

California Seaweeds eFlora:
a free, online resource
for the 21st Century



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History of the University Herbarium and the Silva Center for Phycological Documentation

UC has emphasized marine algae from its inception, primarily due to the interests of its founder, W.A. Setchell, who specialized in several groups of seaweeds and in marine biogeography. As a result of Setchell's efforts and those of his successors, G.F. Papenfuss and P.C. Silva, UC's seaweed collection is exemplary. It has over the years developed an emphasis on Pacific Coast algae, beginning with Setchell's unrealized goals of producing a seaweed flora of the Pacific Coast.



When Setchell arrived in 1895, he inherited a small collection of seaweeds collected by Marshall Avery Howe from Monterey Bay (Silva, 1977). Setchell collected extensively with the help of amateurs and the collections grew in size and geographic scope. Setchell procured a large number of type specimens and established contacts worldwide. His students, including Nathaniel Lyon Gardner, became well known phycologists. One of Setchell's earliest accomplishments was the *Phycotheca Boreali-Americana*, the Algae of North America. This 46 volume set of exsiccatae, including many type specimens, was distributed in 80 sets to major institutions and represents one of the most important historical collections in North America (http://ucjeps.berkeley.edu/ina/pba/pba_main.html).

George F. Papenfuss succeeded Setchell as Curator of Algae and brought with him extensive collections from South Africa and Hawaii. He added collections from east Africa resulting from an expedition funded by the National Science Foundation in the 1960's. Papenfuss supervised 14 dissertations on the morphology and taxonomy of marine algae, maintaining UC's eminence in phycology. Paul C. Silva came to Berkeley in 1948 as a graduate student and returned as Curator of Algae in 1960. He collected extensively on the Pacific coast of North America.

UC has ~180,000 seaweed specimens with ~35% from California. The collections represent voucher material for regionally and internationally important studies and include approximately 2000 type specimens. With the recent addition of 40,000 specimens from the Los Angeles County Museum (including those formerly housed at the Allan Hancock Foundation) plus many gifts from orphaned collections, our holdings of California seaweeds are extraordinary.

The Silva Center for Phycological Documentation (http://ucjeps.berkeley.edu/CPD/algal_research.html) was established in 2004 with an generous endowment gift from Paul C. Silva, Curator Emeritus of Algae. The primary mission of the Center is to develop, maintain, and promulgate documentation in the field of algal systematics. Its heart is the *Index Nominum Algarum* (INA) and *Bibliographia Phycologica Universalis* (BPU), card files available in both physical and electronic formats (<http://ucjeps.berkeley.edu/INA.html>). The INA contains nearly 200,000 names of algae (in the broad sense); the BPU contains bibliographic references pertaining to algal taxonomy. The Center also hosts an endowed position to support and update the INA and BPU.



Our Plan

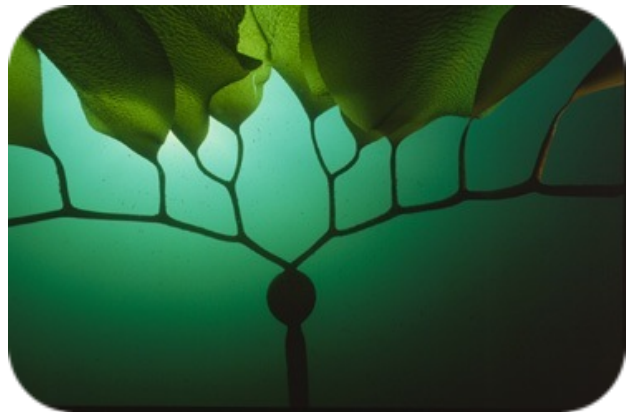
We plan to design, populate and host the *California Seaweed eFlora*, a web-based update of Abbott & Hollenberg (1976) *Marine Algae of California*. Our web-based flora will be free to all and maintained to stay current.

The website will include:

- Current **nomenclature**, with references and links to primary literature and the INA
- **New taxa**, with detailed information on **non-native species**
- Complete **synonymies** to enable the interpretation of older literature and species lists
- Detailed and updated, voucher-based **range data**, including **maps**
- Focus on **field identification**, with field photos, scans of specimens and key field characters, including information on morphological variation and whether a species can be confidently identified to species
- Information and references on the **history** of each taxon
- Information and references for **conservation** issues relevant to species
- Links to genetic data (**DNA sequences**) in GenBank
- Notes on taxa that need **new, critical studies**
- **Species lists**, both historical and recent, generated from herbarium records for important localities

Why California seaweeds?

Seaweeds are the engineers of nearshore environments, providing primary production and habitat for intertidal and subtidal communities. Seaweed populations modify the environment by altering flow patterns, retaining larvae, and creating substrate and structure for myriad marine organisms. The magnificent diversity and abundance of seaweeds along the Pacific Coast reflect the rich coastal environments and habitats – embracing rocky shores and reefs, sandy beaches, and offshore rocks and islands.



California straddles the junction of two great biogeographic provinces: the cold temperate Oregonian Province roughly to the north of the northern Channel Islands and Point Conception, and the warm temperate to subtropical Panamanian Province to the south. The eight California Channel Islands, in the Southern California Bight, are particularly interesting because they are relatively free of coastal development and lie in this hydrographically complex region of warm and cold currents.

Key Objectives

- **Understanding the consequences of global climate change and anthropogenic alteration of the marine environment**

The California coastal environment has suffered from the consequences of rapid population growth: alteration or degradation as the result of development, pollution, overfishing, oil drilling, mariculture and global marine transportation. Habitats for seaweeds, especially in southern California, are vastly different than they were 100 years ago.

We know that biological consequences of global climate changes in the Pacific marine environment will be broad-reaching. Species ranges will expand or contract, depending on physiological tolerances and capacities to adapt to new conditions. Shifts in species geographic ranges have proceeded more rapidly in marine vs. terrestrial systems, with a high potential for community-level changes. The majority of non-native seaweed species reported from California have been discovered in the last 40 years, suggesting a link between climate change and species spread, yet most of these are under the radar of managers and policy makers.

Efforts by federal, state and private agencies and managers will be vastly enhanced by a revised seaweed flora for California for help with identification of native and non-native species based on detailed, geographically explicit historical records that robustly document species distributions over time.

- **Updating taxonomic concepts and biogeography**

Our understanding of the California's seaweed flora has changed dramatically since the publication of *Marine Algae of California* (1976). New collections and new techniques, including culture studies and DNA sequencing, have contributed to a revolution in algal taxonomy during the last three decades.

Since 1976, ~80 taxa have been added to the flora and ~300 names have changed. Many taxonomic problems at the genus and species level need to be acknowledged and solved; strategic molecular investigations are critical. Non-native species that have gone unrecognized need to be identified. Our most common species can be the most difficult to identify with confidence; new field and lab characters, with illustrations, are required as aids. Geographic range data must be updated based on comparisons of historical and recent collections.

- **Fostering education**

There is a pressing need for assistance in identifying California seaweeds. Only a handful of specialists focus on the Pacific coast flora. Fewer courses that include seaweed identification are available as faculty compositions change in our colleges and universities. Educators at all levels as well as dedicated amateurs and coastal managers need a reliable, well-illustrated and accessible reference for identifying, understanding and appreciating our seaweed flora

We are excited by the prospect of continuing in the tradition of Setchell, Gardner, Silva, Abbott and Hollenberg --- to describe and share the riches of our marine flora. The 21st century has brought new tools to explore, illustrate, and communicate our knowledge of and passion for these singularly fascinating and beautiful organisms.

We think that the California Seaweed eFlora will change the face of California phycology as well as serve forth its gifts to a broad and curious audience.

