Agardh. At Trinidad, species such as *Dilsea californica* (J. Agardh) Kuntze and *Ahnfeltiopsis linearis* (C. Agardh) P. C. Silva & DeCew overlapped in the low and mid intertidal. Similarly, these three sites demonstrated their highest dissimilarities between the high and subtidal zones, which is consistent with the large environmental differences between these intertidal elevations. For Crescent City, there was species overlap in the low and shallow subtidal for species such as *Dilsea californica* (J. Agardh) Kuntze and *Constantinea simplex* Setchell.

Vertical patterns of species richness found in each of the four sites were similar to the findings of larger spatial scale intertidal zonation studies from the NE Pacific. Across my four surveyed locations, most of the species were found in the mid (35-56%) and low (30-36%) intertidal. This pattern is consistent with the global analysis by Konar (2010) for the northern hemisphere which showed that algal taxon richness is highest in the mid and low intertidal. The high amount of sand deposition could affect the low richness found in the shallow subtidal and the low intertidal, thereby making the mid intertidal comparatively higher in richness. Temperature extremes and desiccation lead to stress in the higher intertidal where 12-22% of species were found, yet these stresses are minimized on our coast as the spring and summer low tides occur at dawn and a thick fog often protects the algae from desiccation in the afternoon (Foster et al 1988).

The Cheney ratio for the comprehensive study (current and historical records) is 3.7 compared to 3.9 for the 2009-2010 study where values of < 3 indicate a cold-temperate flora and > 6 indicate a tropical flora. Although the comprehensive ratio is lower than the flora derived from the four sites, both values are indicative of a flora that is closer to cold temperate than tropical. Additionally, the Mendocinian Province designated to this area by the Blanchette et al. (2008) has a greater northern extent to Cape Flattery, Washington than to the south of Monterey Bay, California. Therefore both the Cheney ratio and other biogeographic studies indicate that the cape-to-cape flora has more affinities with floras to the north of Cape Blanco than to the south of Cape Mendocino.

The comprehensive floristic list describing the community structure of marine macroalgae and seagrasses from Cape Mendocino to Cape Blanco revealed a total of 322 taxa. This number appears to be attributable more to the number of species with range limits between the capes than to endemism. The only near endemic in this region is *Cumathamnion sympodophyllum*, which also occurs just south of Cape Mendocino (DeCew and Silva 1985). Even though there are many seaweed lineages where high morphological similarity could hide cryptic, genetically different species, molecular studies to date have not identified cryptic endemics between the two capes. However, the same studies have identified range limits in this region. Molecular sequencing of

Porphyra sp. has revealed that *P. conwayae* (S. C. Lindstrom & K. M. Cole) S. C. Lindstrom & S. Fredericq and one species in the *P. schizophylla* Hollenberg complex have their southern limits at Cape Mendocino. *P. pseudolanceolata* V. Krishnamurthy has southern limits at Battery Point Lighthouse in Crescent City, California (Lindstrom 2008a). Similarly, the red alga *Mastocarpus papillatus* (Agardh) Kützing has been shown with molecular methods to be a complex of five cryptic species. Three of these *Mastocarpus* clades, all of which also occur only north of Cape Blanco, have range limits between or at the two capes (Lindstrom 2008b).

The 322 species from cape-to-cape converts to 134 species per degree latitude which is high in comparison to other studies. There are 75 taxa per degree of latitude for all of California (Abbott and Hollenberg 1976) and 90 taxa per degree of latitude for all of Oregon (Hansen 1997). The greater geographic region from the Columbia River, Oregon south to Pt. Conception, California has the lowest number of taxa per degree of latitude (47 taxa; Gabrielson et al. 2004). The lower richness values for the spatially larger floristic studies could be due the inclusion of large stretches of shoreline that are inappropriate habitat for most seaweeds, such as the sandy beaches in Oregon and California. However, the length of coastline from Cape Blanco to Cape Mendocino may have a proportionately similar amount of sandy beach. The 134 species per degree of latitude in this biogeographic region is also a conservative number because varieties were not counted as separate entities whereas they were counted separately for the floras of Abbott and Hollenberg (1976), Hansen (1997) and Gabrielson et al. (2004). It is not possible to know if the 134 species per degree of latitude is a particularly high number until it can be compared to meaningful biogeographic units to the south of Cape Mendocino and to the north of Cape Blanco. With the exception of DeCew and Silva (1985), that is not possible right now because published floras correspond to states or provinces rather than biogeographic units, and while extremely valuable for other purposes, these floras also lack site specific information for each species.

Marine floristic studies attempt to not only describe the community structure of specific stretches of coastline, but also to place it into the greater biogeographic context of the region. This study made a comprehensive macroalgal list for an area that has not been previously described. Not only can it be used by managers, but can also be used to monitor non-native species such as *Sargassum muticum* (Yendo) Fensholt and *Lomentaria hakodatensis* Yendo, evaluate how the community composition changes over time, and to monitor the species' latitudinal spread. The Cape Blanco to Cape Mendocino flora appears to be richer in species than shorelines to the north of Cape Blanco and the south of Cape Mendocino, but this conclusion must be regarded as tentative because of the present difficulties in comparing different sections of the NE Pacific coastline. A comparison needs to be made to the floras from the north and south of the capes. This comparison could further demonstrate if Cape Mendocino and Cape Blanco act as biogeographic range limit barriers to many species of macroalgae.

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TABLES

Table 1. Collection information for each site and transect, including GPS coordinates, height of the low tide on the sampling date, and County name. Latitude and longitude are in the WGS-84 datum.

Site	Transect	latitude	longitude	tide (m)	County
Cape Blanco, OR	Lighthouse	42.84102	-124.564	-0.4	Curry
	East of Lighthouse	42.83950	-124.562	-0.5	
	Battle Rock, Port Orford	42.73735	-124.483	-0.3	
	South of the Cape	42.83358	-124.562	-0.4	
	South of Port Orford	42.71625	-124.465	-0.4	
Crescent City, CA	Pebble Beach	41.75783	-124.223	-0.4	Del Norte
	Point St. George	41.78629	-124.256	-0.6	
	South of Point St. George	41.77144	-124.244	-0.6	
	Battery Point Lighthouse	41.74594	-124.202	-0.2	
	South of Jetty	41.73767	-124.195	-0.6	
Trinidad, CA	Palmer's Point	41.13185	-124.163	-0.5	Humboldt
	North of Luffenhotlz Beach	41.03562	-124.123	-0.5	
	Houda Point	41.03625	-124.121	-0.5	
	Elk Head	41.06942	-124.159	-0.4	
	Martin's Creek	41.07859	-124.156	-0.3	
Cape Mendocino, CA	Mussel Rock, surge channel	40.34884	-124.364	-0.4	Humboldt
	Mussel Rock, urchin dominated	40.41801	-124.401	-0.4	
	Lost Coast	40.41834	-124.4	-0.5	
	Devil's Gate	40.40676	-124.391	-0.2	
	South of Mussel Rock	40.34219	-124.363	-0.1	

Table 2. Species richness per degree latitude for different but overlapping segments of the Northeast Pacific coastline.

AREA and SOURCE	LAT. RANGE	˚ LAT. SPAN	TOTAL TAXA	TOTAL TAXA/ ˚ LAT. SPAN
Oregon (Hansen 1997)	46˚ 17' - 42˚ 00'	4.3	387	90
California (Hansen (1997) based on modified Abbott and Hollenberg (1976))	42˚ 00' - 32˚ 36'	9.4	723	76.9
Southeast Alaska to the OR – CA border (Gabrielson 2004)	58˚ 15' - 42˚ 00'	16.3	635	39
Columbia River, OR to Pt. Conception CA (2006)	46˚ 18' - 34˚ 26'	11.9	567	47.6
Cape Blanco, OR to Cape Mendocino, CA	42˚ 50' - 40˚ 25'	2.4	322	134

FIGURES

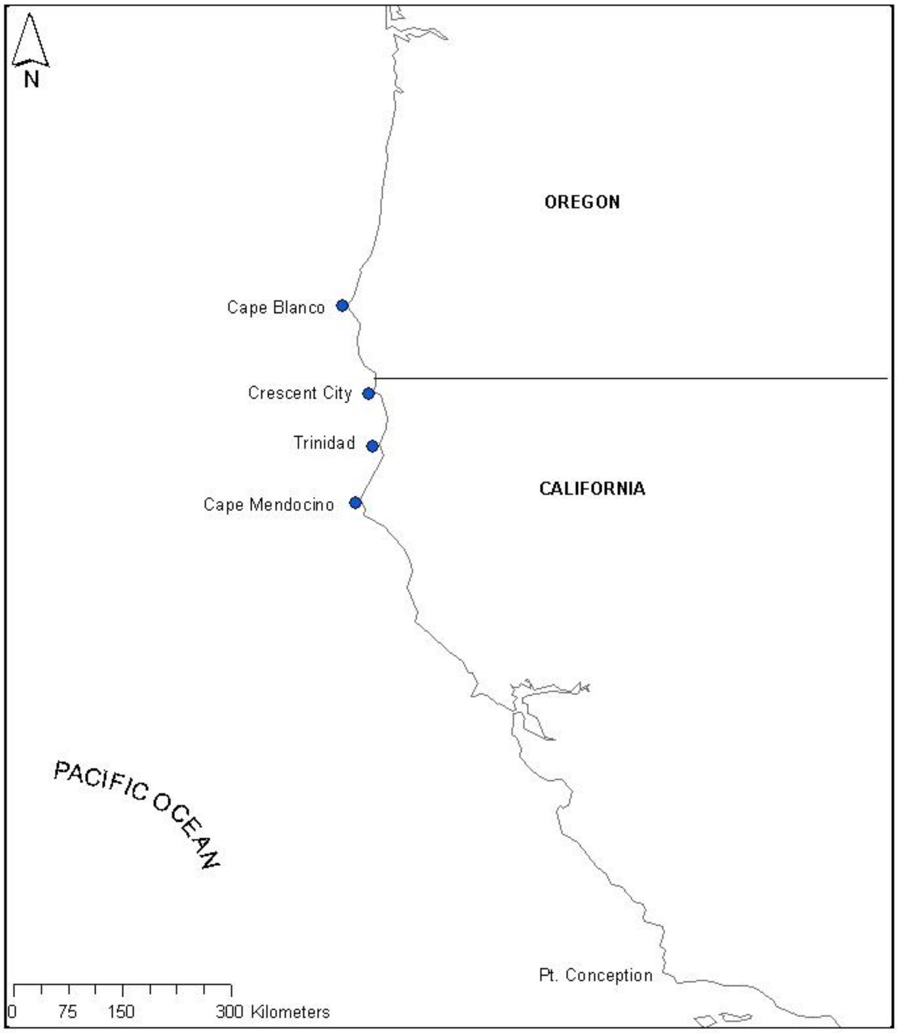

Figure 1. Map of the four study locations.

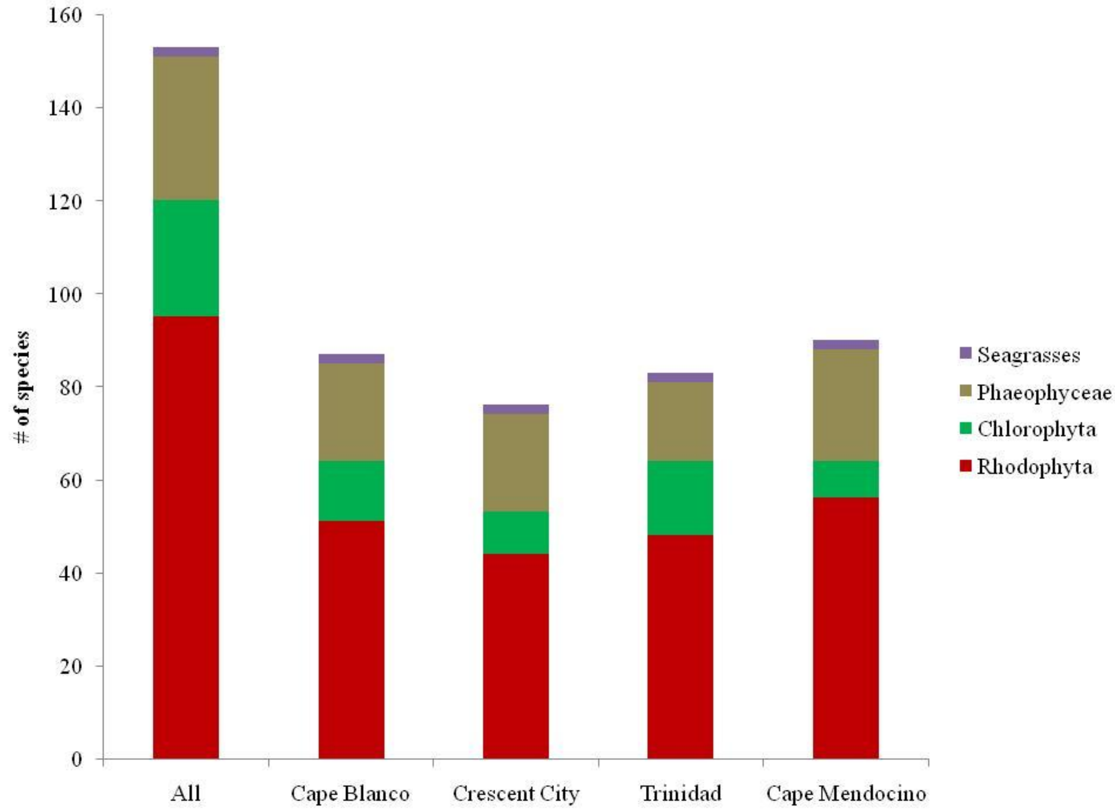

Figure 2. Number of seaweed and seagrass taxa found at each of the four locations for the 2010 field season grouped by phylum.

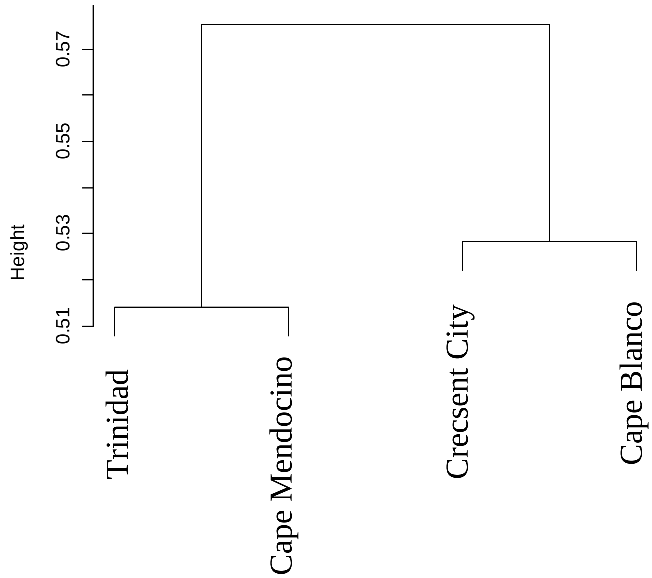

Figure 3. Cluster analysis dendrogram based on farthest neighbor joining methods showing locations arranged by presence/absence of species.

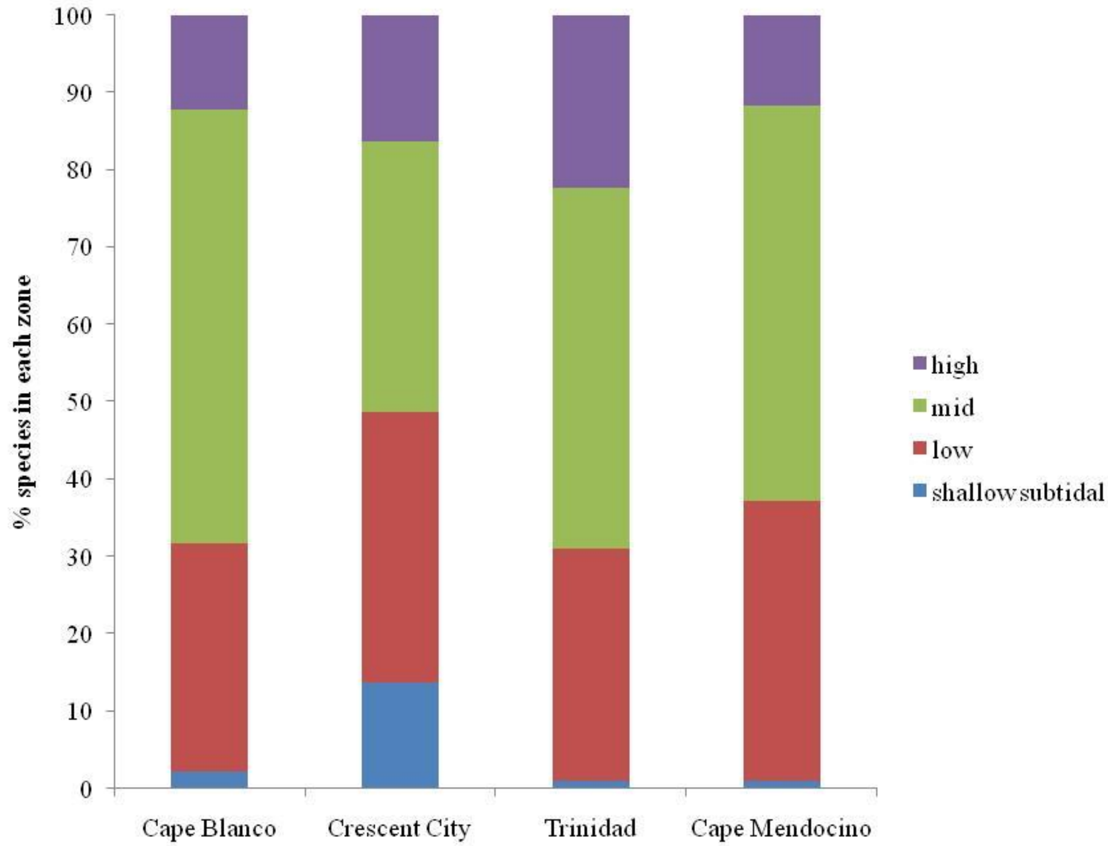

Figure 4. Percentage of species in each zone for each site.

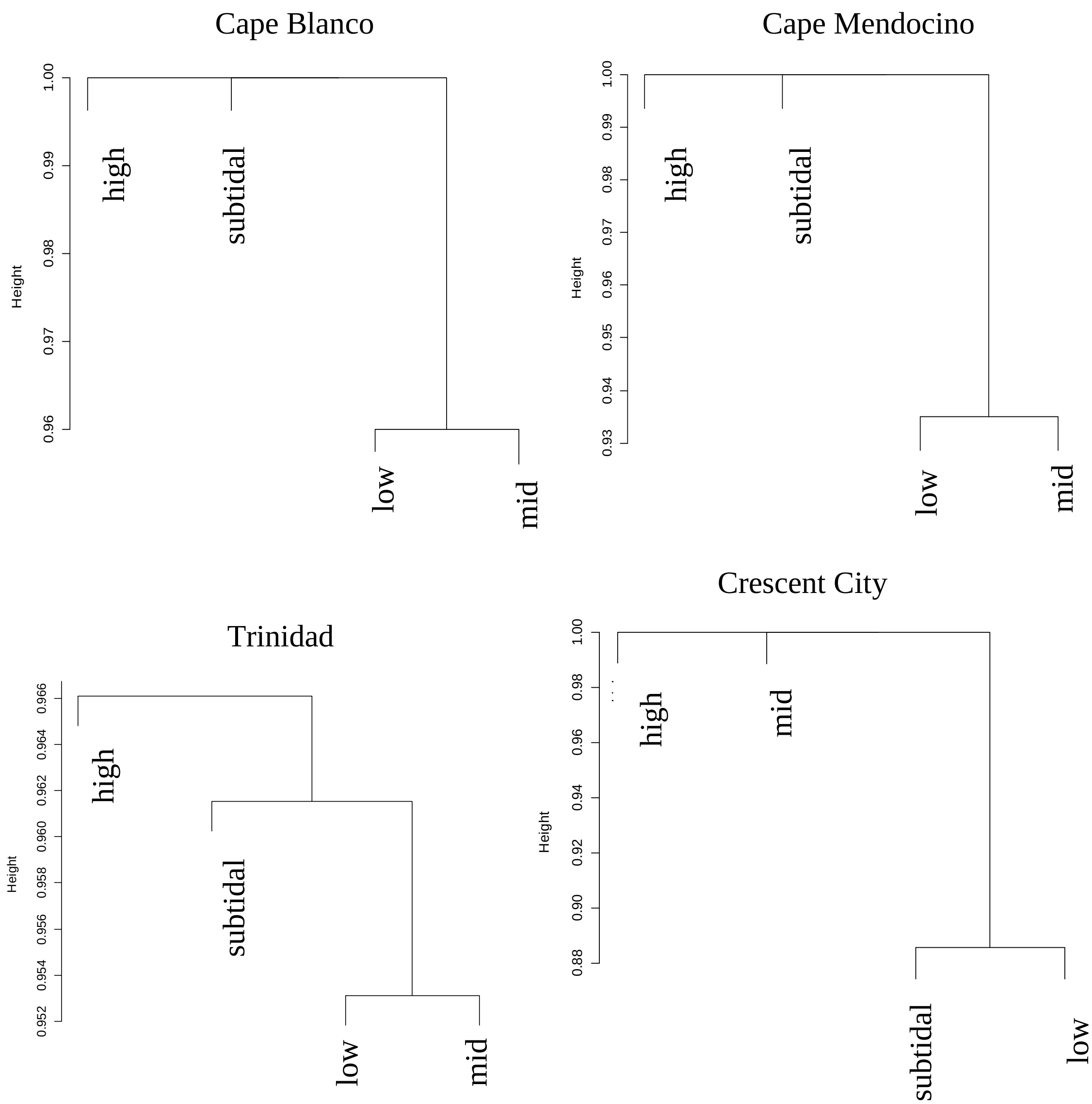

Figure 5. Cluster analysis dendrograms based on farthest neighbor joining methods of four intertidal zones grouped by species within each of the sites.

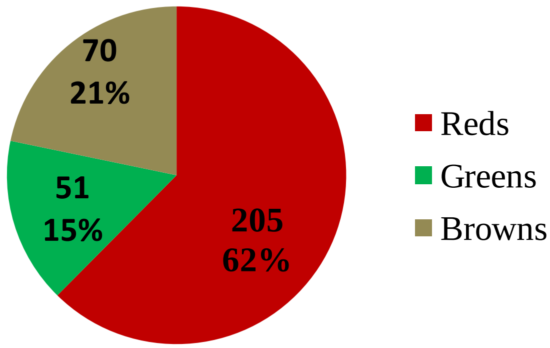

Figure 6. Number and percent of macroalgae and seagrasses species from Cape Mendocino, CA to Cape Blanco, OR grouped by phylum based on current and historical records (Appendix B).

Appendix A. Marine macroalgae and seagrasses taxa between Cape Mendocino and Cape Blanco found during 2009 and 2010. Taxa are arranged by phylum. The four survey locations (Cape Blanco, Crescent City, Trinidad and Cape Mendocino) are listed. Tidal height is indicated as S= splash, H=high, M=mid, L=low, SS=shallow subtidal. Also included are the following habitat attributes: if the species occurred in a tidepool, if sand was present, and substrate type (epilithic, epiphytic, epizooic, and endophytic).

Species Name & Authority	B	C	T	M	Zone	TP	Sand	Substrate
Chlorophyta								
Acrochaete geniculata (N.L. Gardner) O'Kelly	X				L	N	N	Endophytic in *Laminaria*
Acrochaete wittrockii (Wille) R. Nielsen		X			M	N	N	Endophytic on *Spacelaria racemosa*
Acrosiphonia arcta (Dillwyn) Gain	X	X	X		M, H	N	N	Epilithic
Acrosiphonia coalita (Ruprecht) Scagel, Garbary, Golden et M.W. Hawkes	X		X	X	M	N	N	Epilithic
Blidingia dawsonii (Hollenberg et Abbott) Lindstrom, Hanic et Golden	X				M	N	N	Epizoic on shell
Blidingia minima var. *minima* (Nägeli ex Kützing) Kylin	X		X	X	M, H	N	N	Epiphytic on *Fucus*, epilithic, epizoic on limpet shell
Blidingia minima var. *vexata* (Setchell et N.L. Gardner) Norris				X	H	N	N	Epilithic
Bryopsis corticulans Setchell			X		H	Y	N	Epilithic

Species Name & Authority	B	C	T	M	Zone	TP	Sand	Substrate
Chaetomorpha aerea (Dillwyn) Kützing				X	H	Y	Y	Epilithic
Cladophora columbiana Collins	X		X	X	H	N	N	Epilithic
Codium fragile (Suringar) Hariot	X		X		M, H	N	N	Epilithic
Codium setchellii N.L. Gardner		X	X	X	L	N	N	Epilithic
Collinsiella tuberculata Setchell et N.L. Gardner	X	X	X		M	N	N	Epilithic
Endophyton ramosum N.L. Gardener	X				L	N	N	Endophytic in *Mazzaella*
Halochlorococcum porphyrae (Setchell et N.L. Gardner) J.A. West			X		M	N	N	Endophytic in *Porphyra*
Kornmannia leptoderma (Kjellman) Bliding	X	X			H	Y	N	Epiphytic on *Phyllospadix*
Prasiola meridionalis Setchell et N.L. Gardner		X			S	N	N	Epilithic
Rhizoclonium tortuosum (Dillwyn) Kützing	X		X		L, M	N	N	Epilithic and epizoic on limpet shell
Ulothrix flacca (Dillwyn) Thuret			X		M, H	N	N	Epiphytic on *Fucus*, epilithic
Ulva californica Wille		X	X	X	L, M	N	N	Epilithic
Ulva intestinalis Linnaeus	X		X	X	H, S	N	N	Epilithic
Ulva lactuca Linnaeus	X	X	X	X	M	N	Y	Epilithic
Ulva linza Linnaeus	X	X		X	M, H	Y/N	N	Epilithic
Ulva lobata (Kützing) Harvey		X			H	Y	Y	Epilithic
Ulva stenophylla Setchell et N.L. Gardener			X		L	Y	N	Epilithic
Urospora pencilliformis (Roth) Areschoug	X			X	H, S	N	Y	Epilithic
Urospora wormskjoldii (Mertens ex Hornemann) Rosenvinge			X		H	N	N	Epilithic

Species Name & Authority	B	C	T	M	Zone	TP	Sand	Substrate
Heterokontophyta (Phaeophyceae)								
Alaria marginata Postels et Ruprecht	X	X	X	X	L, M	Y/N	Y/N	Epilithic
Analipus japonicus (Harvey) Wynne		X	X	X	M, H	N	N	Epilithic
Coilodesme californica (Ruprecht) Kjellman			X		L	N	N	Epiphytic on *Cystoseira*
Colpomenia peregrina Sauvageau	X	X	X		M	Y/N	N	Epilithic, epiphytic on *Neorhodomela larix*
Costaria costata (Agardh) Saunders	X			X	L	Y/N	N	Epilithic
Cystoseira osmundacea (Turner) Agardh	X	X	X	X	L	N	Y/N	Epilithic
Desmarestia latifrons (Ruprecht) Kützing	X				H	N	Y	Epilithic
Desmarestia ligulata (Stackhouse) Lamouroux	X	X	X	X	L, M	Y/N	N	Epilithic
Ectocarpus fasciculatus Harvey		X		X	L	N	N	Epiphytic on *Egregia*, and *Cystoseira*
Ectocarpus siliculosus (Dillwyn) Lyngbye	X				L	N	N	Epiphytic on *Cystoseira*
Egregia menziesii (Turner) Areschoug	X	X	X	X	L, M	N	N	Epilithic
Elachista fucicola (Velley) Areschoug	X				L	N	N	Epiphytic
Fucus gardneri Silva	X	X	X	X	M	N	N	Epilithic
Haplogloia andersonii (Farlow) Levring	X	X	X	X	L, M	Y/N	N	Epilithic
Hecatonema streblonematoides (Setchell et N.L. Gardner) Loiseaux		X			L	N	N	Epiphytic *Desmarestia*

Species Name & Authority	B	C	T	M	Zone	TP	Sand	Substrate
Laminaria ephemera Setchell				X	L	N	N	Epilithic
Laminaria setchellii Silva	X	X	X	X	S, L	Y/N	N	Epilithic
Laminaria sinclairii (Harvey ex Hooker et Harvey) Farlow, Anderson et Eaton	X	X	X	X	L, M	N	Y/N	Epilithic
Leathesia difformis (Linnaeus) Areschoug	X			X	M, H	N	N	Epilithic
Lessoniopsis littoralis (Tilden) Reinke	X		X	X	L	N	N	Epilithic
Nereocystis leutkeana (Mertens) Postels et Ruprecht	X	X	X	X	L, M	Y/N	N	Epilithic
Pelvetiopsis limitata (Setchell) N.L. Gardner			X	X	H	N	N	Epilithic
Phaeostrophion irregulare (Setchell) N.L. Gardner	X	X	X	X	M, H	Y/N	Y/N	Epilithic
Postelsia palmaeformis Ruprecht	X		X		L	N	N	Epilithic
Pterygophora californica Ruprecht	X	X		X	S	N	N	Epilithic
Ralfsia pacifica Hollenberg		X			M	N	N	Epilithic
Saccharina sessile (Agardh) Kuntze	X	X	X	X	L, M	Y/N	N	Epilithic
Sargassum muticum (Yendo) Fensholt		X			M	N	Y	Epilithic
Scytosiphon dotyi Wynne			X	X	H	Y	N	Epilithic
Scytosiphon lomentaria (Lyngbye) Link			X		H	Y	N	Epilithic
Soranthera ulvoidea Postels et Ruprecht	X	X	X	X	M, H	Y/N	Y/N	Epilithic, epiphytic on *Odonthalia*
Sphacelaria racemosa Greville		X			M	N	Y	Epilithic

Rhodophyta

Species Name & Authority	B	C	T	M	Zone	TP	Sand	Substrate
Acrochaetium densum (K. M. Drew) Papenfuss				X	L	N	N	Epiphytic on *Egregia*
Ahnfeltia fastigiata (Endlicher) Makienko			X	X	L, M	N	Y	Epilithic

Species Name & Authority	B	C	T	M	Zone	TP	Sand	Substrate
Ahnfeltiopsis gigartinoides (Agardh) Silva et DeCrew	X			X	M	Y/N	Y/N	Epilithic
Ahnfeltiopsis linearis (Agardh) Silva et DeCrew	X	X	X	X	L, M	N	Y/N	Epilithic
Antithamnionella spirographidis (Schiffner) Wollaston				X	M	N	N	Epiphytic on *Ceramium*
Bangia sp.	X				H	N	N	Epilithic
Bossiella chiloensis (Decaisne) Johansen		X			L	N	N	Epilithic
Bossiella orbigniana subsp. *dichotoma* (Manza) Silva			X	X	M	N	N	Epilithic
Bossiella orbigniana subsp. *orbigniana* (Decaisne) Silva	X		X		M, H	Y/N	N	Epilithic
Bossiella plumosa (Manza) Silva				X	L	N	N	Epilithic
Calliarthron tuberculosum (Postels et Ruprecht) Dawson	X	X	X	X	L, M	Y/N	N	Epilithic
Callithamnion pikeanum Harvey	X	X	X	X	L, M	N	N	Epilithic
Callophyllis pinnata Setchell et Swezy in Setchell		X		X	L	N	N	Epiphytic on *Cystoseira*
Callophyllis violacea Agardh	X			X	M	N	N	Epilithic
Ceramium gardneri Kylin			X		M, H	N	N	Epilithic
Ceramium pacificum (Collins) Kylin			X	X	M, H	N	N	Epilithic
Chondracanthus canaliculatus (Harvey) Guiry	X		X	X	M, H	Y/N	N	Epilithic
Chondracanthus exasperates (Harvey et Bailey) J.R. Hughey				X	M	Y/N	N	Epilithic
Clathromorphum reclinatum (Foslie) Adey				X	L	N	N	Epiphytic on *Ahnfeltiopsis*
Colaconema rhizoideum (K.M. Drew) P.W. Gabrielson				X	L	N	N	Epiphytic on *Codium*
Constantinea simplex Setchell	X	X	X	X	L, M	N	Y/N	Epilithic
Corallina officinalis var. *chilensis* Kützing	X	X	X	X	L, M	Y/N	N	Epilithic

Species Name & Authority	B	C	T	M	Zone	TP	Sand	Substrate
Corallina vancouverensis Yendo	X		X	X	L, M	Y/N	N	Epilithic
Cryptopleura lobulifera (Agardh) Kylin	X		X	X	L, M	Y/N	N	Epilithic
Cryptopleura ruprechtiana (Agardh) Kylin	X	X	X	X	L, M	N	N	Epilithic
Cryptopleura violacea (Agardh) Kylin			X		L, M	Y	N	Epilithic
Cryptosiphonia woodii (Agardh) Agardh	X	X	X	X	M	N	Y/N	Epilithic
Cumathamnion sympodophyllum M.J. Wynne et K. Daniels			X		M	N	N	Epilithic
Delesseria decipiens Agardh	X		X		L, M	N	N	Epilithic
Dilsea californica (Agardh) Kuntze	X	X	X	X	L, M	Y/N	N	Epilithic
Endocladia muricata (Endlicher) Agardh	X	X	X	X	M, H	N	N	Epilithic
Erythrophyllum delesserioides Agardh	X	X	X		L, M	N	N	Epilithic
Erythrotrichia carnea (Dillwyn) Agardh		X			L	N	N	Epiphytic on *Alaria marginata*
Farlowia conferta (Setchell) Abbott	X	X			M, H	Y/N	N	Epilithic
Farlowia mollis (Harvey et Bailey) Farlow et Setchell	X	X	X	X	M, H	Y/N	Y/N	Epilithic
Gastroclonium subarticulatum (Turner) Kützing			X	X	M, H	N	N	Epilithic
Gelidium coulteri Harvey				X	M	Y	N	Epilithic
Gloiopeltis furcata (Postels et Ruprecht) Agardh			X		M	N	N	Epilithic
Gloiosiphonia californica (Farlow) J. Agardh				X	M	N	N	Epilithic
Gloiosiphonia verticillaris Farlow	X	X			M, H	Y/N	Y	Epilithic
Gonimophyllum skottsbergii Setchell				X	L	N	N	Parasitic on *Cryptopleura ruprechtiana*

Species Name & Authority	B	C	T	M	Zone	TP	Sand	Substrate
Gracilariopsis andersonii (Grunow) E.Y. Dawson		X			M	N	Y	Epilithic
Grateloupia doryphora (Montagne) Howe			X	X	M	Y	Y	Epilithic
Halosaccion glandiforme (Gmelin) Ruprecht	X	X	X	X	M	N	N	Epilithic, epiphytic on *Corallina vancouveriensis*
Halymenia schizymenioides Hollenberg et Abbott			X	X	M, H	N	N	Epilithic
Hildenbrandia occidentalis Setchell	X		X		L	N	N	Epilithic
Hildenbrandia rubra (Sommerfelt) Meneghini	X				M	N	N	Epilithic
Hymenena flabelligera (Agardh) Kylin				X	H	N	N	Epilithic
Hymenena multiloba (Agardh) Kylin				X	L	Y	Y	Epilithic
Janczewskia gardneri Setchell et Guernsey	X	X			L	N	N	Parasitic on *Osmundea spectabilis*
Lithophyllum dispar (Foslie) Foslie	X			X	L, M	Y/N	Y/N	Epilithic, epiphytic on *Prionitis* and *Ahnfeltiopsis*
Lithophyllum impressum Foslie	X				M	N	N	Epilithic
Mastocarpus jardinii (Agardh) West	X	X	X	X	M	N	N	Epilithic
Mastocarpus papillatus sp. *complex* (Agardh) Kützing	X	X	X	X	M	N	N	Epilithic
Mazzaella flaccida (Setchell et N.L. Gardner) Guiry	X	X	X	X	M	N	N	Epilithic
Mazzaella linearis (Setchell et N.L. Gardner) Guiry				X	L	N	Y	Epilithic
Mazzaella oregona (Doty) Hughey, Silva et Hommersand	X	X	X	X	L, M	N	N	Epilithic

Species Name & Authority	B	C	T	M	Zone	TP	Sand	Substrate
Mazzaella parksii (Setchell et N.L. Gardner) Guiry	X		X	X	H	N	N	Epilithic
Mazzaella splendens (Setchell et N.L. Gardner) Fredericq	X	X		X	L, M	N	N	Epilithic
Mazzaella volans (C. Agardh) Fredericq	X	X	X	X	L, M	N	N	Epilithic
Melobesia mediocris (Foslie) Setchell et Mason	X	X	X		SS, L	Y/N	N	Epiphytic on *Phyllospadix*
Mesophyllum conchatum (Setchell et Foslie) Adey			X		L	N	N	Epiphytic on *Bossiella* and *Egregia menziesii*
Microcladia borealis Ruprecht		X	X	X	L	N	N	Epilithic
Microcladia coulteri Harvey	X				L	N	N	Epiphytic on *Cystoseira* stipe
Neorhodomela hypnoides(Harvey) Kylin			X		M	N	N	Epiphytic on corallines
Neorhodomela larix (Turner) Masuda	X	X	X	X	M	N	N	Epilithic
Odonthalia floccosa (Esper) Falkenberg	X	X	X	X	M	N	N	Epilithic
Odonthalia washingtoniensis Kylin			X	X	L, M	N	N	Epilithic
Osmundea spectabilis (Postels et Ruprecht) Nam	X	X	X	X	L, M	N	N	Epilithic
Palmaria mollis (Setchell et Gardner) van der Meer et Bird			X		M	Y	N	Epilithic
Pikea californica Harvey	X		X	X	L, M	Y/N	N	Epilithic
Pikea pinnata Setchell		X	X		L	N	N	Epilithic
Plocamiocolax pulvinata Setchell				X	M	N	N	Parasitic on *Plocamium*
Plocamium oregonum Doty	X		X	X	M	N	N	Epilithic

Species Name & Authority	B	C	T	M	Zone	TP	Sand	Substrate
Plocamium pacificum Kylin	X	X	X	X	L, M	N	N	Epilithic
Plocamium violaceum Farlow		X	X	X	L, M	N	N	Epilithic
Polyneura latissima (Harvey) Kylin	X	X	X		L	N	N	Epilithic
Polysiphonia hendryi var. *deliquescens* (Hollenberg) Hollenberg			X		M, H	N	N	Epilithic
Polysiphonia hendryi var. *gardneri* (Kylin) Hollenberg			X	X	M, H	N	Y	Epilithic
Polysiphonia hendryi var. *hendryi* N.L. Gardner		X	X	X	M, H	N	Y/N	Epilithic
Polysiphonia hendryi var. *luxurians* (Hollenberg) Hollenberg	X	X	X	X	M	N	N	Epilithic
Polysiphonia paniculata Montagne	X			X	M	N	N	Epilithic
Porphyra abbottiae Krishnamurthy			X	X	M	N	N	Epilithic
Porphyra conwayae (Lindstrom et Cole) Lindstrom et Fredericq			X	X	M	N	N	Epilithic
Porphyra gardneri (Smith & Hollenberg) Hawkes	X		X		L	N	N	Epiphytic on *Laminaria*
Porphyra kanakaensis T.F. Mumford			X	X	M	N	N	Epilithic
Porphyra lanceolata (Harvey) Harvey	X	X			M	N	N	Epilithic
Porphyra nereocystis Anderson		X	X		SS	N	N	Epiphytic on *Nereocystis* pneumatocysts
Porphyra occidentalis Setchell et Hus		X			H	Y	Y/N	Epilithic
Porphyra perforata Agardh			X	X	M	N	N	Epilithic
Porphyra schizophylla G.J. Hollenberg	X		X		M	N	N	Epilithic
Porphyra smithii Hollenberg et I.A. Abbott			X		M	N	N	Epiphytic on *Mastocarpus*
Porphyrostromium boryanum (Montagne) P.C. Silva		X			L	N	N	Epiphytic on

Species Name & Authority	B	C	T	M	Zone	TP	Sand	Substrate
								Cystoseira
Prionits filiformis Kylin			X	X	M	N	N	Epilithic
Prionits lanceolata (Harvey) Harvey	X	X	X	X	L, M	N	N	Epilithic
Prionits sternbergii (C. Agardh) J. Agardh	X	X	X	X	L	N	Y/N	Epilithic
Pseudolithophyllum muricatum (Foslie) Steneck et R.T. Paine				X	L	N	N	Epizoic on snail shell
Pterochondria woodii (Harvey) Hollenberg	X	X		X	SS, L	N	N	Epiphytic on *Egregia* and *Cystoseira*
Ptilota filicina Agardh		X	X		SS, L	N	N	Epilithic, epiphytic on *Cystoseira*
Rhodochorton purpureum (Lightfoot) Rosenvinge			X		S	N	N	Epilithic
Rhodymenia pacifica Kylin				X	L	N	N	Epilithic
Schizymenia pacifica (Kylin) Kylin	X		X		L	Y	N	Epilithic
Smithora naiadum (Anderson) Hollenberg	X	X			M	N	Y	Epiphytic on *Phyllospadix*
Tiffaniella snyderae (Farlow) Abbott		X	X	X	L, M	N	N	Epilithic
Anthophyta								
Phyllospadix scouleri W. J. Hooker	X	X	X	X	L, M	Y/N	Y	Epilithic
Phyllospadix torreyi S. Watson	X	X	X	X	L	N	Y/N	Epilithic

Appendix B. Marine macroalgae and seagrasses from Cape Mendocino, California to Cape Blanco, Oregon. The table indicates if species were found by DeCew and Silva (1985), Augyte (2010), the HSU cryptogamic herbarium, Doty (1947a, b), and/or Dawson (1965).

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Chlorophyta					
Acrochaete geniculata (N.L. Gardner) O'Kelly		X		as *Pseudodictyon geniculatum* N.L. Gardner	as *Pseudodictyon geniculatum* N.L. Gardner
Acrochaete ramosa (N.L. Gardner) O'Kelly				as *Endophyton ramosum* N.L. Gardner	as *Endophyton ramosum* N.L. Gardner
Acrochaete wittrockii (Wille) R. Nielsen		X			
Acrosiphonia arcta (Dillwyn) Gain		X			

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Acrosiphonia coalita (Ruprecht) Scagel, Garbary, Golden & M.W. Hawkes		X	X	as *Spongomorpha coalita* (Ruprecht) F.S. Collins	as *Spongomorpha coalita* (Ruprecht) F.S. Collins
Acrosiphonia mertensii (Ruprecht) Yendo				as *Spongomorpha mertensii* (Ruprecht) Setchell & N.L. Gardner	as *Spongomorpha mertensii* (Ruprecht) Setchell & N.L. Gardner
Acrosiphonia saxatilis (Ruprecht) Vinogradova	as *Acrosiphonia spinescens* (Kützing) Kjellman		X	as *Spongomorpha saxatilis* (Ruprecht) F.S. Collins	as *Spongomorpha saxatilis* (Ruprecht) F.S. Collins
Blidingia dawsonii (Hollenberg & I.A. Abbott) S.C. Lindstrom, L.A. Hanic & L. Golden	X	X		as *Percursaria dawsonii* Hollenberg & I.A. Abbott	

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Blidingia marginata (J. Agardh) P. Dangeard				as *Enteromorpha marginata* J. Agardh, prox.	
Blidingia minima (Nägeli ex Kützing) Kylin		as *Blidingia minima* var. *vexata* (Setchell & N.L. Gardner) J.N. Norris		as *Blidingia minima* (Nägeli ex Kützing) Kylin var. *minima*, as *Ulva vexata* Setchell & N.L. Gardner	as *Enteromorpha minima* Nägeli in Kützing, as *Enteromorpha vexata* (Setchell et N.L. Gardner) comb. nov.
Blidingia subsalsa (Kjellman) Kornmann & Sahling ex Scagel et al.					as *Enteromorpha minima* var. *subsalsa* (Kjellman) comb. nov.
Bryopsis corticulans Setchell		X	X	X	X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Bryopsis hypnoides Lamouroux			X	X	
Chaetomorpha aerea (Dillwyn) Kützing	X	X	X	as *Chaetomorpha linum* (O.F. Müller) Kützing	
Cladophora albida (Nees) Kützing			as *Cladophora albida* (Hudson) Kützing		
Cladophora columbiana Collins		X	X	as *Cladophora hemispherica* N.L. Gardner, as *Cladophora trichotoma* (C. Agardh) Kützing	as *Cladophora hemispherica* Gardner & Collins, apud Collins, as *Cladophora trichotoma* (C. Agardh) Kützing, as *Spongomorpha*

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
					duriuscula (Ruprecht) Collins
Cladophora hutchinsiae (Dillwyn) Kützing			X	X	
Cladophora microcladioides Collins				X	X
Cladophora sericea (Hudson) Kützing				as *Cladophora flexuosa* (Griffith) Harvey	
Cladophora stimpsonii Harvey	X				
Codium fragile (Suringar) Hariot		X	X	X	X
Codium setchellii		X	X	X	X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
N.L. Gardner					
Collinsiella tuberculata Setchell & N.L. Gardner		X		X	X
Derbesia marina (Lyngbye) Solier					as *Halicystis ovalis* (Lyngbye) Areschoug
Endophyton ramosum N.L. Gardener		X			
Gayralia oxysperma (Kützing) K.L. Vinogradova ex Scagel *et al.*			X	as *Monostroma oxyspermum* (Kützing) Doty	as *Monostroma oxyspermum* (Kützing) comb. nov.
Halochlorococcum porphyrae		X			as *Chlorochytrium porphyrae*

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
(Setchell & N.L. Gardner) J.A. West					Setchell & Gardner
Kornmannia leptoderma (Kjellman) Bliding		X		as *Monostroma zostericola* Tilden	as *Monostroma zostericola* Tilden
Lola lubrica (Setchell & N.L. Gardner) A. Hamel & G. Hamel					as *Rhizoclonium lubricum* Setchell & Gardner, apud Gardner
Percursaria percursa (C. Agardh) Rosenvinge			X		
Prasiola meridionalis Setchell & N.L. Gardner		X		X	X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Pseudulvella consociata Setchell & N.L. Gardner	X				X
Rhizoclonium riparium (Roth) Harvey			X	as *Rhizoclonium implexum* (Dillwyn) Kützing	also as *Rhizoclonium implexum* (Dillwyn) Kützing
Rhizoclonium tortuosum (Dillwyn) Kützing		X			X
Ulothrix flacca (Dillwyn) Thuret		X		as *Ulothrix laetevirens* (Kützing) Collins, as *Ulothrix pseudoflacca* Wille	also as *Ulothrix pseudoflacca* Wille
Ulothrix implexa (Kützing) Kützing					X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Ulva californica Wille		X	X	as *Ulva angusta* Setchell et N.L. Gardner, prox.	as *Enteromorpha angusta* (Setchell & Gardner) comb. nov.
Ulva clathrata (Roth) C. Agardh			X	as *Enteromorpha clathrata* (Roth) Greville, as *Enteromorpha muscoides* (Clemente) Cremades	as *Enteromorpha clathrata* (Roth) Greville
Ulva compressa Linnaeus				as *Enteromorpha compressa* (Linnaeus) Nees	as *Enteromorpha compressa* (Linnaeus) Nees
Ulva flexuosa Wulfen	X		X		as *Enteromorpha prolifera* var. *flexuosa* (Wulf.) comb. nov., Also

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
					as *Enteromorpha linza* var. *flexicaulis* var. nov.
Ulva intestinalis Linnaeus		X	X	as *Enteromorpha intestinalis* (Linnaeus) Nees	as *Enteromorpha intestinalis* (L.) Link
Ulva lactuca Linnaeus		X	X	as *Ulva fenestrata* Postels et Ruprecht, as *Ulva latissima* Linnaeus	as *Ulva expansa* (Setchell) Setchell & Gardner
Ulva linza Linnaeus		X	X	as *Enteromorpha linza* (Linnaeus) J. Agardh	as *Enteromorpha ahlneriana* Bliding, as *Enteromorpha linza* (L.) J. Agardh, as *Enteromorpha*

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
					linza var. *lanceolata* J. Agardh, as *Enteromorpha linza* var. *crispata* J. Agardh, as *Enteromorpha linza* var. *oblanceolata* var. nov.
Ulva lobata (Kützing) Harvey		X	X	X	as *Ulva lobata* (Kützing) Setchell & Gardner
Ulva prolifera O. F. Müller					as *Enteromorpha prolifera* (Müller) J. Agardh
Ulva stenophylla Setchell & N.L.		X	X		

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Gardener					
Ulva taeniata (Setchell) Setchell & N.L. Gardner	X				X
Ulva torta (Mertens) Trevisan	X				
Urospora doliifera (Setchell & N.L. Gardner) Doty				X	X
Urospora pencilliformis (Roth) Areschoug	X	X	X	X	X
Urospora wormskioldii (Mertens ex Hornemann)		X		as *Urospora grandis* Kylin, as *Urospora sphaerulifera* Setchell et N.L.	as *Urospora grandis* Kylin

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Rosenvinge				Gardner	
Heterokontophyta, Phaeophyceae					
Alaria marginata Postels et Ruprecht		X	X	X	X
Alaria nana Schrader				X	
Analipus japonicus (Harvey) Wynne		X	X	as *Heterochordaria abietina* (Ruprecht) Setchell et N.L. Gardner	*Heterochordaria abietina* (Ruprecht) Setchell & Gardner
Coilodesme californica (Ruprecht) Kjellman		X	X	X	X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Coilodesme plana Hollenberg & I. A. Abbott			X		
Colpomenia bullosa (Saunders) Yamada			X	as *Heterochordaria abietina* (Ruprecht) Setchell & Gardner	as *Scytosiphon bullosus* Saunders
Colpomenia peregrina (Sauvageau) Hamel		X	X		X
Compsonema fructosum Setchell & N.L. Gardner				X	
Costaria costata (Agardh) Saunders		X	X	as *Costaria costata* (Turner) Saunders	also as *Costaria mertensii* J. Agardh
Cystoseira osmundacea (Turner) Agardh		X	X	as *Cystoseira osmundacea* (Menzies) Agardh	X
Desmarestia aculeata					as *Desmarestia intermedia* Postels

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
(Linnaeus) Lamouroux					& Ruprecht
Desmarestia latifrons (Ruprecht) Kützing	X	X	X	X	X
Desmarestia ligulata (Stackhouse) Lamouroux		X	X	as *Desmarestia herbacea* (Turner) Lamouroux	as *Desmarestia herbacea* (Turner) Lamouroux
Desmarestia munda Setchell et N.L. Gardner				X	
Desmarestia viridis (Müller) Lamouroux			X	X	
Dictyoneurum californicum Ruprecht			X	X	
Dictyota binghamiae J. Agardh	X				
Ectocarpus commensalis Setchell et N.L.				X	

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Gardner					
Ectocarpus corticulatus Saunders				as *Ectocarpus confervoides* (Roth) Le Jolis	
Ectocarpus fasciculatus Harvey		X	X	as *Ectocarpus acutus* Setchell et N. L. Gardner	as *Ectocarpus acutus* Setchell & Gardner
Ectocarpus siliculosus (Dillwyn) Lyngbye		X		also as *Ectocarpus simulans* Setchell et N.L. Gardner	
Egregia menziesii (Turner) Areschoug		X	X	X	X
Elachista fucicola (Velley) Areschoug	X	X		as *Elachistea fucicola* (Velley) Areschoug	
Feldmannia paradoxa var. *cylindrica* (Saunders) Kim et Lee				as *Ectocarpus cylindricus* var. *codiophilus* Setchell et N.L. Gardner	

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Fucus gardneri Silva		X	X	as *Fucus distichus* Linnaeus, emend. Powell	X
Fucus parksii N.L. Gardner					
Halorhipis winstonii (Anderson) Saunders			X		
Haplogloia andersonii (Farlow) Levring		X	X	X	X
Hecatonema primarium (Setchell et N.L. Gardner) Loiseaux				as *Myrionema primarium* Setchell et N. L. Gardner	
Hecatonema streblonematoides (Setchell et N.L. Gardner) Loiseaux		X		as *Compsonema pusillum* Setchell et N. L. Gardner	
Hincksia granulosa (J.E. Smith) P.C. Silva	X				

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Laminaria ephemera Setchell	X	X	X	X	
Laminaria setchellii Silva		X		as *Laminaria setchellii* (Anderson) Eaton	*Laminaria andersonii* Eaton in Hervey
Laminaria sinclairii (Harvey ex Hooker et Harvey) Farlow, Anderson et Eaton		X	X	X	*Laminaria sinclairii* (Areschoug) Anderson
Laminariocolax aecidioides (Rosenvinge) Peters				as *Streblonema aecidioides* De Toni	
Leathesia difformis (Linnaeus) Areschoug		X	X	X	also as *Leathesia nana* Setchell & Gardner
Lessoniopsis littoralis (Tilden) Reinke		X	X	X	X
Macrocystis integrifolia Bory de Saint-Vincent					*Macrocystis pyrifera* (L.) C. Agardh

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Melanosiphon intestinalis (Saunders) Wynne			X	as *Myelophycus intestinale f. tenue* Setchell et N.L. Gardner	
Myrionema balticum (Reinke) Foslie				as *Myrionema attenuatum* Setchell et N.L. Gardner	
Myrionema corunnae Sauvageau				also as *Myrionema minutissimum* Setchell et N.L. Gardner	
Nereocystis leutkeana (Mertens) Postels et Ruprecht		X	X	X	X
Pelvetiopsis limitata (Setchell) N.L. Gardner		X	X	X	X
Petalonia fascia (Müller) Kuntze				as *Petalonia debilis* (C. Agardh) Derbes et Solier	*Ilea fascia* (Miller) Fries

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Petroderma maculiforme (Wollny) Kuckuck	X				
Phaeostophion irregulare Setchell et N.L. Gardener		X	X		X
Pylaiella N.L. Gardneri Collins in Collins et al.	X				
Pylaiella littoralis (Linnaeus) Kjellman				as *Pylaiella littoralis* (Linnaeus) Kjellman	X
Pleurophycus N.L. Gardneri Setchell et Saunders ex Tilden	X		X		X
Postelsia palmaeformis Ruprecht		X	X	X	X
Pterygophora californica Ruprecht		X	X	X	X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Punctaria hesperia Setchell et N.L. Gardener			X		
Punctaria occidentalis Setchell et N.L. Gardner			X	X	
Ralfsia hesperia Setchell et N.L. Gardner			X	X	
Ralfsia pacifica Hollenberg		X			
Saccharina latissima (Linnaeus) C.E. Lane, C. Mayes, Druehl & G.W. Saunders	as *Laminaria saccharina*		as *Laminaria saccharina*		as *Laminaria cuneifolia* J.Agardh
Saccharina sessilis (Agardh) Kuntze		X	X	as *Hedophyllum sessile* (C. Agardh) Setchell	X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Sargassum muticum (Yendo) Fensholt		X	X	X	
Scytosiphon attenuatus Kjellman					as *Scytosiphon attenuatus* (FosIie) comb. nov.
Scytosiphon dotyi Wynne		X		as *Scytosiphon attenuatus* (Foslie) Doty	
Scytosiphon lomentaria (Lyngbye) Link		X	X	as *Scytosiphon lomentaria* (Lyngbye) J. Agardh, as *Scytosiphon complanatus* (Rosenvinge) Doty	X
Soranthera ulvoidea Postels et Ruprecht		X	X	X	X
Sphacelaria plumigera Holmes	X				

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Sphacelaria racemosa Greville		X		X	X
Sphacelaria rigidula Kützing				as *Sphacelaria furcigera* Kützing	
Spongonema tomentosum (Hudson) Kützing				as *Ectocarpus tomentosus* (Hudson) Lyngbye	
Streblonema evagatum Setchell et N.L. Gardner				X	
Streblonema pacificum Saunders				X	
Syringoderma abyssicola (Setchell et N.L. Gardner) Levring				X	
Rhodophyta					

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Acrochaetium densum (K.M. Drew) Papenfuss		X			
Acrochaetium porphyrae (Drew) Smith				as *Acrochaetium ascidiophilum* E. Y. Dawson, prox.	
Ahnfeltia fastigiata (Endlicher) Makienko		X	X	as *Ahnfeltia plicata* (Hudson) Fries	as *Ahnfeltia plicata* (Hudson) Fries
Ahnfeltiopsis gigartinoides (Agardh) Silva et DeCrew		X	X	as *Ahnfeltia concinna* J. Agardh	as *Ahnfeltia concinna* J. Agardh
Ahnfeltiopsis leptophylla (Agardh) Silva et DeCew			X	as *Gymnogongrus leptophyllus* J. Agardh	
Ahnfeltiopsis linearis (Agardh) Silva et DeCew		X	X	as *Gymnogongrus linearis* (Turner) Agardh	X
Antithamnion defectum Kylin	X				

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Antithamnion kylinii N.L. Gardner	X				
Amplisiphonia pacifica Hollenberg				as *Antithamnion pacificum* (Harvey) Kylin; as *Antithamnion uncinatum* N.L. Gardner	as *Antithamnion pacificum* (Harvey) Kylin
Antithamnionella pacifica (Harvey) Wollaston			X	X	X
Antithamnionella spirographidis (Schiffner) Wollaston		X		as *Antithamnion glanduliferum* Kylin	
Bangia high intertidal (winter-spring)		X		as *Bangia fuscopurpurea* (Dillwyn) Lyngbye	as *Bangia vermicularis* Harvey
Bonnemaisonia californica Buffham					as *Pikea nootkana* (Esper) comh. nov.
Bossiella californica (Decaisne) Silva			X	as *Calliarthron schmittii* Manza	

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Bossiella chiloensis (Decaisne) Johansen		X	X	as *Bossiella corymbifera* (Manza) P.C. Silva, as *Bossiella interrupta* (Manza) P.C. Silva, as *Bossiella ligulata* (E.Y. Dawson) P.C. Silva, as *Bossiella sagittata* (E.Y. Dawson et P.C. Silva) P.C. Silva	
Bossiella dichotoma (Manza) P.C. Silva		as *Bossiella orbigniana* (Decaisne) Silva	as *Bossiella orbigniana* (Decaisne) Silva	as *Bossiella orbigniana* (Decaisne) P.C. Silva also a variety: as *Bossiella dichotoma* (Manza) P.C. Silva	as *Bossea gardneri* Manza
Bossiella plumosa (Manza) P.C. Silva		X	X	X	as *Bossea plumosa* Manza

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Calliarthron tuberculosum (Postels et Ruprecht) Dawson		X	X	as *Calliarthron setchelliae* Manza	as *Calliarthron regenerans* Manza
Callithamnion acutum Kylin	X				
Callithamnion pikeanum Harvey		X	X	X	also as *Callithanmion pikeanum* var. *laxum* (SetcheII & Gardner) comb. nov. , as *Callithamnion pikeanum* var. *pacificum* (Harvey) Setchell & Gardner
Callocolax fungiformis Kylin				as *Callocolax* sp.	
Callophyllis crenulata Setchell	X		X		X
Callophyllis edentata Kylin					X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Callophyllis flabellulata Harvey			X	X	X
Callophyllis heanophylla Setchell	X				
Callophyllis pinnata Setchell et Swezy in Setchell		X	X	X	X
Callophyllis stenophylla Setchell	X				X
Callophyllis violacea Agardh		X	X	X	also as *Callophyllis megalocarpa* Setchell & Swezy
Campylaephora californica (Farlow) T.O. Cho			X	X	X
Ceramium californicum Agardh	X				
Ceramium codicola J. Agardh	X				X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Ceramium gardneri Kylin		X		X	
Ceramium pacificum (Collins) Kylin	X	X			as *Ceramium washingtoniense* Kylin
Chondracanthus canaliculatus (Harvey) Guiry		X	X	as *Gigartina canaliculata* Harvey	
Chondracanthus corymbiferus (Kützing) Guiry in Hommersand, Guiry, Fredericq & Leister	X		X		as *Gigartina californica* J. Agardh
Chondracanthus exasperatus (Harvey et Bailey) J.R. Hughey		X	X		X
Chondracanthus harveyanus (Kützing) Guiry	X		X		

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Chondracanthus tepidus (Hollenberg) Harvey			X		
Clathromorphum parcum (Setchell et Foslie) Adey				as *Polyporolithon parcum* (Setchell et Foslie) L. R. Mason	as *Lithothamnion parcum* Setchell & Foslie
Clathromorphum reclinatum (Foslie) Adey		X		as *Polyporolithon reclinatum* (Foslie) L. R. Mason	
Colaconema amphiroae (K.M. Drew) P.W. Gabrielson				as *Acrochaetium amphiroae* (K. M. Drew) Papenfuss	as *Acrochaetium amphiroae* (Drew) Papenfuss
Colaconema desmarestiae (Kylin) P.W. Gabrielson	X				
Colaconema pacificum (Kylin) Woelkerling				as *Acrochaetium pacificum* Kylin	

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Colaconema plumosum (Kylin) Woelkerling				as *Acrochaetium plumosum* (K. M. Drew) G. M. Smith	
Colaconema plumosum var. *variable* (K.M. Drew) P.W. Gabrielson				as *Acrochaetium variabilis* (K. M. Drew) G. M. Smith	
Colaconema rhizoideum (K. M. Drew) P.W. Gabrielson		X			
Colaconema subimmersum (Setchell et N.L. Gardner) P.W. Gabrielson	X				
Constantinea simplex Setchell		X	X	X	X
Corallina frondescens Postels & Ruprecht					X
Corallina officinalis		as *Corallina*		as *Corallina*	X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Linnaeus		*officinalis* var. *chilensis* (Decaisne) Kützing		*officinalis* var. *chilensis* (Decaisne) Kützing	
Corallina vancouverensis Yendo		X		as *Corallina vancourveriensis* Yendo, as *Corallina gracilis* Lamouroux	as *Corallina densa* (Collins) comb. nov.
Corallophila eatoniana (Farlow) T.O. Cho, H.-G. Choi, G. Hansen & S.M. Boo			X	X	as *Ceramium eatonianum* (Farlow) De Toni
Cryptopleura corallinara (Nott) N.L. Gardner				X	
Cryptopleura lobulifera (Agardh) Kylin		X	X	X	as *Cryptopleura brevis* Gardner
Cryptopleura ruprechtiana (Agardh) Kylin	X	X	X	X	X
Cryptopleura		X	X	also as *Cryptopleura*	also as *Cryptopleura*

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
violacea (Agardh) Kylin				*crispa* Kylin	*crispa* Kylin
Cryptonemia obovata Agardh					X
Cryprosiphonia woodii (Agardh) Agardh		X	X	X	X
Cumagloia andersonii (Farlow) Setchell et N.L. Gardner			X	X	X
Cumathamnion sympodophyllum M.J. Wynne & Daniels	X	X	X	X	
Delesseria decipiens Agardh		X	X	X	X
Dilsea californica (Agardh) Kuntze		X	X	X	X
Endocladia muricata (Endlicher) Agardh		X	X	X	X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Erythrocladia irregularis Rosenvigne				X	
Erythrophyllum delesserioides Agardh		X	X	X	X
Erythrophyllum splendens Doty			X?		
Erythrotrichia carnea (Dillwyn) Agardh				X	
Farlowia conferta (Setchell) Abbott	X	X		as *Leptocladia conferta* Setchell	
Farlowia mollis (Harvey et Bailey) Farlow et Setchell		X	X	as *Farlowia mollis* (Harvey et Bailey) Farlow et Setchell	X
Fryeella gardneri (Setchell) Kylin	X				
Gastroclonium subarticulatum (Turner) Kützing		X	X	as *Gastroclonium coulteri* (Harvey) Kylin	
Gelidium coulteri Harvey		X	X		X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Gelidium purpurascens N.L. Gardner					as *Gelidium pulchrum* N. L. Gardener
Gelidium pusillum (Stackhouse) Le Jolis				as *Gelidium sinicola* Gardner	
Gloiopeltis furcata (Postels et Ruprecht) Agardh		X	X	X	X
Gloiosiphonia californica (Farlow) J. Agardh		X	X	X	
Gloiosiphonia verticillaris Farlow		X			X
Gonimophyllum skottsbergii Setchell		X		X	
Gracilaria pacifica Abbott			X	as *Gracilaria verrucosa* (Hudson) Papenfuss	
Gracilariophila oryzoides Setchell			X	X	

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
et Wilson					
Gracilariopsis andersonii (Grunow) E.Y. Dawson		X	X	as *Gracilariopsis sjoestedtii* (Kylin) Dawson	as *Gracilariopsis sjoestedtii* (Kylin) Dawson
Grateloupia doryophora (Montagne) Howe		X	X	as *Grateloupia doryphora* Montagne	X
Grateloupia setchellii Kylin				X	X
Halosaccion glandiforme (Gmelin) Ruprecht		X	X	X	X
Halymenia californica Smith et Hollenberg			X		
Halymenia schizymenioides Hollenberg et Abbott	X	X		X	
Harveyella mirabilis (Reinsch) Schmitz et Reinke	X				

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Herposiphonia plumula (Agardh) Falkenberg			X	as *Herposiphonia subdisticha* Okamura	as *Herposiphonia rigida* Gardner
Hildenbrandia occidentalis Setchell		X		as *Hildenbrandia occidentalis* Setchell	X
Hildenbrandia rubra (Sommerfelt) Meneghini		X		as *Hildenbrandia prototypus* Nardo	
Hollenbergia subulata (Harvey) E.M. Wollaston	X				
Holmesia californica (E.Y. Dawson) E.Y. Dawson	Abbott & Hollenberg (1976) say it is in Humboldt and Mendocino counties				
Hymenena cuneifolia Doty - *Hymenena flabelligera* (Agardh) Kylin; a		X	X	X	X

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
complex.					
Hymenena multiloba (Agardh) Kylin		X	X	X	X
Hymenena setchellii N. L. Gardener - *Hymenena smithii* Kylin; a complex	X		X		
Isabbottia ovalifolia (Kylin) M.S. Balakrishnan	X				
Janczewskia N.L. Gardneri Setchell et Guernsey		X	X	X	X
Kallymeniopsis oblongifructa (Setchell) G.I. Hansen	X		X		
Leachiella pacifica Kugrens	X				
Leptophytum adeyi Steneck et Paine				as *Lithothamnion californicum* Foslie	

Current Species Name and Authority	DeCew, Silva (1985)	Augyte (2010)	HSU Herbarium	Dawson (1965)	Doty (1947a, b)
Levringiella N.L. Gardneri (Setchell) Kylin	X				
Lithophyllum dispar (Foslie) Foslie		X		as *Tenarea dispar* (Foslie) Adey	as *Fosliella dispar* (Foslie) G. M. Smith
Lithophyllum grumosum (Foslie) Foslie	X				
Lithophyllum impressum Foslie		X			
Lithophyllum pustulatum (Lamouroux) Foslie	also as *Titanoderma pustulatum* var. *confine* (Crouan et Crouan) Chamberlain				
Lithothamnion phymatodeum Foslie					as *Lithothamnion pacificum* Foslie
Lomentaria hakodatensis Yendo	X		X		
Mastocarpus jardinii		X	X	as *Gigartina*	

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(Agardh) West				*agardhii* Setchell et N. L. Gardner	
Mastocarpus papillatus (Agardh) Kützing		X	X	as *Gigartina papillata* (Agardh) J. Agardh	as *Gigartina papillata* (C. Agardh) J. Agardh, also as *Gigartina cristata* (Setchell) Setchell & Gardner
Mazzaella californica (Agardh) De Toni			X	as *Rhodoglossum americanum* Kylin	
Mazzaella flaccida (Setchell et N.L. Gardner) Guiry		X	X	as *Iridaea flaccidum* (Setchell et N. L. Gardner) Papenfuss	as *Iridophycus ftaccidum* Setchell & Gardner
Mazzaella leptorhynchos (Agardh) Leister			X	as *Gigartina leptorhynchos* J. Agardh	
Mazzaella linearis (Setchell et N.L. Gardner) Guiry		X	X	as *Iridaea lineare* (Setchell et N. L. Gardner) Kylin	

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Mazzaella oregona (Doty) Hughey, Silva et Hommersand		X	X	as *Iridaea heterocarpa* Postels et Ruprecht	as *Iridophycus oregonum* sp. nov., also as *Iridophycus heterocarpum* (Postels & Ruprecht) Setchell & Gardner, also as *Iridophycus parvulum* (Kjellman) Setehell & Gardner
Mazzaella parksii (Setchell et N.L. Gardner) Guiry		X	X	as *Iridaea parksii* (Setchell et N. L. Gardner) Papenfuss	
Mazzaella rosea (Kylin) Fredericq	X				
Mazzaella sanguinea (Setchell et N.L. Gardner) Fredericq	X		X		

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Mazzaella splendens (Setchell et N.L. Gardner) Fredericq		X	X	as *Iridaea fulgens* (Setchell et N. L. Gardner) Papenfuss, as *Iridaea splendens* (Setchell et N. L. Gardner) Papenfuss	X
Mazzaella volans (C. Agardh) Fredericq		X	X		
Meiodiscus spetsbergensis (Kjellman) Saunders et Mclachlan				as *Rhodochorton penicilliforme* (Kjellman) Rosenvinge	
Melobesia marginata Setchell et Foslie				X	
Melobesia mediocris (Foslie) Setchell et L R Mason		X		X	

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Membranoptera dimorpha N.L. Gardner	X				X
Membranoptera platyphylla (Setchell et N.L. Gardner) Kylin			as *Membranoptera multiramosa* N. L. Gardener	as *Membranoptera multiramosa* N. L. Gardener	
Mesophyllum conchatum (Setchell et Foslie) Adey	X	X			as *Lithothamnion conchatum* Setchell & Foslie, apud FosIie
Mesophyllum lamellatum (Setchell et Foslie) Adey			X		as *Lithothamnion lamellatum* Setchell & Foslie, apud Foslie
Microcladia borealis Ruprecht		X	X	X	X
Microcladia coulteri Harvey		X	X	X	
Myriogramme spectabilis (Eaton) Kylin				X	

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Neoptilota californica (Ruprecht ex Harvey) Kylin	X		X		
Neoptilota densa (C. Agardh) Kylin			X	X	
Neoptilota hypnoides (Harvey) Kylin		X	X	X	as *Plumaria hypnoides* (Harvey) comb. nov.
Neorhodomela larix (Turner) Masuda		X	X	X	as *Rhodomela larix* (Turner) C. Agardh
Neorhodomela oregona (Doty) Masuda	X		X	X	as *Odonthalia oregona* Doty sp. nov
Nienburgia andersoniana (J. Agardh) Kylin	X		X		
Odonthalia floccosa (Esper) Falkenberg		X	X	X	X
Odonthalia lyallii (Harvey) Agardh			X	X	

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Odonthalia washingtoniensis Kylin		X	X	X	X
Opuntiella californica (Farlow) Kylin			X	X	X
Osmundea spectabilis (Postels et Ruprecht) Nam		X	X	as *Laurencia spectabilis* Postels et Ruprecht	as *Laurencia spectabilis* Postels et Ruprecht
Palmaria hecatensis M.W. Hawkes			X		
Palmaria mollis (Setchell et N.L. Gardner) van der Meer et Bird		X	X	as *Rhodymenia palmata* (Linnaeus) Greville	as *Rhodymenia palmata* var. *mollis* Setchell & Gardner
Peyssonnelia meridionalis Hollenberg et Abbott				as *Peyssonnelia pacifica* Kylin	
Phycodrys setchellii Skottsberg	X		X		
Pikea californica Harvey		X	X	X	

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Pikea pinnata Setchell		X	X	X	X
Plocmiocolax pulvinata Setchell		X	X	X	
Plocamium oregonum Doty		X	X	X	X
Plocamium pacificum Kylin		X	X	as *Plocamium coccineum* var. *pacificum* (Kylin) Dawson	X
Plocamium violaceum Farlow		X	X	as *Plocamium violaceum* Farlow, as *Plocamium tenue* Kylin	as *Plocamium tenue* Kylin
Pneophyllum nicholsii (Setchell et Mason) Silva et P.W. Gabrielson				X	
Polyneura latissima (Harvey) Kylin		X	X	X	X
Polysiphonia hendryi N.L. Gardner		X	X	X	as *Polysiphonia collinsii* Hollenberg

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Polysiphonia pacifica Hollenberg			X	as *Polysiphonia pacifica* Hollenberg	X
Polysiphonia paniculata Montagne		X	X	X	X
Polysiphonia scopulorum (Agardh) Hollenberg				as *Lophosiphonia villum* (J. Agardh) Setchell et N. L. Gardner	
Porphyra abbottiae Krishnamurthy	X	X			
Porphyra conwayae (Lindstrom et Cole) Lindstrom et Fredericq		X			
Porphyra cuneiformis (Setchell et Hus) Krishnamurthy				as *Porphyra miniata* var. *cuneiformis* Setchell & Hus)	X
Porphyra gardneri (G.M.Smith & Hollenberg)	X	X	X		as *Porphyrella gardneri* Smith &

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M.W.Hawkes					Hollenberg
Porphyra kanakaensis T.F. Mumford	X	X			
Porphyra lanceolata (Setchell et Hus) Smith		X	X	X	
Porphyra mumfordii S.C. Lindstrom et K.M. Cole		S. Lindstrom sequences from Camel Rock and the North Jetty, Humboldt County			
Porphyra nereocystis Anderson		X	X	X	X
Porphyra occidentalis Setchell et Hus	X	X	X		as *Porphyra variegata* (Kjellman) Hus
Porphyra perforata Agardh		X	X	X	X

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Porphyra pseudolanceolata V. Krishnamurthy	Annotated by T. Mumford				
Porphyra pulchra Hollenberg			X	X	
Porphyra rediviva J.W.Stiller & R.J.Waaland	X				
Porphyra schizophylla Hollenberg	Annotated by T. Mumford	X			X
Porphyra smithii Hollenberg & I. A. Abbott	Abbott 1968 record	X	X		
Porphyra thuretii Setchell et Dawson			X	X	X
Porphyra torta V. Krishnamurthy	X				
Porphyrostromium boryanum (Montagne) P.C. Silva		X			X

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Prionits filiformis Kylin		X	also as *Prionitis cornea* (Okamura) E. Y. Dawson	also as *Prionitis cornea* (Okamura) E. Y. Dawson	as *Zanardinula filiformis* (Kylin) Papenfuss
Prionits lanceolata (Harvey) Harvey		X	X	as *Prionitis lanceolata* (Harvey) De Toni	as *Zanardinula lanceolata* (Harvey) De Toni
Prionitis sternbergii (C. Agardh) J. Agardh		X	X	X	as *Zanardinula lyallii* (Harvey) De Toni, also as *Zanardinula andersoniana* (J. Agardh) Papenfuss
Pseudolithophyllum muricatum (Foslie) Steneck et R.T. Paine		X			
Pseudolithophyllum neofarlowii (Setchell et Mason) Adey				as *Lithophyllum neofarlowii* Stchell et L. R. Mason	as *Lithophyllum neofarlowii* Setchell et L.R. Mason
Pterochondria woodii (Harvey)		X	X	X	X

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Hollenberg					
Pterosiphonia baileyi (Harvey) Falkenberg	X				
Pterosiphonia bipinnata (Postels et Ruprecht) Falkenberg			X	X	X
Pterosiphonia dendroidea (Montagne) Falkenberg			X	X	X
Pterothamnion pectinatum (Kylin) Athanasiadis & Kraft			X	as *Platythamnion pectinatum* Kylin	as *Platythamnion pectinatum* Kylin
Pterothamnion villosum (Kylin) Athanasiadis et Kraft	X				
Ptilota filicina Agardh		X	X	X	as *Plumaria filicina* (Farlow) comb. nov.

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Ptilothamnionopsis lejolisea (Farlow) Dixon				as *Callithamnion lejolisii* Farlow	
Pugetia firma Kylin	X				
Rhodochorton purpureum (Lightfoot) Rosenvinge		X	X	X	X
Rhodophysema elegans (Crouan et Crouan ex J. Agardh) Dixon				X	
Rhodymenia californica Kylin			X	X	X
Rhodymenia pacifica Kylin		X			X
Sahlingia subintegra (Rosenvinge) Kornmann				as *Erythrocladia subintegra* Rosenvinge	as *Erythrocladia subintegra* Rosenvinge
Schizymenia pacifica (Kylin) Kylin		X	X	X	X

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Scinaia confusa (Setchell) Huisman				as *Pseudogloiophloea confusa* (Setchell) Levring	as *Gloiophloea confusa* Setchell
Serraticardia macmillanii (Yendo) Silva		X	X	X	
Smithora naiadum (Anderson) Hollenberg		X	X	X	as *Porphyra naiadum* Anderson, apud Blankinship & Keeler
Stenogramma interrupta (Agardh) Montagne			X	X	X
Tiffaniella snyderae (Farlow) Abbott		X	X	as *Spermothamnion snyderae* Farlow	
Weeksia digitata I. A. Abbott			X		

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Anthophyta					
Phyllospadix scouleri W.J. Hooker			X	X	
Phylospadix torreyi S. Watson			X	X	
Zostera japonica Ascherson & Graebner			X		
Zostera japonica Linnaeus			X		