

Adopted: March 10, 2015

**ACADEMIC SENATE
of
CALIFORNIA POLYTECHNIC STATE UNIVERSITY
San Luis Obispo, CA**

AS-790-15

**RESOLUTION ON PROPOSED NEW DEGREE PROGRAM:
BACHELOR OF SCIENCE IN MARINE SCIENCES**

1 **RESOLVED:** That the proposed new degree program, Bachelor of Science in Marine Sciences,
2 be approved.

Proposed by: The Department of Biological Sciences
Date: February 20, 2015

Center by placing a new CA Sea Grant Extension Specialist at Cal Poly in Fall 2014.

Cal Poly has an ideal geographic location for training future marine scientists. Importantly, Cal Poly is situated near diverse ecosystems that we incorporate into our teaching and research programs, including the CCMS Pier marine laboratory facility. The CCMS pier facility is a 1 km long pier off Avila Beach, CA, approximately 12 miles from campus (www.marine.calpoly.edu). The CCMS pier provides 2,000 sq. ft. laboratory space, with an overall usable space offshore of 40,000+ sq. ft. for field-based experiments, field-testing of sensors and platforms, educational activities, and small vessels launch for near shore research, teaching and collections. The facility has internet connectivity and a state-of-the-art classroom space. The CCMS also owns and operates five small vessels used for near shore research and teaching. This facility has a high quality flowing seawater system that allows us to maintain marine life in natural seawater and conduct large-scale, long-term experiments and course projects.

This new Marine Sciences B.S. degree will emphasize an interdisciplinary approach, attracting students from many areas of science. Currently, all degree programs at Cal Poly are classified as "Impacted" (CSU Impacted Programs report, 2012-2013). This degree option may open opportunities and draw from those impacted programs.

Note: A full version of the proposal is available from N. Adams upon request.

3. Expected student learning outcomes and methods for assessing outcomes:

a. Learning Outcomes

Program learning outcomes (PLOs)

Graduates of the Marine Sciences B.S. program will be able to:

1. Integrate and synthesize information from the various marine disciplines
2. Recognize and value the diversity of marine life and ecosystems
3. Apply the scientific method, by formulating hypotheses, making predictions, and assesses, analyzing, synthesizing, and interpreting data
4. Communicate marine scientific principles and research findings effectively to diverse audiences verbally and in writing
5. Demonstrate proficiency in lab and field techniques relevant to marine sciences
6. Locate and utilize bibliographic resources and demonstrate the ability to evaluate scientific literature.

Student learning outcomes (SLOs)

Students who successfully complete the Marine Sciences B.S. program will be able to:

Identify, explain, critically evaluate and solve problems using principles, methodology, theories and literature from multiple disciplines in marine sciences

1. Classify, organize, evaluate and compare the structures and function of major life forms in the ocean
2. Describe how these life forms interact with one another and the ocean ecosystem
3. Design, conduct, evaluate and compare experimental approaches to scientific observation, hypothesis testing, data acquisition and statistical analysis in marine systems
4. Demonstrate and apply excellent written, verbal, and listening communication skills

- **Surveys/Interviews:** The Marine Sciences program will survey graduating seniors and alumni to gather data and feedback for assessment of program objectives.
- **Graduate status report:** External indicators can serve as excellent feedback that the Marine Sciences degree is meeting its program goals. The Graduate Status reports will help determine the success of the graduates at securing positions in industry, governmental agencies and associated careers in marine sciences or enrolling in graduate programs.

4. Anticipated student demand and enrollment:

	At initiation	After 3 years	After 5 years
Number of Majors	24	100	≥ 150
Number of Graduates (total)	--	12	≥ 50
Basis for projection	Numbers will be from recruitment and some internal transfers.	Anticipated number of students the program will be able to support.	Anticipated number of students the program will be able to support.

Indicate briefly what these projections are based upon:

This new Marine Sciences B.S. degree will emphasize an interdisciplinary approach, attracting students from many areas of science. Currently, all degree programs at Cal Poly are classified as “Impacted” (CSU Impacted Programs report, 2012-2013). This degree option may open opportunities and draw from those impacted programs. For example CSU Monterey Bay, which is the only other campus in the CSU system to offer a specifically “marine science” B.S. degree, had a ~11% acceptance rate this fall and has experienced a greater than 200% growth rate since piloting their program in Fall 2011 (e.g. enrollment has been as follows: Fall 2011= 1 student, Spring 2012=78 students and Fall 2012= 219 students) (CSU Monterey Bay 2011 and 2012 Institutional Planning enrollment reports).

Data from a Nov 2014 analysis by Cal Poly’s Office of Enrollment Planning showed that students nationwide graduating between 2015-2018, meeting the Cal Poly average College Board exams of 1200-1600, with a GPA of C or higher and who have an interest in a major in Marine Sciences will provide Cal Poly with a potential pool of at least 1,886 applicants.

A Fall 2014 survey of our current PHYS, CHEM, BIO students reveals that at least 38 of 92 existing students who completed the survey would like to transfer into the Marine Sciences B.S. program when it starts in 2016.

5. If additional resources (faculty, student allocations, support staff, facilities, equipment, etc.) will be required, please identify the resources needed and from where they will come:

There is no anticipated need for additional resources because this program will incorporate expertise from across campus, welcoming faculty from several departments to develop curricula, team-teach courses, and co-advise students. Over 85% of the curriculum is being delivered through existing courses. Faculty members already teach most of the courses included in the

CSM BS majors (some students will remain and graduate in the existing concentration). After three years, we anticipate we will grow to 84-100 students, attracting students who would already be interested in CSM degrees. After five years, we anticipate we will have 100-150 total majors. We believe the program will grow and after the third year we will be drawing additional students beyond the average CSM student body. Therefore, we anticipate CSM will grow slightly over time due to this program.

8. If the new program is not commonly offered as a bachelor's or master's degree, provide a brief, compelling rationale explaining how the proposed subject area constitutes a coherent, integrated degree major, which has potential value for students:

There is only one other Marine Sciences B.S. program in the CSU system. There are other Marine Biology programs, but the Marine Sciences degree offers more interdisciplinary training.

In 2010, President Obama established a National Policy for the Stewardship of the Ocean, Coasts, and Great Lakes and adopted the recommendations of the report by the national Interagency Ocean Policy Task Force for improved stewardship of our oceans. The recommendations included using an interdisciplinary approach to marine resource management to better maintain healthy, resilient and sustainable oceans and coasts. This established the first national policy on ocean stewardship and created the National Ocean Council (NOC). This initiative mandates increased training for our future workforce and better educating the public through formal and informal programs about the ocean, our coasts, and the Great Lakes (Final Recommendations Report, NOC). Our proposed B.S. degree in Marine Sciences at Cal Poly will align with many of the recommendations of the NOC and will prepare our graduates for careers contributing to informing science, management, policy and the public about the best practices for conserving our nation's marine resources.

The marine environment is particularly important to the California economy and its ecology; unprecedented changes to our coastal ecosystems are anticipated over the next 50 years, which has created a critical need for a better understanding of how such changes will affect our environment, human health, coastal communities, and economies. The citizens of California and the nation rely on a multibillion-dollar ocean economy. California's coastal systems require novel multidisciplinary efforts because of the inherent complexities, and responsible and sustainable solutions required for the problems. Implementing emerging innovative solutions requires an educated populace that can appreciate and understand the complex environmental challenges and act to meet them. The current workforce of California is ill prepared to meet these challenges (Science Literacy in California, Ocean Science Literacy Campaign). The California State University (CSU) and Cal Poly can play a key role in providing the necessary transformations in sustainable environmental science needed by the State.

The CSU system is well positioned to take a leadership role in training bachelors and masters levels students in marine science. To address these needs, the CSU Council on Ocean Affairs, Science and Technology (COAST) was established in 2008 to integrate system-wide resources and promote interdisciplinary multi-campus collaborations to advance our knowledge of California's natural coastal and marine resources and the processes that affect them (CSU COAST Strategic Plan 2010). COAST's mission is to provide vision, leadership, and support throughout the CSU system for education, policy and research related to marine, estuarine, and coastal regions, and to promote the public dissemination of knowledge gained to foster stewardship and sustainable use of our coast. In addition to having two faculty campus representatives to COAST, Cal Poly's Director of the Center for Coastal Marine Sciences was

STAT 313 Applied Experimental Design and Regression Models (4)

* Those emphasizing Chemistry, Physics or Engineering should take MATH 141 and 142 instead of MATH 161 and 162. Those emphasizing Physics should take PHYS 141, 132, 133 instead of PHYS 121, 122, and 123.

3. Free Electives (4 units)

4. Major Requirements (71 units)

Marine Sciences Core (36). Take each of these courses:

- BIO 160 Diversity and History of Life (4)
- BIO 161 Introduction to Cell and Molecular Biology (4)
- BIO 162 Introduction to Organismal Form and Function (4)
- BIO 263 Introductory Ecology and Evolution (4)
- BIO 461 Senior Project Proposal Writing (2) or BIO 462-Senior Project Research (2)
- CHEM 302 Marine Chemistry (3)
- MSCI 100 Introduction to Marine Sciences (1)
- MSCI 301 Biological Oceanography (3)
- MSCI 303 Ocean Sampling Techniques (3)
- MSCI 328 Marine Ecology (4)
- PSC 201 Physical Oceanography (4)

Marine Resources Conservation and Policy (4). Take one course from the following list:

- BIO 401 Principles of Conservation Biology (4)
- MSCI 428 Marine Conservation and Policy (4)
- MSCI 438 Aquaculture (4)
- MSCI 439 Fisheries Science and Resource Management (4)

Marine Biodiversity (4). Take one course from the following list:

- MCRO 436 Environmental Microbiology (4)
- MSCI 324 Marine Mammals, Birds, Reptiles (4)
- MSCI 437 Marine Botany (4)
- ZOO 322 Ichthyology (4)
- ZOO 336 Invertebrate Zoology (4)

Communicating Science (1-4). Take one course from the following list:

- COMS 390 Environmental Communication (4)
- COMS 395 Science Communication (4)
- MSCI 401 Marine Sciences Outreach (1-4)
- MSCI 440 Communicating Ocean Science to Informal Audiences (3)
- SCM 302 Learn by Doing Lab (2)

Approved Electives (23-26 units). Take courses from the following list to fulfill degree requirements:

Some courses on list require other courses on the list as prerequisites.

- BIO 200 Special Problems for Undergraduates (1-2)
- BIO 327 Wildlife Ecology (4)
- BIO 330 Extended Field Biology Activity (1-3)
- BIO 351 Principles of Genetics (5)
- BIO 361 Principles of Physiology (4)
- BIO 400 Special Problems for Undergraduates (1-2)
- BIO 401 Conservation Biology (4)
- BIO 414 Evolution (4)
- BIO 415 Biogeography (4)
- BIO 419 Analytical Methods in Ecology (4)
- BIO 434 Environmental Physiology (4)

Appendix: Table 1. Matrix – Comprehensive Assessment Plan

Institutional Learning Outcomes (ILOs) Cal Poly ULOs	Program Learning Outcomes (PLOs)	Corresponding Student Learning Outcomes (SLOs)	Course(s) Where SLOs are Assessed	Assessment activities (to measure each SLO)	Suggested assessment tools	Assessment schedule - how often SLOs will be assessed	How will data/findings be reported?	Designated personnel to collect, analyze, and interpret	Program findings dissemination schedule	Anticipated closing the loop strategies
Demonstrate expertise in scholarly discipline and understand the discipline in relation to the larger world Think critically and creatively	1. Integrate and synthesize information from the various marine disciplines	1. Identify, explain, critically evaluate and apply to problem solving principles, methodology, theories and literature from multiple disciplines in marine sciences	CHEM 302 MSCI 328 MSCI 428 MSCI 439	Exams term papers, lab reports or projects	Rubrics for papers or reports with criteria based on SLOs	PLOs and associated SLOs will be assessed every three years (two PLOs each year)	Report on percentage of students that meet or exceed a minimum level established learning outcomes for each PLO/SLO.	Faculty teaching specific courses	Annual Program retreat for all faculty and review by Academic Assessment Council	We will implement a continuous improvement process based on results of assessment data.
Engage in lifelong learning and have an awareness of sustainability Demonstrate expertise in field.	2. Recognize and value the diversity of marine life and ecosystems	1. Classify, organize, evaluate and compare the structures and function of major life forms in the ocean 2. Describe how these life forms interact with one another and the ocean ecosystem	Diversity electives	Exams, term papers or lab reports	Rubric for written reports with criteria based on SLOs	Complete cycle of assessment in 3 years	Graduate status reports will determine success of graduates at securing positions in industry	Assessment committee comprised of faculty and staff	Review by Academic Programs Office as part of program review.	
Think critically and creatively. Demonstrate expertise in the scholarly discipline.	3. Apply the scientific method, by formulating hypotheses, making predictions, and assesses, analyzing, synthesizing, and interpreting data	1. Design, conduct, evaluate and compare experimental approaches to scientific observation, hypothesis testing, data acquisition and statistical analysis in marine systems	MSCI 328 MSCI 439 BIO 462	Exams, term papers, lab reports or oral presentations	Rubrics for written reports or oral presentations with criteria based on SLOs	Surveys/ Interviews of graduating seniors each year. Surveys of alumni every 3 to 5 years				
Communicate effectively. Make reasoned decisions based on an understanding of ethics, a respect for diversity, and an awareness of issues related to sustainability. Use knowledge and skills to make a positive contribution to society.	4. Communicate marine scientific principles and research findings effectively to diverse audiences verbally and in writing	1. Demonstrate and apply excellent written, verbal, and listening communication skills. 2. Demonstrate the ability to work in a professional communications setting through experiential learning (i.e. internships, work experience, outreach events)	MSCI 401 MSCI 440 BIO 485	Written term papers, lab reports, oral presentations or projects.	Rubrics for written reports or oral presentations with criteria based on learning outcomes					
Work productively as individuals and in groups. Demonstrate expertise in scholarly discipline and understand that discipline in relation to the larger world.	5. Demonstrate proficiency in lab and field techniques relevant to marine sciences	1. Use basic field and lab equipment to gather data on biological, chemical and physical characteristics of the ocean	MSCI 303 MSCI 328 BIO 462	Laboratory practical exams, field exercises and projects	Rubrics for practical examinations and projects with criteria based on SLOs					
Engage in lifelong learning.	6. Locate and utilize bibliographic resources and demonstrate the ability to evaluate scientific literature	1. Procure, explain and critically evaluate primary literature and key theories in the marine sciences	MSCI 303 MSCI 328 BIO 461 BIO 462	Written term papers, lab reports, or projects.	Rubric for written reports or oral presentations with criteria based on SLOs					

**State of California
Memorandum**

CAL POLY
SAN LUIS OBISPO

To: Gary Laver, Chair
Academic Senate

Date: March 19, 2015

From: Jeffrey D. Armstrong
President



Copies: K. Enz Finken
M. Pedersen
P. Bailey
D. Gragson
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C. O'Bryant

Subject: Response to Academic Senate Resolution AS-790-15—
Resolution on Proposed New Degree Program: Bachelor
of Science in Marine Sciences

I am pleased to approve the above-entitled Academic Senate resolution. The proposal will now be sent to the Chancellor's Office for approval.

Please express my appreciation to the Academic Senate members for their attention to this important curricular matter.