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<https://escholarship.org/uc/item/27z0f9j7>

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Publication Date

2021-07-13

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DIGITIZATION OF THE UCSB HERBARIUM'S SEAWEED COLLECTION PROVIDES VITAL DATA TO BETTER UNDERSTAND THE CHANGING MARINE ENVIRONMENT.

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About the Project:

An important mission of the Cheadle Center for Biodiversity and Ecological Restoration (CCBER) is to promote education, research, and outreach by disseminating the biodiversity data contained in our natural history collections. Among our half million specimens is an outstanding collection of marine algae, with ca. 10,000 specimens from the Pacific Coast of North America. Herbaria have long been used to study and teach through academic, museum, and personal collections. They created vaults of knowledge and history within institutions' and collectors' shelves. With new project funding from the Institute for Museum and Library Services (IMLS), we are now able to bring these collections into digital format to share the data more widely and publicly, as well as encouraging new scientific inquiry and exploration using digital herbarium data. Currently we are focusing on digitizing and curating our collection of Pacific Coast seaweeds.

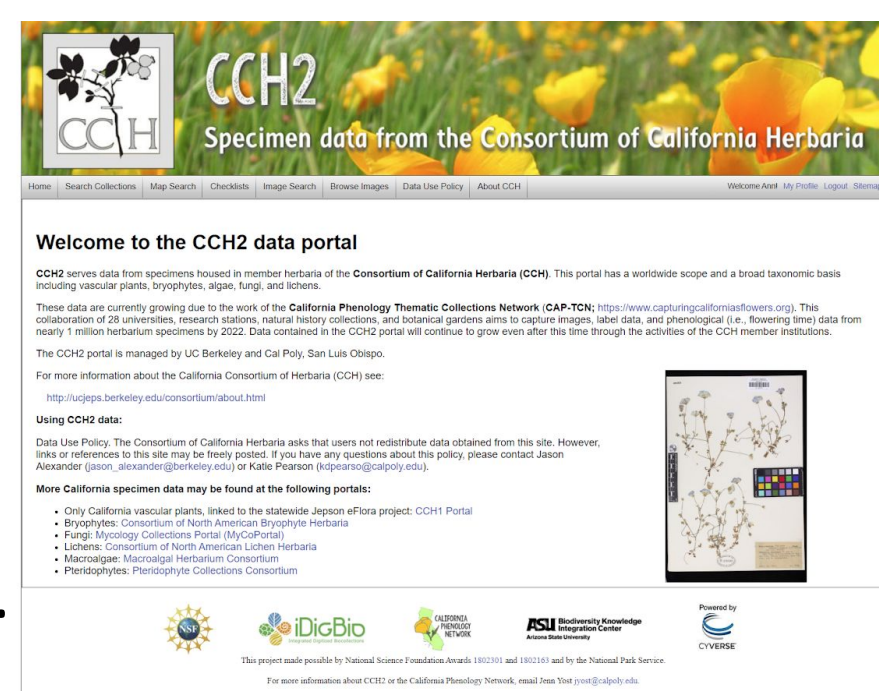
Project Goals:

- 1) Verify or provide taxonomic identifications of specimens.
- 2) Curate, image, and digitize specimens and provide geographic coordinates.
- 3) Upload digitized specimen records to the Symbiota-based web portal: the Consortium of California Herbaria 2 (CCH2), which is then published to the Global Biodiversity Information Facility (GBIF).
- 4) Organize public workshops and community outreach events focused on seaweed identification and digitization of algal herbarium specimens.

Student Engagement:

Course offering: Introduction to Curation of Natural History Collections: Seaweeds

Over the course of this project, we will offer three sections of our Natural History Curation class focusing on seaweeds. In this experiential class, students earn credit by transcribing digital records and providing geographic coordinates in our CCH2 database. In addition to learning firsthand about biodiversity informatics, students learn the basics about algal taxonomy and diversity, issues related to marine ecology, and the threats to the ocean environment from invasives and climate change. Our first class was conducted entirely remotely due to COVID restrictions, but future classes will include on-site specimen curation experiences in addition to digital remote learning options.



Internships & Student workers:

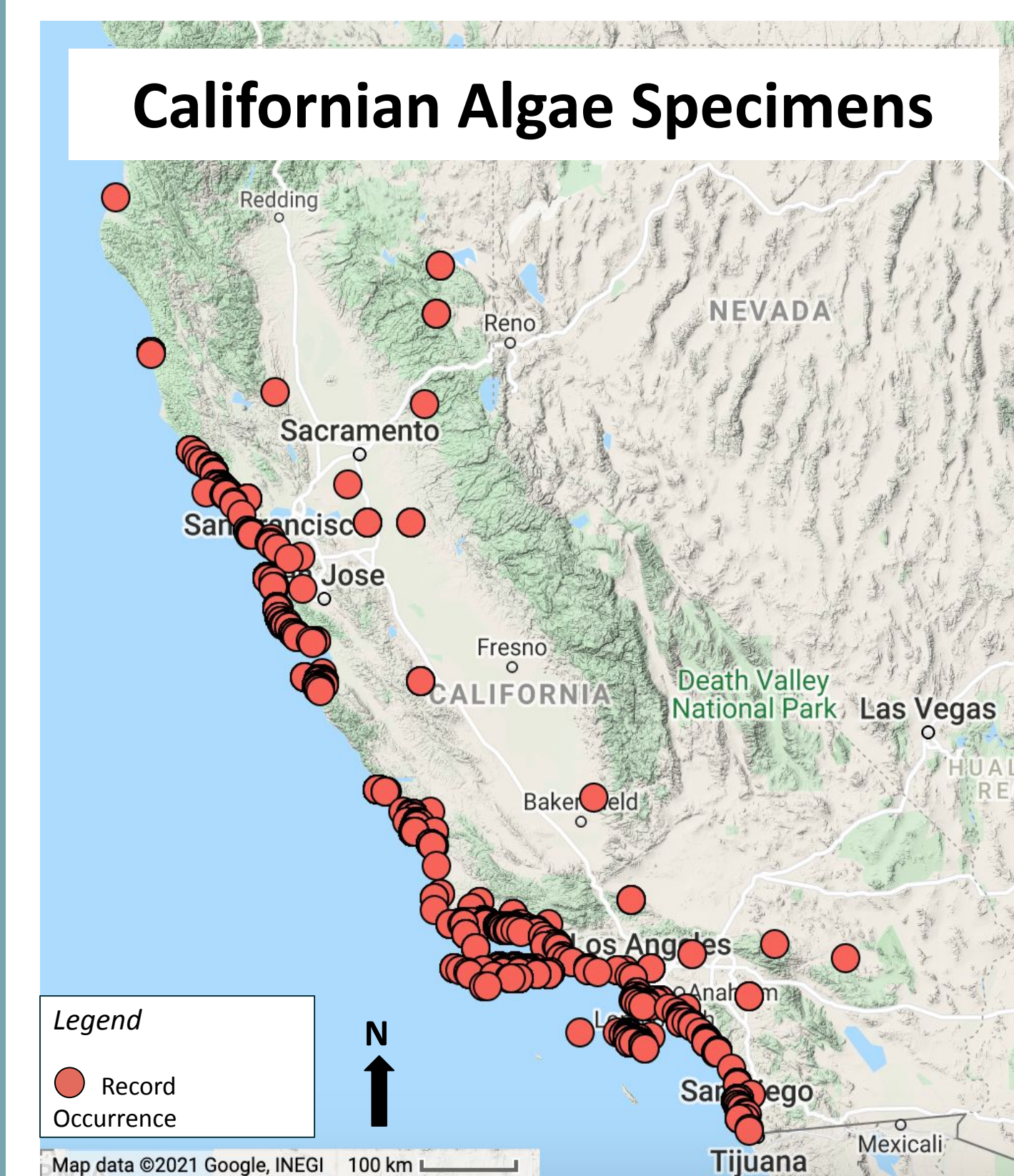
Working with the Office of Educational Partnerships, and through student engagement and work study, we are able to fund student interns to dive deeper into the world of algae and specimen curation. In addition to the class experiences, CCBER internships provide the opportunity to work one-on-one with the curation staff and more directly with the specimens, including labeling, barcoding, imaging, and specimen repair.



Where collections come from: California Example

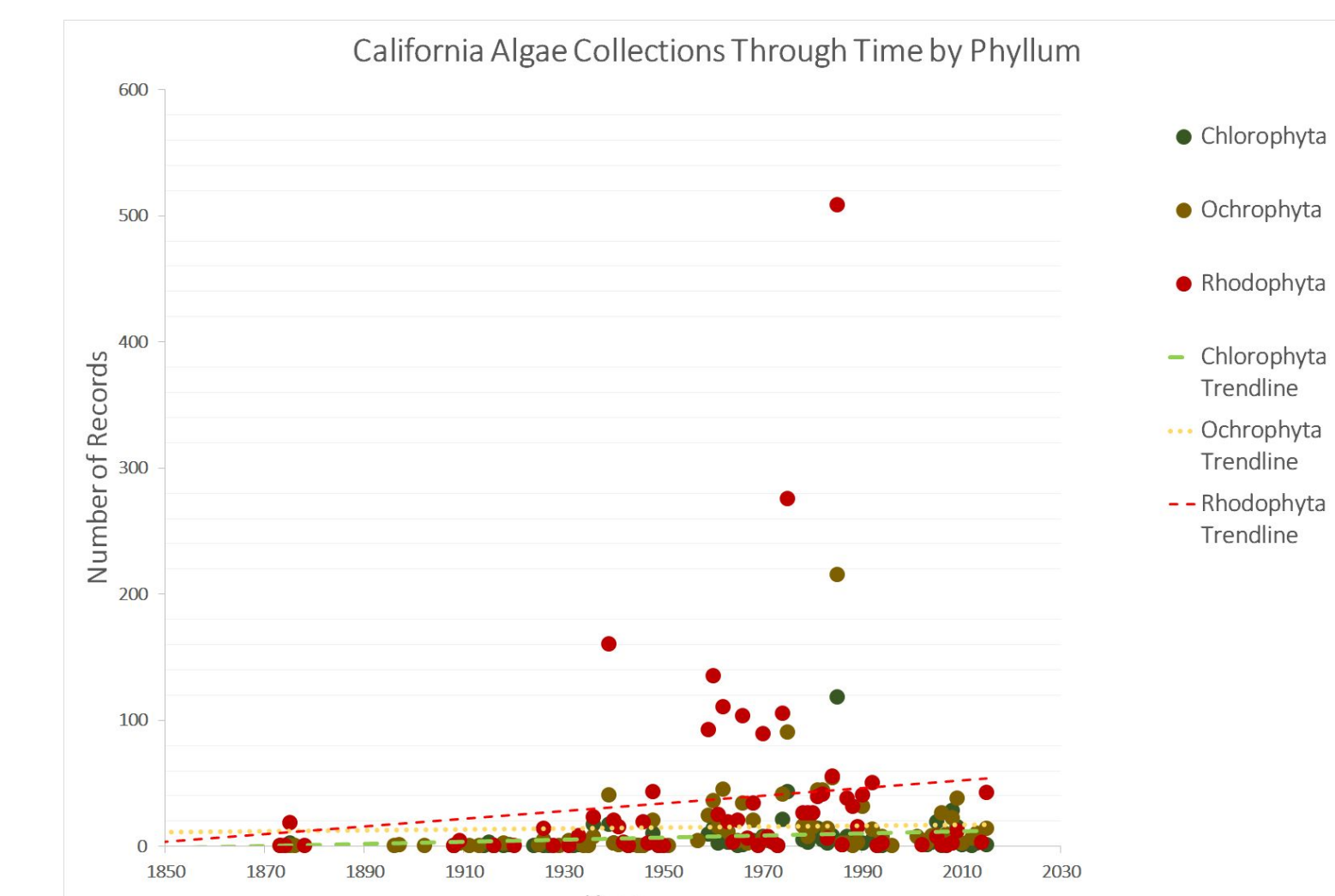
Exploring California Records

Using the records of specimens collected in California as example, we can explore the geospatial and temporal breadth of the collection. Of our currently geo-referenced specimens the most northern CA specimen is from Humboldt Bay, and south Imperial Beach in San Diego.



Collections Through Time

The 4,000+ CA records with georeferenced data were not collected at one place or time. The temporal distribution of records is important to understand the context of the collection and types of data available. Our CA records span from 1873 (top right) to 2016 (mid right). But, the bulk of records for all phyla were collected between 1960-1990. This is important for considering the kinds of questions we can ask about a single species or region.



How do you use herbariums for research?

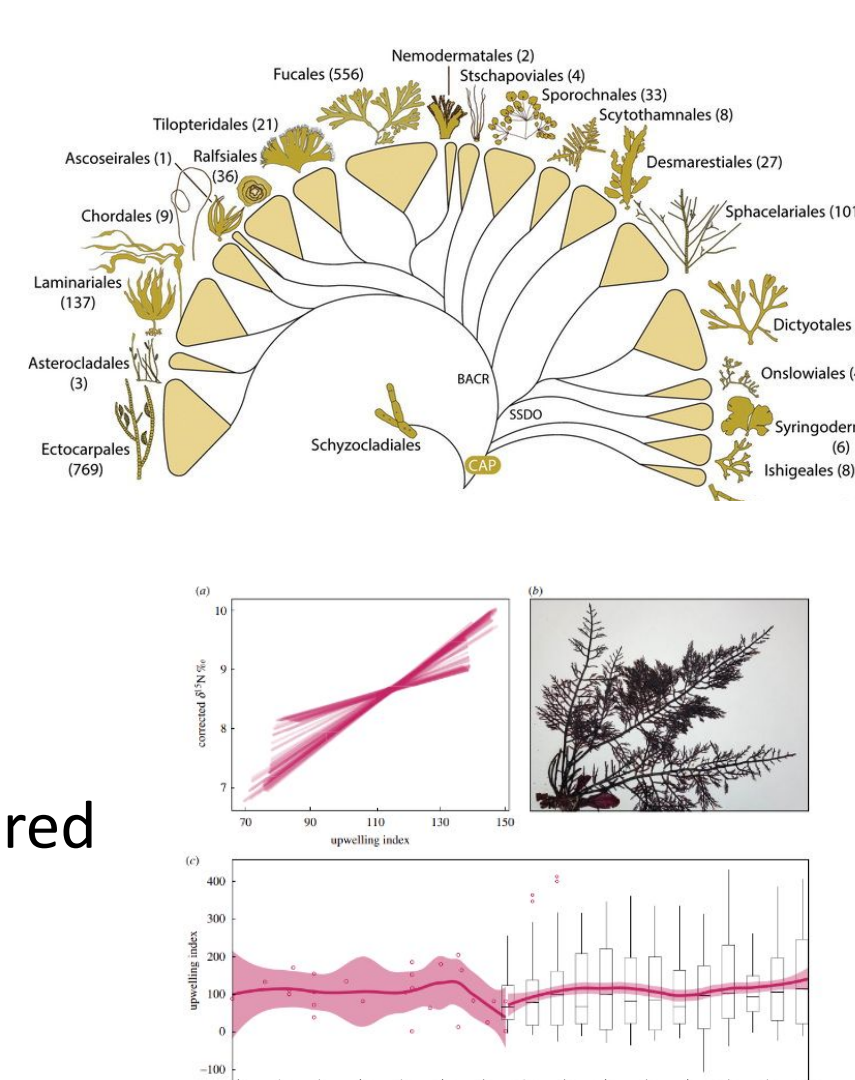
Past and present:

Collecting plants and algae into herbaria has long been a method to scientifically identify, order, and compare species. These collections have been used to determine the taxonomy of species and are still used to compare morphology and aid in species identification. They are also used to determine the geographic range of a species, and how that range changes through time, by population decline, introduction by anthropogenic means, or shifts due to climate or local environmental events. Many herbaria, including the UCSB collection, contain voucher specimens from long-term ecological monitoring projects that are essential for measuring biodiversity and ecological changes over decades (and in some cases) centuries. Herbaria have both been made and used by naturalists to document and explore the natural world. The first "field guides" were bound books of herbaria or pressed specimens. Today herbarium specimens are photographed or used by artists to create the colorful books and pamphlets used by many.



DNA:

Today, molecular systematics and new genetic methods are allowing new ways to explore the data in these specimens. DNA & genomic techniques allow us to understand the taxonomic relationships among species, to examine the variation within a single species, and to understand how gene diversity may improve a species's resilience to warming ocean temperatures or increased acidity. Image at right from Binghoe et al. 2020.



Isotopic:

All living things process the molecules that are the building blocks of life, including carbon and nitrogen. The isotopes of these elements can be measured and allow us to learn something about the world the organisms lived in. Research is beginning to explore how these techniques can be applied to preserved algae specimens. Using these specimens it may be possible to research the environmental conditions of oceans in the past. Image at right from Miller et al. 2020

Community Engagement:

Climate change threatens to change the ecology of many ecosystems, and the kelp forests and seaweed-draped coasts of California and North America are no exception. Our hope is that a well-curated and digitized seaweed collection will provide scientists with an invaluable resource to help understand many aspects of marine biology, including ecology, biodiversity, invasive species, and global climate change. By hosting workshops and community volunteers we seek to foster an understanding of the oceans in the general public of all ages. We are also planning to expand outreach through tours of our herbarium and by artistic installations using UCSB seaweed specimens. It is our hope that the citizen scientists and students who are always captivated by the beauty of CCBER's seaweed specimens will gain a heightened appreciation for the importance of algae in the oceans.



Images: Previous algae workshops hosted by CCBER at UCSB's campus and at Rancho Marino NRS Reserve taught by Dr. Kathy Ann Miller to both novices and experienced phycophiles alike. We hope to conduct more workshops beginning in fall 2021.

Source: CCBER Archives



First Quarter Progress:

Our digitization and curation of the collection began in March of 2021 and progress has been encouraging. In the first quarter of this project we have taught one section of the curation course, and trained three student interns and a student worker. Our progress in the digitization of specimens is easily tracked in the CCH2.

Specimen Records in CCH2	Number of Records
Specimen Records in CCH2 from the CCBER	9,110
Specimens Imaged	8,000
Specimen Records with Images	5,061
Specimen Records Completed or "Closed"	1,330

Acknowledgement and References:

Acknowledgment
We would like to thank the Coastal Fund (CF 18-14) and the Institute of Museum and Library Services (MA-245711-OMS-20) for supporting this project. As well as our volunteers, interns, and students working with the collection on this project.

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