Integrative Biosciences Program
at Coastal Marine Biolabs

CMB is a California 501(c)(3) organization that was established in 2006 to transform the way high school students experience science.

visit www.coastalmarinebiolabs.org for more information about CMB's educational programming

Federal Funding Status

CMB is currently supported by a five-year Science Education Partnership Award from the National Institute of General Medical Sciences (NIGMS) at the National Institutes of Health (NIH)

NIGMS is organized into five divisions that support research, research training, and capacity building in a range of scientific fields

The SEPA program supports educational activities that complement or enhance workforce training to meet the nation's biomedical, behavioral, and clinical research needs

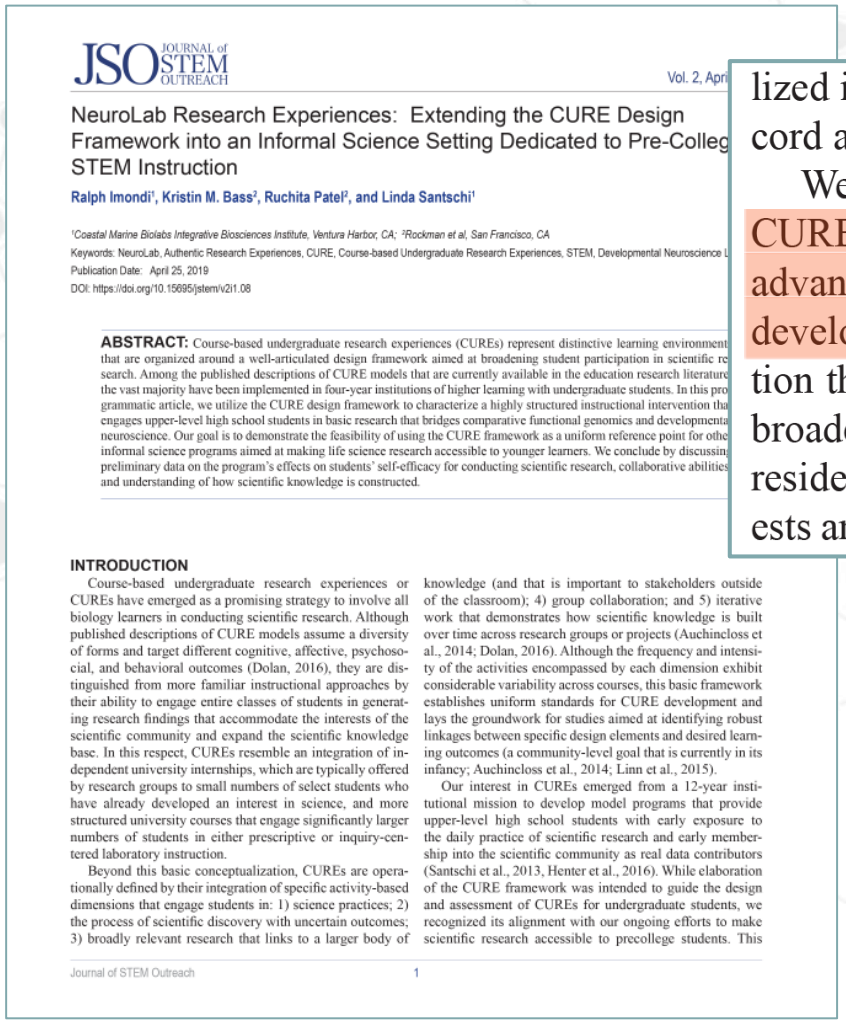
NIH
National Institute of General Medical Sciences

SEPA SCIENCE EDUCATION PARTNERSHIP AWARD
Supported by the National Institutes of Health

Project Period:	*07/01/2019 - 06/30/2024*
Approved Budget:	*$1,162,602*

Grant activities

Our current effort builds upon an earlier SEPA project that engaged students in authentic, neuroscience-based research experiences hosted in the CMB lab



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NeuroLab Research Experiences: Extending the CURE Design Framework into an Informal Science Setting Dedicated to Pre-Colleg STEM Instruction

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Keywords: NeuroLab, Authentic Research Experiences, CURE, Course-based Undergraduate Research Experiences, STEM, Developmental Neuroscience L

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ABSTRACT: Course-based undergraduate research experiences (CUREs) represent distinctive learning environment that are organized around a well-articulated design framework aimed at broadening student participation in scientific re search. Among the published descriptions of CURE models that are currently available in the education research literature the vast majority have been implemented in four-year institutions of higher learning with undergraduate students. In this pro grammatic article, we utilize the CURE design framework to characterize a highly structured instructional intervention tha engages upper-level high school students in basic research that bridges comparative functional genomics and developmenta neuroscience. Our goal is to demonstrate the feasibility of using the CURE framework as a uniform reference point for othe informal science programs aimed at making life science research accessible to younger learners. We conclude by discussin preliminary data on the program's effects on students' self-efficacy for conducting scientific research, collaborative abilities and understanding of how scientific knowledge is constructed.

INTRODUCTION

Course-based undergraduate research experiences or CUREs have emerged as a promising strategy to involve all biology learners in conducting scientific research. Although published descriptions of CURE models assume a diversity of forms and target different cognitive, affective, psychosocial, and behavioral outcomes (Dolan, 2016), they are distinguished from more familiar instructional approaches by their ability to engage entire classes of students in generating research findings that accommodate the interests of the scientific community and expand the scientific knowledge base. In this respect, CUREs resemble an integration of independent university internships, which are typically offered by research groups to small numbers of select students who have already developed an interest in science, and more structured university courses that engage significantly larger numbers of students in either prescriptive or inquiry-centered laboratory instruction.

Beyond this basic conceptualization, CUREs are operationally defined by their integration of specific activity-based dimensions that engage students in: 1) science practices; 2) the process of scientific discovery with uncertain outcomes; 3) broadly relevant research that links to a larger body of knowledge (and that is important to stakeholders outside of the classroom); 4) group collaboration; and 5) iterative work that demonstrates how scientific knowledge is built over time across research groups or projects (Auchincloss et al., 2014; Dolan, 2016). Although the frequency and intensity of the activities encompassed by each dimension exhibit considerable variability across courses, this basic framework establishes uniform standards for CURE development and lays the groundwork for studies aimed at identifying robust linkages between specific design elements and desired learning outcomes (a community-level goal that is currently in its infancy; Auchincloss et al., 2014; Linn et al., 2015).

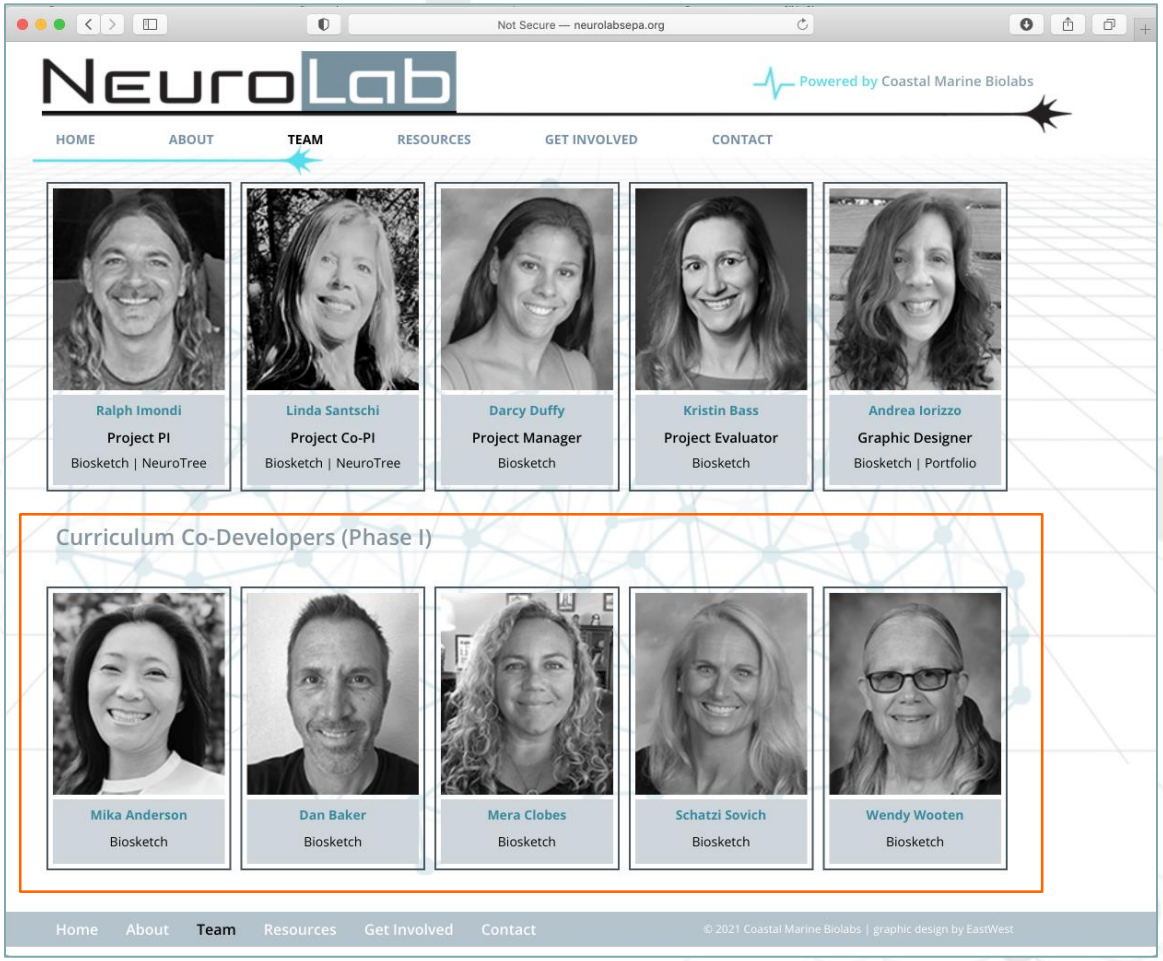
Our interest in CUREs emerged from a 12-year institutional mission to develop model programs that provide upper-level high school students with early exposure to the daily practice of scientific research and early membership into the scientific community as real data contributors (Santschi et al., 2013, Henter et al., 2016). While elaboration of the CURE framework was intended to guide the design and assessment of CUREs for undergraduate students, we recognized its alignment with our ongoing efforts to make scientific research accessible to precollege students. This

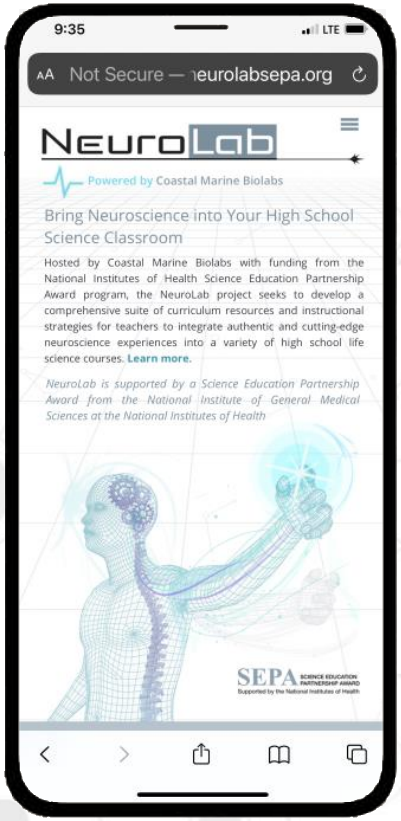
lized in future studies to deepen our understanding of spinal cord assembly.

We acknowledge that in its current form, our early-stage CURE model engages a limited number of academically advanced and highly motivated students who have already developed a broad interest in science or medicine (a limitation that we seek to overcome through program iteration in broader educational contexts as discussed below). Extending residential experiences to students with more mixed interests and academic performance histories would undoubtedly

Grant activities

NeuroLab 2.0 involves extensive collaborations with local high school science teachers





www.NeuroLabSEPA.org

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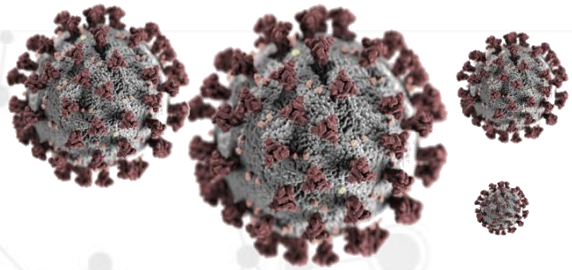
Impacts of SARS-CoV-2 on programming

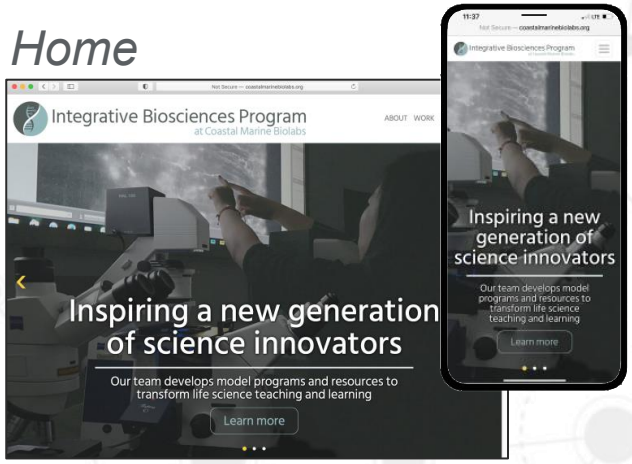


- *Suspended student internship program (expected to resume in fall 2021)*
- *Suspended summer residential research experiences (expected to resume in July 2022)*
- *Adopted virtual format for curriculum development workshops hosted in connection with NIH SEPA project (will resume in-person or hybrid workshops in summer 2021)*

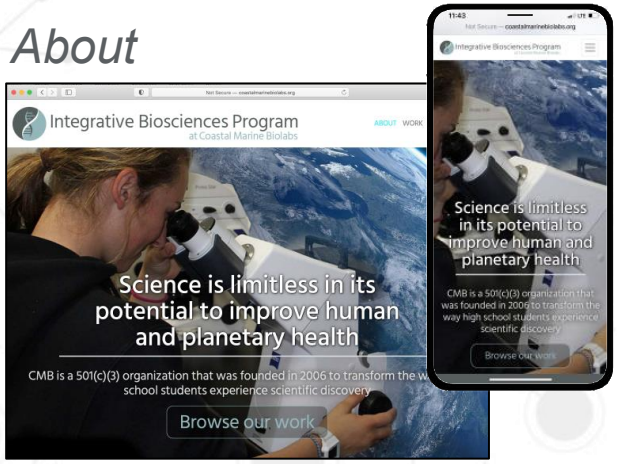
Updated primary website

www.coastalmarinebiolabs.org

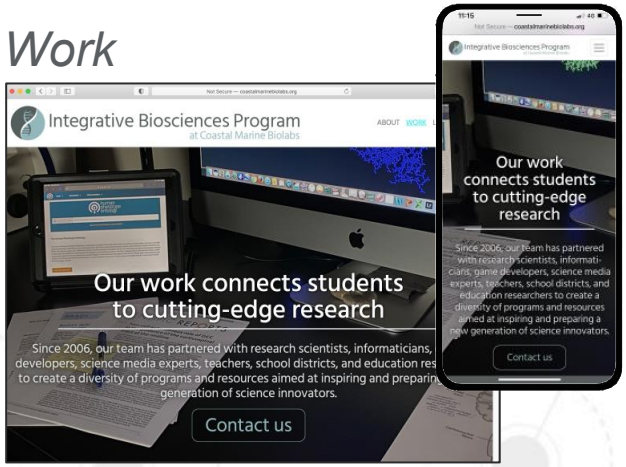
Home



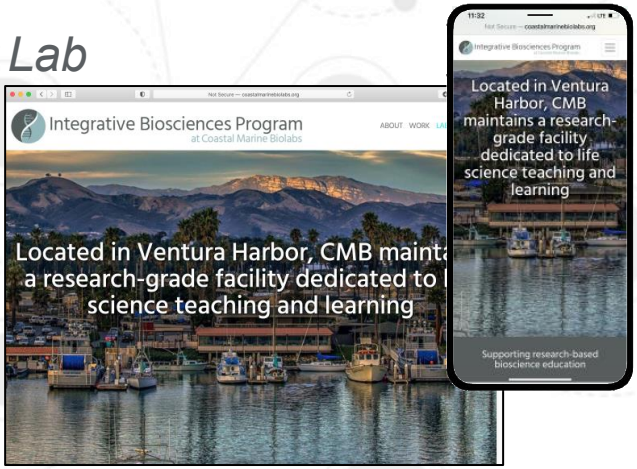
About



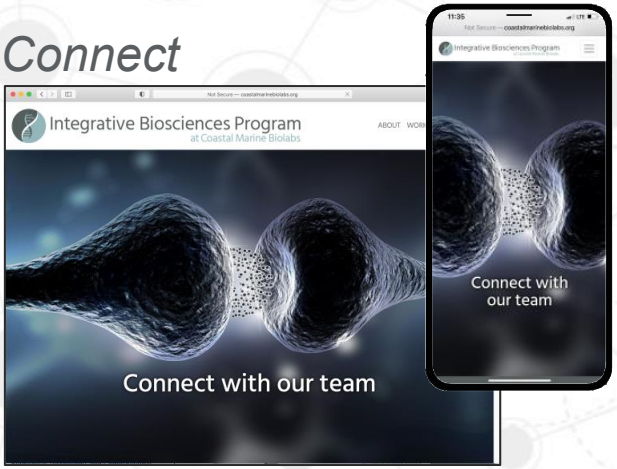
Work



Lab



Connect



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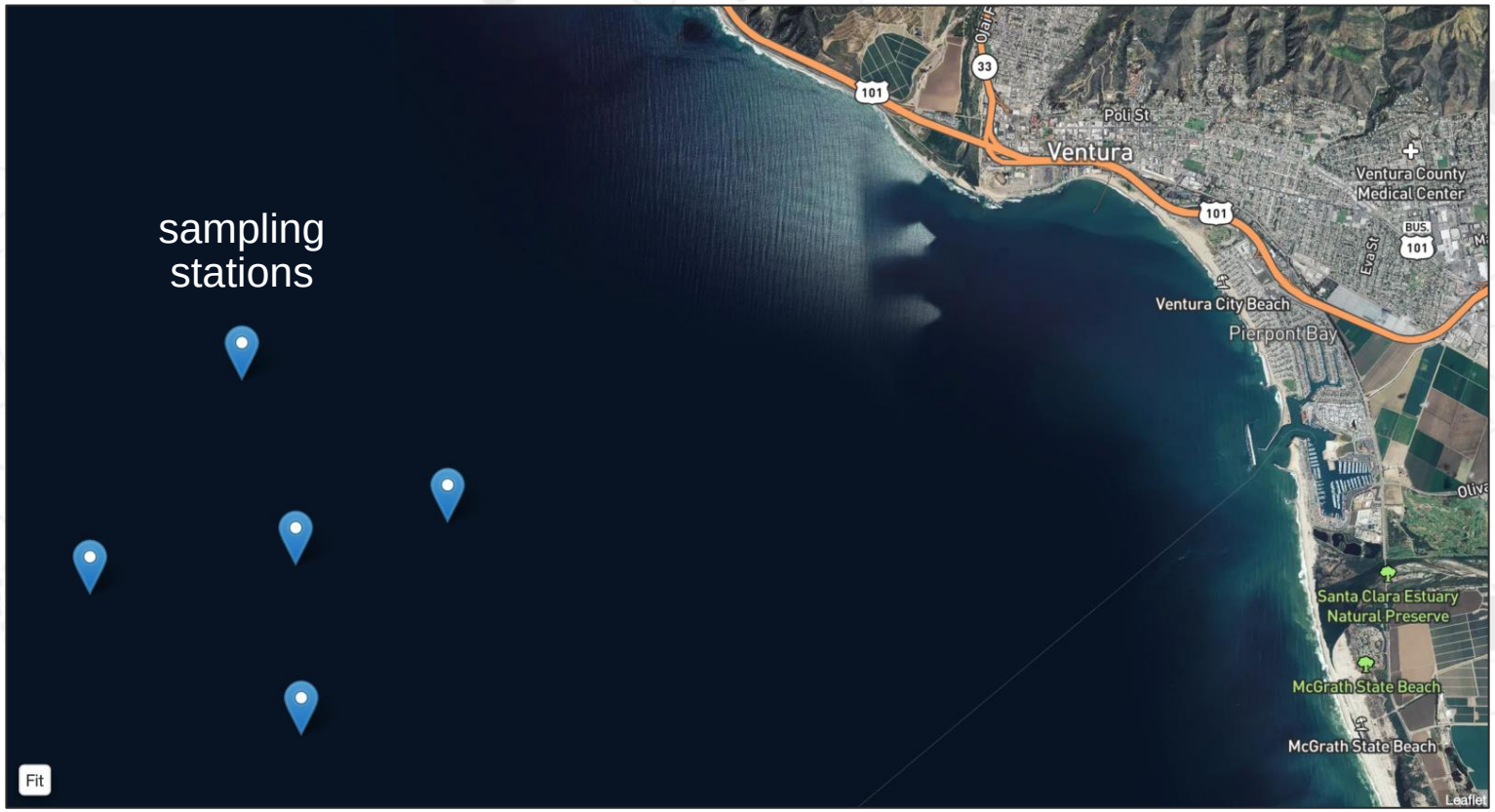
Collaboration with the VPD on NOAA SeaGrant

CMB is implementing a baseline biotoxin monitoring program developed in consultation with the FDA

The program involves the collection of data from five sampling stations within the formerly proposed growing area



Collaboration with the VPD on NOAA SeaGrant

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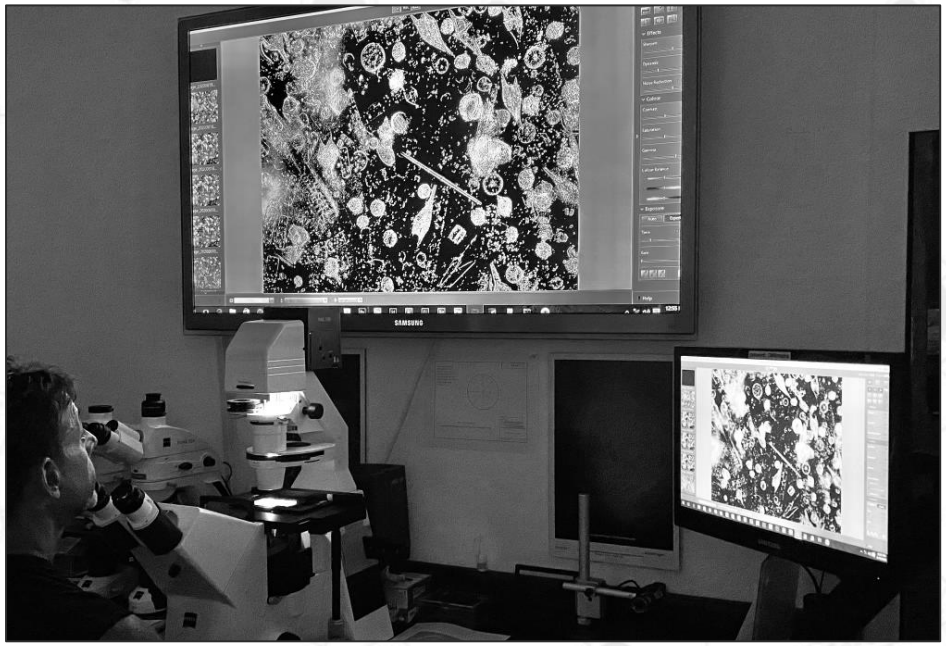
Enumeration of biotoxin-producing phytoplankton from water samples taken at sampling sites via vertical tows

vertical phytoplankton tow in field



microscopic analysis of phytoplankton in the CMB lab (Utermöhl sedimentation method)

Collaboration with the VPD on NOAA SeaGrant

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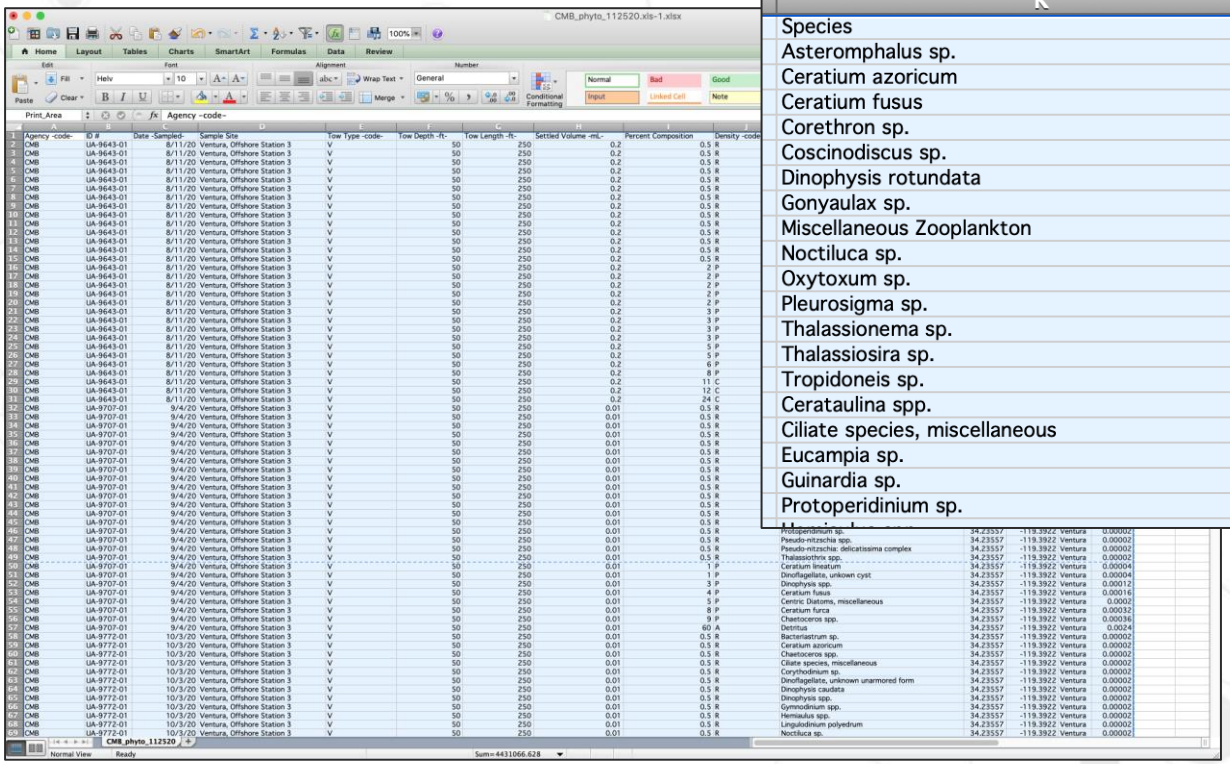
CDPH is conducting independent counts of duplicate phytoplankton samples obtained from the center site and shipped to the Richmond lab



K	L	M	N	O
Species	Latitude	Longitude	County	RA Index
Asteromphalus sp.	34.23557	-119.3922	Ventura	0.0004
Ceratium azoricum	34.23557	-119.3922	Ventura	0.0004
Ceratium fusus	34.23557	-119.3922	Ventura	0.0004
Corethron sp.	34.23557	-119.3922	Ventura	0.0004
Coscinodiscus sp.	34.23557	-119.3922	Ventura	0.0004
Dinophysis rotundata	34.23557	-119.3922	Ventura	0.0004
Gonyaulax sp.	34.23557	-119.3922	Ventura	0.0004
Miscellaneous Zooplankton	34.23557	-119.3922	Ventura	0.0004
Noctiluca sp.	34.23557	-119.3922	Ventura	0.0004
Oxytoxum sp.	34.23557	-119.3922	Ventura	0.0004
Pleurosigma sp.	34.23557	-119.3922	Ventura	0.0004
Thalassionema sp.	34.23557	-119.3922	Ventura	0.0004
Thalassiosira sp.	34.23557	-119.3922	Ventura	0.0004
Tropidoneis sp.	34.23557	-119.3922	Ventura	0.0004
Cerataulina spp.	34.23557	-119.3922	Ventura	0.0016
Ciliate species, miscellaneous	34.23557	-119.3922	Ventura	0.0016
Eucampia sp.	34.23557	-119.3922	Ventura	0.0016
Guinardia sp.	34.23557	-119.3922	Ventura	0.0016
Protoperidinium sp.	34.23557	-119.3922	Ventura	0.0016

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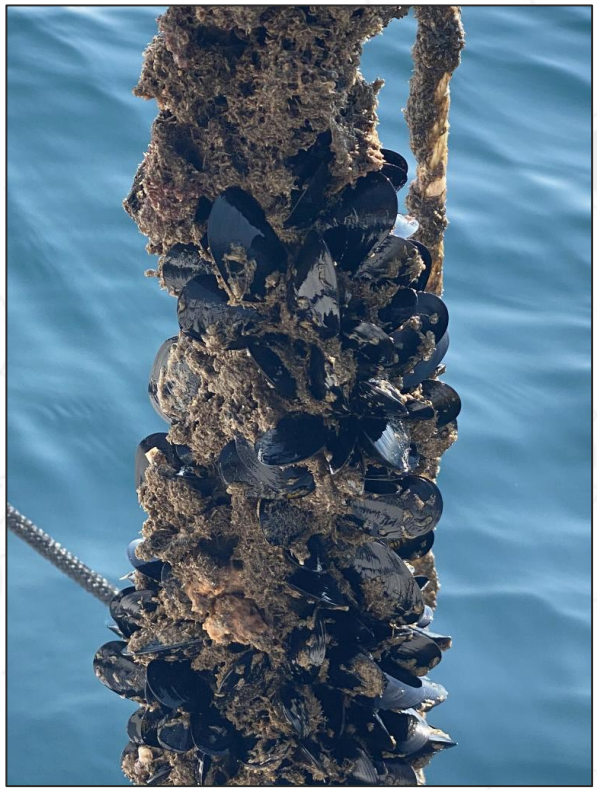
Detection of biotoxins in tissue obtained from mussel sentinels grown within the farming area



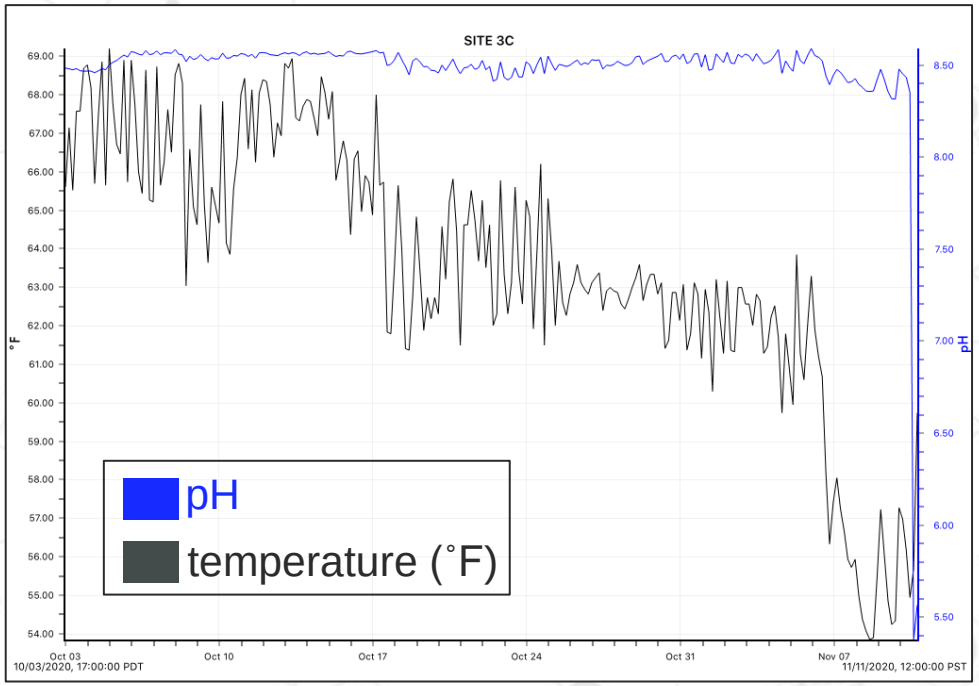
mussels affixed to fuzzy rope of sentinel line (center station)

Collaboration with the VPD on NOAA SeaGrant

CMB is implementing a baseline biotoxin monitoring program developed in consultation with the FDA

The collection of physical data (pH and temperature) at sampling sites

submersible data logger affixed to leader above fuzzy rope



graph of raw pH and temperature data downloaded from logger

Emerging collaboration with the LAUSD

CMB is collaborating with the LAUSD on a new Career Technical Education course that crosscuts two prominent CA industry sectors

Health Science and Medical Technology
(Biotechnology | Public and Community Health)

Agriculture and Natural Resources
(Agriscience | Forestry and Natural Resources)

The new course will emphasize the science and public health safety aspects of the baseline biotoxin monitoring project