

Ventura River Delta Marine Algae Collection

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As part of an on-going study of the physical and biological resources of the Ventura River watershed, staff from the UCSB Herbarium undertook a comprehensive inventory of the botanical resources of the Ventura River Estuary and Delta, including its marine algal flora. The project extended over five years, from 1985 through 1990. Using a modified version of the Cowardin wetland classification system developed by Wayne R. Ferren, Jr., former Principle Museum Scientist of the UCSB Herbarium, the Environmental Research Team described wetlands from four major wetland systems associated with the Ventura River Estuary and Delta: Marine, Estuarine, Riverine, and Palustrine. This article focuses on the Marine wetland species collected during this investigation.

Marine wetlands occur seaward of the coastal dunes and berm at the mouth of the Ventura River Estuary, and include both Intertidal Wetlands and nearshore Subtidal Deepwater Marine Habitats. The Marine wetlands occur over the tidally influenced seaward edge of the Ventura River Delta. The substrate of the intertidal and subtidal habitats is characterized by sedimentary cobble transported to the river's delta during major storm events, and sorted by ocean waves, tides and currents. This cobble ranges in size from 10-92 cm, and is derived from a wide variety of inland sedimentary rock formations, from the Pleistocene (1.8 million to 20,000 years) to the Eocene (53 to 39 million years), as well as several granitic and metamorphic rock types. The cobble substrate, which extends approximately 2.2 km along the shoreline of the Ventura River Delta, is intermixed with fine sediments derived from river flows and the long-shore littoral current.



Ventura River Delta Mid and Low-intertidal cobble marine wetlands at low tide.

Cobble provides a relatively stable hard substrate upon which plants and other benthic organisms may attach, with different sized and shaped cobble providing varying levels of

stability. Exposed cobble substrate is relatively rare along the California coast, and comprises less than 10% of the Ventura County coastline. While limited in extent, cobble habitats support a wide variety of marine plants, primarily algal species, and several flowering plants. These marine plants harbor a diverse assemblage of marine vertebrate and invertebrate species, many of which are not found in other substrates (*e.g.*, sand or mud). One group of green marine algal species (*Ulva spp.*, including the formerly recognized genera, *Enteromorpha spp.*) provides an important food source of the American Black Brant. Black Brant, the smallest species of North American goose, prefer to feed on Eelgrass (*Zostera spp.*), a marine flowering plant generally found in large enclosed bays and estuaries – an uncommon habitat along the southern California coast. Black Brant supplement their diet with the green algae associated with marine cobble wetlands as they migrate south along the southern California Coast in winter, and on their way north in early spring. Surfgrass (*Phyllospadix spp.*), a dominant flowering marine plant found in the lower intertidal and subtidal Deepwater Marine Habitats, is the preferred habitat for the commercially important California Spiny Lobster (*Panulirus interruptus*).



American Black Brant (*Branta bernicla*) feeding on *Ulva* spp. in mid-intertidal marine wetlands at the Ventura River Delta.

For study purposes, the intertidal and nearshore subtidal portions of the study area were divided into four broad zones: high-, mid-, and low-intertidal Rocky Shore, and subtidal Rocky and Sandy Bottom. The relative dominance of genera and species was determined for each zone, and a map was developed based on aerial photography which depicts the distribution of the basic marine algae associations (including the marine angiosperms, Surfgrass and Eelgrass.)

The cobble at the upper margins of the shoreline ranges in elevation from 0.8 to 0.3 m above Mean Lower Low Water (MLLW). This area is alternately flooded and exposed by mixed semi-

diurnal tides. The upper intertidal area is dominated by *Ulva* spp. and *Chaetomorpha linum*. *Bryopsis corticulans* is also common in some reaches. In the mid-intertidal reaches (0.3 to -0.2 m MLLW) the cobble is flooded and exposed during most tidal cycles. The mid-intertidal area is dominated by green and red algal species, including *Gigartina* spp., *Porphyra* spp., *Ulva* spp., and *Polysiphonia* spp. At the lowest elevations of the shoreline (-0.2 to -0.4 m MLLW) the cobble is almost continuously flooded, with exposure only occurring during minus tides. The lower intertidal area exhibits the greatest species diversity, with representatives from the three marine algal groups (red, green, and brown). Dominant algal species include *Gigartina* spp., *Ulva* spp., *Gracilaria*, spp. and *Pterosiphonia* spp. Dense beds of Surfgrass are found in the lower intertidal margins, mixed with scattered Eelgrass in the subtidal area.

The distribution and density of marine algal species varies both seasonally and inter-annually in response to a variety of factors including littoral beach sand transport, wave action, and the discharge of freshwater from the Ventura River. In addition to surface flow, subsurface flow is continuously conveyed through the cobble berm at the river mouth to the intertidal and subtidal marine habitats. Salinity of this seaward subsurface flow ranges from strongly brackish (25 o/oo) to nearly fresh (5 o/oo).

A total of 328 voucher specimens representing 108 taxa of marine algae were collected and identified from the project study area: 20 Chlorophyta, 10 Phaeophyta, and 78 Rhodophyta. The intertidal and subtidal distribution of marine algae at the Ventura River Delta is typical of the zonation along the Pacific Coast south of Point conception: green (Chlorophyta) are dominant in the high-intertidal; a mix of red (Rhodophyta) and green in the mid- and low-Intertidal, and a combination of red, green, and brown (Phaeophyta) in Subtidal Deepwater Marine Habitats.

Fourteen of the algal collections were initially identified only to genus, though work continues on refining these identifications. All of the taxa identified are native to the coast of California, with the one exception, *Sargassum muticum*, a species native to Japan and China that was accidentally introduced into southern California in 1946, and is now widely distributed along the Pacific Coast. Several species are notable because of their restricted range or rarity in California. *Grateloupia filicina* is generally found in more northern latitudes, and only rarely in California. *Porphyra lanceolata*, *Prionitis australis*, and *Rhodoglossum affine* are also more northern species, and uncommon south of San Luis Obispo County. *Ulva costata* and *Gracilariopsis andersonii* are reported from Santa Barbara County south to Baja, California. Ventura County is the southernmost reported location for *Ulva taeniata*. The giant brown algae, *Macrocystis pyrifera*, which is common in rocky offshore subtidal areas between central California and Baja California, is generally absent in the area offshore of the Ventura River Delta, where the substrate is differentiated by fine sediments derived from the Ventura and Santa Clara Rivers.

Specimens collected during the study were compared with specimens collected in the project study area during a similar survey in 1956 by E. Y. Dawson (1918-1966), an influential American marine phycologist and the first curator of Cryptogrammic Botany at the Smithsonian National Museum of Natural History. A comparison of the Dawson voucher collection (formerly housed at the Los Angeles County Museum of Natural History, but now at the Smithsonian Natural History Museum) revealed little change in the basic composition or distribution of the intertidal marine flora along the Ventura River Delta. However, 15 species reported by Dawson were not collected during our subsequent survey, or possibly have been identified differently.

Additionally, 20 species collected from Subtidal Deepwater Marine Habitats were not reported by Dawson, who largely confined his collecting at the Ventura River Delta to the intertidal zone.



Callophyllis violacea J. Agardh. Usually found attached to cobble in the low intertidal to Subtidal Deepwater Habitats at the Ventura River Delta.

The records and collections of these two investigations conducted more than thirty years apart form part of an important base-line of information on the marine conditions at the Ventura River Delta. Such base-line data can be used to evaluate future changes in marine ecosystems arising from climate driven changes, including sea-level rise; alterations in ocean currents; fluctuations in water and air temperature; frequency and intensity of storm activity; and potentially water quality issues related to discharges from the Ventura River.

All the marine algal vouchers collected during the Ventura River Delta investigation are housed in the Herbarium of the Cheadle Center for Biodiversity and Ecological Restoration, along with other important marine algal collections from the west coast and Pacific Rim.

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