ACADEMIC POLICIES COMMITTEE

STANDARD ONE YEAR PROCESS: UNDERGRADUATE CURRICULAR PROPOSAL(S) PROCEDURES TO CHANGE 2013-2014 CATALOG *(Approved by APC September 6, 2012)*

DEADLINES:

1. Review any proposed changes in person with your College Dean by **October 5 …..,** prior to submitting the proposal to APC;
2. Submit a short narrative to the APC chair highlighting the proposed changes by **October 12 …;**
3. Final proposals are due no later than **November 9 …., PROPOSALS SUBMITTED AFTER THAT DATE WILL BE CONSIDERED FOR THE 2014-2015 CATALOG.**

BASIC ASSUMPTIONS - Curricular changes:

1. May be generated by any faculty member within a department;
2. Are made as a result of a department or school program review and assessment data or due to external requirements made by outside accrediting agencies (provide appropriate documentation);
3. Are voted on and approved by all full time department members;
4. Will be thoroughly discussed with other departments who are directly affected by the proposed changes (a written response must be received by affected schools or departments and included in the proposal);
5. Will be reviewed by the dean of the College of Arts & Sciences or the Dean of Social Sciences and Professional Studies before the proposal is sent to APC;
6 . Will be recommended for consideration by APC to the faculty at large;
7. Are finally voted on by the entire faculty.

ACADEMIC POLICIES INFORMATION TO FACILITATE YOUR WORK

Majors:

1. Maximum number of units for a B.A. major: **49 units beyond G.E.**
2. Maximum number of units for a B.S. major: **59 units beyond G.E.**
3. Minimum number of upper division units in any major: **24 units**, half of which must be completed in residency.

Minors:

1. Minimum number of units for a minor: **16 units**
2. Minimum number of upper division units: **12 units**
3. Minimum number of units completed in residency: **9 units**
4. Of the 16+ units in the minor, **9 units** must be distinct from the major.

TEMPLATE FOR PROPOSALS: All submitted proposals need to adhere to the following template in order to facilitate the work of the Academic Policies Committee. **Please fill in boxes.**

NAME OF SCHOOL OR DEPARTMENT:
Biology

ACTION ITEMS/SUBSTANTIVE CHANGES INCLUDE: addition/deletion of courses, additions/deletions of a major, changes in degree requirements and changes in general education requirements.

I. List proposal(s) with a one line abstract (examples):

Proposal I: To drop xx course from the xx major (concentration, minor), etc.
Proposal II: To add xx course as a requirement to xx major (concentration, minor, etc.)
Proposal III: To add or drop a major, minor, concentration, etc.
Proposal IV: To add xx course to the General Education cluster……
Proposal V: To add a hybrid, online, or video conferencing course….

Proposal I: To drop BIO360 (Ecology) as a required course for the Biology – BA, Biology – BS, and Environmental Science majors, and the Environmental Biology and Organismal Biology minors. (- 3 units)

Proposal II: To add BIO363 (Conservation Ecology) as a required course for the Biology – BA, Biology – BS, and Environmental Science majors, and the Environmental Biology and Organismal Biology minors. (+ 3 units)

Proposal III: To drop BIO420 (Vertebrate Physiology) as a required course for the Biology – BA and Biology – BS majors. (- 3 units)

Proposal IV: To add BIO420 (Vertebrate Physiology) as an elective course for the Biology – BA and Biology – BS majors. (+ 3 units)

Proposal V: To drop BIO310 (Botany) as a required course for the Biology – BA and Biology – BS majors, and the Environmental Biology and Organismal Biology minors. (- 3 units)

Proposal VI: To add BIO312 (Applied Plant Biology) as an elective course for the Biology – BA, Biology – BS, and Environmental Science majors, and the Environmental Biology and Organismal Biology minors. (+ 2 units)

Proposal VII: To drop BIO320 (Marine Vertebrate Zoology) as an elective course for the Biology – BA, Biology – BS, and Environmental Science majors, and the Environmental Biology and Organismal Biology minors. (- 3 units)

Proposal VIII: To add BIO323 (Introduction to Oceanography) as an elective course for the Biology – BA, Biology – BS, and Environmental Science majors, and the Environmental Biology

and Organismal Biology minors. (+ 3 units)

Proposal IX: To drop BIO330 (Marine Invertebrate Zoology, 2 units) as an elective course for the Biology – BA, Biology – BS, and Environmental Science majors, and the Environmental Biology and Organismal Biology minors. (- 1 unit because every other year)

Proposal X: To add BIO333 (Marine Biology, 3 units) as an elective course for the Biology – BA, Biology – BS, and Environmental Science majors, and the Environmental Biology and Organismal Biology minors. (+ 1.5 units, because every other year)

Proposal XI: To drop BIO370 (Marine Plant & Microbial Life, 2 units) as an elective course for the Biology – BA, Biology – BS, and Environmental Science majors, and the Environmental Biology minor. (- 1 unit because every other year)

Proposal XII: To add BIO473 (Experimental Marine Ecology, 3 units) as an elective course for the Biology – BA, Biology – BS, and Environmental Science majors, and the Environmental Biology and Organismal Biology minors. (+ 1.5 units, because every other year)

Proposal XIII: To change the upper-division required courses from 21 units to 15 units, and the elective courses from 8-9 units to 12 units for the Biology – BA major, resulting in a decrease of 2-3 units in the major.

Proposal XIV: To change the upper-division required courses from 21 units to 15 units, and the elective courses from 10-11 units to 14 units for the Biology – BS major, resulting in a decrease of 3-4 units in the major.

II. Rationale: Each proposal needs thorough explanations as to why the change is being suggested. Please answer the following questions in your rationale and include other appropriate reasons in this section. All proposals must address the following questions including face to face, hybrid, online and videoconferencing courses. **FOR HYBRID, ONLINE, AND VIDEO COURSES, PLEASE , Please fill out the additional questions in the template attached at the end of this document :**

1. How has assessment data informed the proposed change and how recently has your department or school completed a program review? For example, have alumni, outside reviewers, etc., suggested improvements?

The Biology Department completed a program review in 2009. At that time, we made a change to all of our majors (Biology – BA/BS, Biology-Chemistry, Environmental Science) that has ramifications for this proposal. That change was to split BIO215 (Animal Biology), a required course, into two required courses: BIO211 (Ecological & Evolutionary Systems) and BIO212 (Organismal Biology). The rationale was to better prepare students in both of these crucial areas of Biology, and the change was based on our assessment data, which showed that students were deficient in their understanding of organismal biology. Because of this change, we now need to modify two upper-division courses: BIO360 (Ecology) and BIO310 (Botany). Our students are getting a much better background in ecology in BIO211 and plant biology in BIO212, such that the upper-division courses no longer need to teach the background content. Thus, we propose to significantly change the content of the upper-division courses. Instead of Botany, we will offer

BIO312 (Applied Plant Biology). This course will now be an elective instead of a requirement, since students are receiving the basic botany content in BIO212. Instead of Ecology, we will now offer BIO363 (Conservation Ecology), which will focus on conservation and sustainability. This course will still be required of Biology-BA/BS and Environmental Science majors, as these issues are crucial to modern biology.

In addition, we are significantly changing the content of all of our Marine Biology courses (BIO320, BIO330, BIO370). With the addition of a faculty member with a PhD in Marine Biology, Dr. Walter Cho, we discovered that our current courses do not reflect how modern Marine Biology is taught. This issue is described in more detail in the section describing what comparable institutions are doing.

Finally, we are proposing to change the structure of our Biology-BA/BS majors. We are decreasing the number of required courses, increasing the number of electives, and decreasing the size of the majors by 2-4 units. We are also removing the track system from our electives, whereby students had to take a certain amount of units in each track. These changes are being driven by both assessment and enrollment. First, three years of conducting senior exit interviews revealed that many students want more choice in their electives. They would also like to be able to do minors and to study abroad. Decreasing the number of required courses and the total number of units in the major will help with these issues. Second, the number of students who select Biology-BA/BS, Biology-Chemistry, or Environmental Science majors has been growing over the past 3 years. We are struggling to offer enough sections of required classes and electives in order for students to graduate in 4 years. Students are also complaining that they cannot take the electives they want; rather they are forced into certain electives based on which classes do not fill to capacity. This problem is contributing to the frustration we have documented in the more recent senior exit interviews. Again, reducing the number of required classes, increasing the number of electives, removing the track system, and decreasing the total number of units required in the Biology-BA/BS majors will give students more choice. Moreover, the size of these majors will still be similar to their size at comparator and aspirant institutions (see below).

2. What are comparable universities and colleges doing?

<u>Marine Biology curriculum</u>

We propose to change our Marine Biology curriculum from a series of survey courses (Marine Vertebrate Zoology, Marine Invertebrate Zoology, Marine Plant & Microbial Life) to a more comprehensive menu of courses (Introduction to Oceanography, Marine Biology, Experimental Marine Ecology). Instead of being exposed to a survey of marine life, students will study the broader context of ocean science as it relates to the biology of marine organisms. Moreover, students will have the option of doing research in marine biology via the Experimental Marine Ecology course.

A comparison of marine courses offered at our comparator and aspirant schools revealed current trends in marine science curricula (see Table I). This comparison showed that 81% of comparator and aspirant schools offer some type of marine course. The most popular course offered was <u>marine biology</u> (offered by 69% of institutions that offer a marine science course of some kind). Of these, 39% of the institutions offered a non-majors marine biology course for GE credit while 65% offered a marine biology course for credit within the major. Most institutions offered at least one marine course on-campus (91%) and 28% offered marine courses through an off-campus program (such as the Au Sable Institute or a field research station). Following a marine biology course, the next most popular marine courses offered are:

oceanography (offered by 4 institutions on-campus), fish biology (offered by 3 institutions on-campus, 1 at an off-campus program), marine plants (offered by 2 institutions on-campus, 1 at an off-campus program), marine invertebrates (offered by 2 institutions at an off-campus program), and marine mammals (offered by 1 institutions on-campus, 1 offered at an off-campus program). In addition, five of the six schools that have a significant interest in marine science (as indicated by offering a concentration or major in marine biology and/or operating a field station) offer an oceanography class. A marine field research class is offered by 28% of the institutions, but the majority of these are offered through off-campus programs and only 2 schools offer this type of course on-campus.

Decrease of units in Biology-BA/BS majors

There is no standardized definition of a Biology BA vs. BS major. Most of our comparator and aspirant institutions, but not all, require more units of a Biology- BS major. Even with a 2-4 unit reduction, the size of these majors at PLNU is still similar to the range within our comparator and aspirant institutions (Table II). The newly structured Biology-BS will have 10 more required units than the newly structured Biology-BA. This difference includes 8 units of Physics, which is also required by many comparator schools, and 2 additional units of Biology electives.

3. Is the change related to stipulations imposed by outside accrediting agencies (addressing standards, etc.)?

NO

4. How does the proposed change relate to the mission of the university?

The learning outcomes for the majors will not change. These outcomes are still tied to the mission of the university.

5. How does the change accommodate the department or school's learning outcomes for the major, minor, concentration, etc.? For instance, does the change help balance out the curriculum, or does it fill in a missing gap that would help strengthen the program? Does it add breadth or depth, etc.?

As stated above, the learning outcomes for the majors will not change. The specific changes to the courses will, however, strengthen our curriculum. BIO363 will add sustainability and conservation issues to the Biology and Environmental Science majors. BIO312 will add to the breadth of our electives. BIO323/333/473 will bring our Marine Biology curriculum into alignment with modern Marine Biology.

6. What impact will it have on the size of the major, minor, etc.?

The size of the Biology-BA will be reduced 2-3 units and the size of the Biology-BS will be reduced 3-4 units.

7. Will the change(s) be sustainable with human and financial resources?

These changes will make it much easier to offer our students the courses they need with the faculty we currently have.

8. How does the proposal(s) address the PLNU strategic plan?

We predict that by making these changes, we will not have to add sections of required courses in order for students to graduate in 4 years, which will obviously save PLNU money. We predict

that students will spread out between various elective options such that we can better fill the courses we are already offering. We predict that these changes will increase enrollment in lower enrollment elective courses due to removing course conflicts with previously required courses and generally creating more freedom of choice.

9. State other rationale that you deem appropriate.
Some of the required courses were at full capacity and class size was at the high end of what might be considered "small class size." Giving students the freedom to take elective courses that they are interested in and that best align with their career choices will allow us to keep class sizes reasonable.

III. Tentative Syllabus/Course Learning Outcomes: If you are proposing new courses, please include a tentative syllabus with course learning outcomes. This should not include textbooks, calendar, etc., but merely an idea of what the course content will include as well as what you hope the student will accomplish by the end of the course. **State at least four course learning outcomes (CLO's).**

Syllabus: BIO312 – Applied Plant Biology
A study of plant structure, function, and phytochemistry through an examination of economically and culturally important plants, including plants used for medicine, food, energy, fiber, and building materials. Topics include environmental plant physiology, biotechnology, plant propagation, medicinal botany, and sustainable land use. Lecture, lab and fieldwork.

Outcomes:
Upon completion of the course, students will be able to…

1. …distinguish between 1) possible benefits to the plant and 2) possible uses by humans for any specific botanical structure or molecule.
2. …apply knowledge of specific botanical structures to explain the physiological function of those structures in an intact plant.
3. …compare and contrast plants and human in terms of physiological responses to common challenges, such as loss of water or obtaining nutrients.
4. …describe the roles of biotechnology, traditional plant breeding, and sustainable land use in meeting the needs (such as food and medicine) of a growing world population.

Syllabus: BIO363 – Conservation Ecology
An examination of the key concepts and issues at the intersection of conservation biology and ecology, including ethics, value of biodiversity, extinction vortices, habitat loss, fragmentation, overharvesting, invasive species, climate change, trophic cascades, pollution and dead zones, disease and human health, protected areas and poaching, biological corridors, restoration, economic valuation, community-based conservation, and sustainable development. The course will incorporate review of case studies, analysis of journal articles, exploration of local habitats and conservation issues, critique of current events, and development of an original field project

that combines field techniques and literature review. Lecture, lab, and fieldwork.

Outcomes:
Upon completion of the course, students will be able to:

1. ...explain the value of biodiversity and the role of conservation in relation to economics, sustainability, and ethical/spiritual considerations.
2. …recognize the forces at work to diminish biodiversity and predict the consequences of various scenarios based upon ecological principles and case studies.
3. …critically read and evaluate journal articles and current events from both technical and theoretical perspectives.
4. … recognize the environmental symptoms of habitat degradation and biodiversity loss from first hand observations (e.g., field trips).
5. …design an original field project that juxtaposes ecological and conservation issues and communicate the results and conclusions via written and oral presentations.

Syllabus: BIO323 – Introduction to Oceanography

An introduction to the interdisciplinary study of the oceans, including a survey of geological, chemical, physical, and biological oceanography. Includes consideration of current research methods and exploration of marine systems. Lecture, lab, and fieldwork.

Outcomes:
Upon completion of the course, students will be able to…

1. … analyze, evaluate, and apply the model of Plate Tectonics to the study of geological features of ocean basins.
2. … evaluate the effects of temperature, pressure, and salinity on the density, layering, and dynamics of the oceans.
3. … integrate and evaluate the general circulation of the atmosphere and oceans.
4. … analyze and assess the origin and effects of waves, tides, and ocean currents.
5. … examine and illustrate the characteristics of life in the oceans, including photosynthesis, nutrient cycling, and organismal traits adapted specifically to the marine environment.
6. … analyze and evaluate the interactions and effects of the biological, physical, and chemical components of the oceans in the context of marine habitats.
7. … discuss ocean policy and analyze it from a scientific and social perspective.
8. … apply the methods of science to a problem involving the earth and environment.

Syllabus: BIO333 – Marine Biology

The study of life in the oceans, including the ecology, structure, function, and adaptations of marine organisms to their environment. Lecture, lab and fieldwork.

Outcomes:

Upon completion of the course, students will be able to…

1. … define and explain the fundamental marine habitats and marine organisms.
2. … classify marine life based upon distinguishing characteristics and adaptations of multiple categories, including major taxonomic groups, major categories of aquatic life (plankton, nekton, benthos), and major biogeographic and habitat/depth patterns related to the physical characteristics of the ocean.
3. …identify the major anatomical and physiological adaptations of marine organisms to the physical, chemical, and geological conditions of marine environments.
4. …describe and interpret patterns of marine primary and secondary production, including energy flow in marine food webs, trophic structure, and the microbial loop.
5. … describe the interactions of marine organisms through processes such as growth, reproduction, competition, predation, and varied symbioses and understand how these behaviors and processes are influenced by the physical environment.
6. … describe the major marine community types, including their dominant habitat, community structure, and ecological characteristics.
7. … discuss current and potential anthropogenic impacts upon marine ecosystems and demonstrate informed judgments about the effects of human activities on the marine environment.

Syllabus: BIO473 – Experimental Marine Ecology

A field-oriented course that explores aspects of marine ecology within the context of coastal communities, including ecological relationships within the marine environment, factors influencing community structure, and biogeography. A central component of the course will be an independent project with experimental design. Lecture, lab, and fieldwork.

Outcomes:

Upon completion of the course, students will be able to…

1. … describe several major ecological processes that influence marine population dynamics and marine community structure, including current hypotheses regarding relationships between marine organisms and their environment, intra- and interspecific interactions, and biotic and abiotic factors that structure marine communities.
2. … identify and apply several metrics that can be used to describe populations and communities in nature.
3. … describe laboratory techniques for quantifying characteristics of marine sediments, water chemistry, and sampling techniques for planktonic and benthic habitats.
4. … develop a working knowledge of relevant research literature.
5. … design and conduct an original research project.
6. … develop experience with experimental techniques in marine ecology.
7. … organize, statistically analyze, and interpret field data and communicate your interpretations in written and oral form.

IV. Catalog Copy: What will these changes look like in the catalog?

A. New Courses:

1. If proposing to substitute new courses for old ones, list old and new course descriptions side by side. Please also highlight any changes in number of units or grade type.
2. Keep in mind academic policies with regard to number of units for major, minors, etc. See resource section at the beginning of this template.

Catalog Copy (Present)	Catalog Copy (New)
BIOLOGY - BA Lower-Division Requirements --- BIO 210 - Cell Biology and Biochemistry (GE) (4) BIO 211 - Ecological and Evolutionary Systems (GE) (4) BIO 212 - Organismal Biology (3) CHE 151 - General Chemistry Tutorial (1) * CHE 152 - General Chemistry I (GE) (4) CHE 153 - General Chemistry II (4) CHE 294 - Organic Chemistry I (4) MTH 144 - Calculus With Applications (GE) (4) Total: 27-28 Units --- Note(s): *Course can be waived. Upper-Division Requirements --- BIO 301 - Research Methodology (2) BIO 310 - General Botany (3) BIO 345 - Genetics (4) BIO 360 - Ecology (3) BIO 380 - Molecular Biology (3) BIO 420 - Vertebrate Physiology (3) BIO 497 - Biology Seminar (1) MTH 362 - Calculus Based Statistics (2) Total: 21 Units ---	**BIOLOGY - BA** Lower-Division Requirements --- BIO 210 - Cell Biology and Biochemistry (GE) (4) BIO 211 - Ecological and Evolutionary Systems (GE) (4) BIO 212 - Organismal Biology (3) CHE 151 - General Chemistry Tutorial (1) * CHE 152 - General Chemistry I (GE) (4) CHE 153 - General Chemistry II (4) CHE 294 - Organic Chemistry I (4) MTH 144 - Calculus With Applications (GE) (4) Total: 27-28 Units --- Note(s): *Course can be waived. Upper-Division Requirements --- BIO 301 - Research Methodology (2) BIO 345 - Genetics (4) **BIO 363 – Conservation Ecology (3)** BIO 380 - Molecular Biology (3) BIO 497 - Biology Seminar (1) MTH 362 - Calculus Based Statistics (2) **Total: 15 Units** ---

Complete one of the following three options ---------- Track I - Organismal Emphasis Take Track I electives to a minimum of 8 units. Track II - Cell and Molecular Emphasis Take Track II electives to a minimum of 9 units. Track III - Individualized Emphasis Take one elective from Track I or one elective from Track II (minimum 3 units) plus a combination of two upper-division, non-GE courses from inside or outside of Biology, approved by the department chair. Track I Electives ---------- BIO 315 - Microbiology (3) BIO 320 - Marine Vertebrate Zoology (3) BIO 325 - Insect Biology (3) BIO 330 - Marine Invertebrate Zoology (2) BIO 340 - Field Biology (2) BIO 370 - Marine Plant and Microbial Life (2) BIO 410 - Vertebrate Biology (3) BIO 430 - Animal Behavior (3) Track II Electives ---------- BIO 315 - Microbiology (3) BIO 350 - Advanced Cell Biology (3) BIO 390 - Immunology (3) BIO 400 - Developmental Biology (3) BIO 450 - Advanced Biochemistry (4) BIO 470 - Neuroscience (3) Upper-division Elective Total: 8-9 Units ---------- Bachelor of Arts Total: 56-58 Units	**Take a minimum of 12 units of electives from the following options:** **BIO312 – Applied Plant Biology (2)** BIO 315 - Microbiology (3) **BIO 323 – Introduction to Oceanography (3)** BIO 325 - Insect Biology (3) **BIO 333 - Marine Biology (3)** BIO 340 - Field Biology (2) BIO 350 - Advanced Cell Biology (3) **BIO 473 – Experimental Marine Ecology (3)** BIO 390 - Immunology (3) BIO 400 - Developmental Biology (3)BIO 410 - Vertebrate Biology (3) BIO420 – Vertebrate Physiology (3) BIO 430 - Animal Behavior (3) BIO 450 - Advanced Biochemistry (4) BIO 470 - Neuroscience (3) **Upper-division Elective Total: 12 Units** ---------- **Bachelor of Arts Total: 54-55 Units**** **12 units meet general education requirements.

Catalog Copy (Present) **BIOLOGY - BS** Lower-Division Requirements --- BIO 210 - Cell Biology and Biochemistry (GE) (4) BIO 211 - Ecological and Evolutionary Systems (GE) (4) BIO 212 - Organismal Biology (3) CHE 151 - General Chemistry Tutorial (1) * CHE 152 - General Chemistry I (GE) (4) CHE 153 - General Chemistry II (4) CHE 294 - Organic Chemistry I (4) MTH 144 - Calculus With Applications (GE) (4) PHY 141 - General Physics I (GE) (4) PHY 142 - General Physics II (GE) (4) Total: 35-36 Units --- Note(s): *Course can be waived. Upper-Division Requirements --- BIO 301 - Research Methodology (2) BIO 310 - General Botany (3) BIO 345 - Genetics (4) BIO 360 - Ecology (3) BIO 380 - Molecular Biology (3) BIO 420 - Vertebrate Physiology (3) BIO 497 - Biology Seminar (1) MTH 362 - Calculus Based Statistics (2) Total: 21 Units --- Complete one of the following two options --- Track I: Organismal Emphasis Take three Track I electives and one Track II elective (minimum 10 units). Track II: Cell and Molecular Emphasis Take three Track II electives and one Track I elective (minimum 11 units). Track I Electives	Catalog Copy (New) **BIOLOGY - BS** Lower-Division Requirements --- BIO 210 - Cell Biology and Biochemistry (GE) (4) BIO 211 - Ecological and Evolutionary Systems (GE) (4) BIO 212 - Organismal Biology (3) CHE 151 - General Chemistry Tutorial (1) * CHE 152 - General Chemistry I (GE) (4) CHE 153 - General Chemistry II (4) CHE 294 - Organic Chemistry I (4) MTH 144 - Calculus With Applications (GE) (4) PHY 141 - General Physics I (GE) (4) PHY 142 - General Physics II (GE) (4) Total: 35-36 Units --- Note(s): *Course can be waived. Upper-Division Requirements --- BIO 301 - Research Methodology (2) BIO 345 - Genetics (4) **BIO 363 – Conservation Ecology (3**) BIO 380 - Molecular Biology (3) BIO 497 - Biology Seminar (1) MTH 362 - Calculus Based Statistics (2) **Total: 15 Units** --- **Take a minimum of 14 units of electives from the following options:** **BIO312 – Applied Plant Biology (2)** BIO 315 - Microbiology (3) **BIO 323 – Introduction to Oceanography (3)** BIO 325 - Insect Biology (3) **BIO 333 - Marine Biology (3)** BIO 340 - Field Biology (2) BIO 350 - Advanced Cell Biology (3) **BIO 473 – Experimental Marine Ecology (3)** BIO 390 - Immunology (3)

----------	BIO 400 - Developmental Biology (3)
BIO 315 - Microbiology (3)	BIO 410 - Vertebrate Biology (3)
BIO 320 - Marine Vertebrate Zoology (3)	BIO420 – Vertebrate Physiology (3)
BIO 325 - Insect Biology (3)	BIO 430 - Animal Behavior (3)
BIO 330 - Marine Invertebrate Zoology (2)	BIO 450 - Advanced Biochemistry (4)
BIO 340 - Field Biology (2)	BIO 470 - Neuroscience (3)
BIO 370 - Marine Plant and Microbial Life (2)	BIO490 or BIO499 – Internship or Research (1-3)
BIO 410 - Vertebrate Biology (3)	Approved off-campus (1-4)
BIO 430 - Animal Behavior (3)	
Approved off-campus (1-4) +	
Track II Electives	

BIO 315 - Microbiology (3)	
BIO 350 - Advanced Cell Biology (3)	
BIO 390 - Immunology (3)	
BIO 400 - Developmental Biology (3)	
BIO 450 - Advanced Biochemistry (4)	
BIO 470 - Neuroscience (3)	
Approved off-campus (1-4)	
Upper-division Elective Total: 10-11 Units	**Upper-division Elective Total: 14 Units**
----------	----------
Bachelor of Science Total: 67-69 Units	**Bachelor of Science Total: 64-65 Units****
	**12 units meet general education requirements.

Catalog Copy (Present)	Catalog Copy (New)
ENVIRONMENTAL SCIENCE - BS	**ENVIRONMENTAL SCIENCE - BS**
Lower-Division Requirements	Lower-Division Requirements
----------	----------
BIO 102 - Environment and People (GE) (4)	BIO 102 - Environment and People (GE) (4)
BIO 210 - Cell Biology and Biochemistry (GE) (4)	BIO 210 - Cell Biology and Biochemistry (GE) (4)
BIO 211 - Ecological and Evolutionary Systems (GE) (4)	BIO 211 - Ecological and Evolutionary Systems (GE) (4)
BIO 212 - Organismal Biology (3)	BIO 212 - Organismal Biology (3)
CHE 151 - General Chemistry Tutorial (1) *	CHE 151 - General Chemistry Tutorial (1) *
CHE 152 - General Chemistry I (GE) (4)	CHE 152 - General Chemistry I (GE) (4)
CHE 153 - General Chemistry II (4)	CHE 153 - General Chemistry II (4)
CHE 213 - Analytical Chemistry (3)	CHE 213 - Analytical Chemistry (3)
CHE 294 - Organic Chemistry I (4)	CHE 294 - Organic Chemistry I (4)
MTH 144 - Calculus With Applications (GE) (4)	MTH 144 - Calculus With Applications (GE) (4)

Choose one sequence: 8 Units --- PHY 141 - General Physics I (GE) (4) PHY 142 - General Physics II (GE) (4) PHY 241 - University Physics I (GE) (4) PHY 242 - University Physics II (4)	Choose one sequence: 8 Units --- PHY 141 - General Physics I (GE) (4) PHY 142 - General Physics II (GE) (4) PHY 241 - University Physics I (GE) (4) PHY 242 - University Physics II (4)
Choose one of three: 3 Units --- ECO 101 - Principles of Economics I (GE) (3) ECO 102 - Principles of Economics II (GE) (3) SOC 201 - Cultural Anthropology (GE) (3)	Choose one of three: 3 Units --- ECO 101 - Principles of Economics I (GE) (3) ECO 102 - Principles of Economics II (GE) (3) SOC 201 - Cultural Anthropology (GE) (3)
Total: 45-46 Units --- Note(s): *Course can be waived	Total: 45-46 Units --- Note(s): *Course can be waived
Upper-Division Requirements --- BIO 345 - Genetics (4) BIO 360 - Ecology (3) BIO 497 - Biology Seminar (1) CHE 370 - Instrumental Analysis (2) MTH 362 - Calculus Based Statistics (2) Total: 12 Units	Upper-Division Requirements --- BIO 345 - Genetics (4) **BIO 363 – Conservation Ecology (3)** BIO 497 - Biology Seminar (1) CHE 370 - Instrumental Analysis (2) MTH 362 - Calculus Based Statistics (2) Total: 12 Units
Upper-Division Electives (14 units minimum) --- A minimum of 8 units of upper-division electives are required from approved environmental off-campus programs. Both departmental chairs (Biology and Chemistry) or their designees are responsible for approving all off-campus courses. At least one-half of upper-division units in the major must be taken at PLNU.	Upper-Division Electives (14 units minimum) --- A minimum of 8 units of upper-division electives are required from approved environmental off-campus programs. Both departmental chairs (Biology and Chemistry) or their designees are responsible for approving all off-campus courses. At least one-half of upper-division units in the major must be taken at PLNU.
Advanced Science Electives (8 units minimum) --- One or more approved off-campus environmental course(s) may fulfill part or all	Advanced Science Electives (8 units minimum) --- One or more approved off-campus environmental course(s) may fulfill part or all of this requirement.

of this requirement.	
BIO 310 - General Botany (3) BIO 315 - Microbiology (3) BIO 320 - Marine Vertebrate Zoology (3) BIO 325 - Insect Biology (3) BIO 330 - Marine Invertebrate Zoology (2) BIO 340 - Field Biology (2) BIO 370 - Marine Plant and Microbial Life (2) BIO 410 - Vertebrate Biology (3) BIO 420 - Vertebrate Physiology (3) BIO 430 - Animal Behavior (3)	**BIO 312 – Applied Plant Biology (2)** BIO 315 - Microbiology (3) **BIO 323 - Introduction to Oceanography (3)** BIO 325 - Insect Biology (3) **BIO 333 - Marine Biology (3)** BIO 340 - Field Biology (2) **BIO 473 – Experimental Marine Ecology (3)** BIO 410 - Vertebrate Biology (3) BIO 420 - Vertebrate Physiology (3) BIO 430 - Animal Behavior (3)
BIO 450 - Advanced Biochemistry (4) OR CHE 450 - Advanced Biochemistry (4)	BIO 450 - Advanced Biochemistry (4) OR CHE 450 - Advanced Biochemistry (4)
CHE 304 - Organic Chemistry II (4) CHE 325 - Physical Chemistry I (5) CHE 351 - Organic Qualitative Analysis (2) CHE 466 - Advanced Inorganic Chemistry I (2) CHE 468 - Advanced Inorganic Chemistry II (2)	CHE 304 - Organic Chemistry II (4) CHE 325 - Physical Chemistry I (5) CHE 351 - Organic Qualitative Analysis (2) CHE 466 - Advanced Inorganic Chemistry I (2) CHE 468 - Advanced Inorganic Chemistry II (2)
Other Related Electives (6 units minimum) --- Students can customize their degree by taking one course from each of the two categories below. One or more approved off-campus environmental course(s) may fulfill part or all of this requirement.	Other Related Electives (6 units minimum) --- Students can customize their degree by taking one course from each of the two categories below. One or more approved off-campus environmental course(s) may fulfill part or all of this requirement.
Methodology: --- BIO 301 - Research Methodology (2) BIO 490 - Internship in Biology (1-3) BIO 499 - Research in Biology (1-3) CHE 490 - Internship in Chemistry (1-3) CHE 499 - Research in Chemistry (1-2)	Methodology: --- BIO 301 - Research Methodology (2) BIO 490 - Internship in Biology (1-3) BIO 499 - Research in Biology (1-3) CHE 490 - Internship in Chemistry (1-3) CHE 499 - Research in Chemistry (1-2)
Public Policy and Stewardship: --- PHL 451 - Philosophy of Science (3) POL 435 - Global Governance (4) POL 441 - Issues in Public Policy (4)	Public Policy and Stewardship: --- PHL 451 - Philosophy of Science (3) POL 435 - Global Governance (4) POL 441 - Issues in Public Policy (4)
Upper-Division Elective Total: 26 Units ---	Upper-Division Elective Total: 26 Units ---

Bachelor of Science Total: 71 - 72 Units ** **15 units meet general education requirements.	Bachelor of Science Total: 71 - 72 Units ** **15 units meet general education requirements.

Catalog Copy (Present) **ENVIRONMENTAL BIOLOGY MINOR** Required ---------- BIO 102 - Environment and People (GE) (4) BIO 211 - Ecological and Evolutionary Systems (GE) (4) BIO 360 - Ecology (3) CHE 101 - Chemistry and Society (GE) (4) OR CHE 151 - General Chemistry Tutorial (1) * AND CHE 152 - General Chemistry I (GE) (4) Total: 15-16 Units ---------- Note(s): *Course can be waived. Upper-Division Requirements ---------- Approved electives (5)** One approved off-campus field-immersion course (4) Total: 9 Units Note(s): ---------- **Approved electives include the following: BIO 310 , BIO 320 , BIO 325 , BIO 330 , BIO 340 , BIO 370 , BIO 410 , and BIO 430	Catalog Copy (New) **ENVIRONMENTAL BIOLOGY MINOR** Required ---------- BIO 102 - Environment and People (GE) (4) BIO 211 - Ecological and Evolutionary Systems (GE) (4) **BIO 363 – Conservation Ecology (3)** CHE 101 - Chemistry and Society (GE) (4) OR CHE 151 - General Chemistry Tutorial (1) * AND CHE 152 - General Chemistry I (GE) (4) Total: 15-16 Units ---------- Note(s): *Course can be waived. Upper-Division Requirements ---------- Approved electives (5)** One approved off-campus field-immersion course (4) Total: 9 Units Note(s): ---------- **Approved electives include the following: **BIO 312(2)** , **BIO 323(3)** , BIO 325(3), **BIO 333**(3), BIO 340(2), **BIO 473**(3), BIO 410(3), and BIO 430(3) ---------- Total: 24 Units *** ***8 units meet general education requirements.

Catalog Copy (Present) **ORGANISMAL BIOLOGY MINOR** Required --- BIO 210 - Cell Biology and Biochemistry (GE) (4) BIO 211 - Ecological and Evolutionary Systems (GE) (4) BIO 212 - Organismal Biology (3) BIO 360 - Ecology (3) Nine units from the following electives: --- BIO 310 - General Botany (3) BIO 315 - Microbiology (3) BIO 320 - Marine Vertebrate Zoology (3) BIO 325 - Insect Biology (3) BIO 330 - Marine Invertebrate Zoology (2) BIO 340 - Field Biology (2) BIO 410 - Vertebrate Biology (3) BIO 420 - Vertebrate Physiology (3) BIO 430 - Animal Behavior (3) Total: 23 Units	Catalog Copy (New) **ORGANISMAL BIOLOGY MINOR** Required --- BIO 210 - Cell Biology and Biochemistry (GE) (4) BIO 211 - Ecological and Evolutionary Systems (GE) (4) BIO 212 - Organismal Biology (3) **BIO 363 – Conservation Ecology (3)** Nine units from the following electives: --- **BIO 312 – Applied Plant Biology (2)** BIO 315 - Microbiology (3) **BIO 323 - Introduction to Oceanography (3)** BIO 325 - Insect Biology (3) **BIO 333 - Marine Biology (3)** BIO 340 - Field Biology (2) **BIO 473 – Experimental Marine Ecology (3)** BIO 410 - Vertebrate Biology (3) BIO 420 - Vertebrate Physiology (3) BIO 430 - Animal Behavior (3) Total: 23 Units* *4 units meet general education requirements.

Old Descriptions BIO 310 - General Botany (3) Principles of plant structure, function and diversity. Lecture and lab. Offered every year. Prerequisite(s): BIO 210 or BIO 105 or consent of instructor. Recommended: MTH 203 or MTH 362.	New Descriptions BIO 312 – Applied Plant Biology (2) A study of plant structure, function, and phytochemistry through an examination of economically and culturally important plants, including plants used for medicine, food, energy, fiber, and building materials. Topics include environmental plant physiology, biotechnology, plant propagation, medicinal botany, and sustainable land use. Lecture, lab and fieldwork. Offered every year. Prerequisite or Corequisite: BIO 212.

BIO 360 - Ecology (3) A study of current ecological theory with environmental applications. Lecture, lab, and field work. Offered every year. Prerequisite(s): BIO 211 . MTH 203 or MTH 362 recommended.	BIO 363 – Conservation Ecology (3) An examination of the key concepts and issues at the intersection of conservation biology and ecology, including ethics, value of biodiversity, extinction vortices, habitat loss, fragmentation, overharvesting, invasive species, climate change, trophic cascades, pollution and dead zones, disease and human health, protected areas and poaching, biological corridors, restoration, economic valuation, community-based conservation, and sustainable development. The course will incorporate review of case studies, analysis of journal articles, exploration of local habitats and conservation issues, critique of current events, and development of an original field project that combines field techniques and literature review. Lecture, lab, and fieldwork. Offered every year. Prerequisite: BIO 211. Recommended: BIO 212
BIO 320 - Marine Vertebrate Zoology (3) A study of marine animals and their habitats, with an emphasis on marine vertebrates. Lecture, lab, and field work. Offered every year. Prerequisite(s): BIO 211.	BIO 323 – Introduction to Oceanography (3) An introduction to the interdisciplinary study of the oceans, including a survey of geological, chemical, physical, and biological oceanography. Includes consideration of current research methods and exploration of marine systems. Lecture, lab, and fieldwork. Offered every year. Prerequisite: BIO 211.
BIO 330 - Marine Invertebrate Zoology (2) A study of invertebrate adaptive biology, including anatomy, locomotion, nutrition, respiration, excretion, reproduction, and behavior. An emphasis on marine invertebrates and other invertebrate representatives of importance to the Southern California ecosystems. Includes lecture and lab. Offered Spring 2013. Prerequisite(s): BIO 211.	BIO 333 - Marine Biology (3) The study of life in the oceans, including the ecology, structure, function, and adaptations of marine organisms to their environment. Lecture, lab and fieldwork. Offered Spring 2015. Prerequisite: BIO 211.
BIO 370 - Marine Plant and Microbial Life (2) An analysis of shoreline, tidal and floating marine plants, and associated microbial life of the Southern California coastline. Ecological and habitat characteristics are studied. Lecture, lab, and field work. Offered Spring 2014. Prerequisite(s): BIO 211 or BIO 210 or consent of instructor.	BIO 473 – Experimental Marine Ecology (3) A field-oriented course that explores aspects of marine ecology within the context of coastal communities, including ecological relationships within the marine environment, factors influencing community structure, and biogeography. A central component of the course will be an independent project with experimental design. Lecture, lab, and fieldwork. Prerequisite: BIO211; BIO323 or BIO333.

Note: Please list other departments using this course___NONE_____

V. Recorded Department/School Vote:

Please state the number and percentage of department school faculty who voted for the proposal. If other departments are affected, please inform the committee how those departments voted. All department members present and approved all proposals (except Darrel Falk was not present).

VI. Library Impact:

What new library acquisitions, if any, will be needed to support the proposed changes? (If none, please state that.) Please consult the check off list at the end of the template. No library impact.

VII. Technological Impact:

What additional or new software, hardware , lab space or tech supported space will be needed to support the proposed changes? (If none, please state that.) For hybrid, online or video conferencing proposals, please answer questions at the end of the template. No technological impact.

VIII. WASC Credit Hour Standards: All new course proposals must meet the standards as set by the United States Department of Education with regard to the credit hour definition. One semester unit represents an hour (minimum fifty minutes) of class time per week for at least 15 weeks (Carnegie definition). Two hours of preparation are normal for each hour of class. Please state how this new course(s) will meet those minimum requirements. See section on distance learning to answer questions on hybrid, online, and video conferencing courses.

Direct instructional hours are equivalent to the following:

1 credit hour =750 minutes instructional time
2 credit hours=1,500 minutes
3 credit hours=2,250 minutes
4 credit hours=3000 minutes
5 credit hours=3750 minutes

Credit hours will be met via lecture and lab:

1) **3 unit courses meet for 2.5 hours of lecture per week plus at least 3 hours of lab, for a total of 5.5 hours per week.**
2) **4 unit courses meet for 3.25 hours of lecture per week plus at least 3 hours of lab, for a total of 6.25 hours per week.**

IX. Final Summary: Review course and staffing impact with your College Dean or appropriate administrator.

Total course additions: 5
Total course deletions: 5
Total unit additions: 14
Total unit deletions: 14
Rotation of courses or deletion of sections to accommodate additions: None
Staffing impact/increase or decrease: None

NON ACTION OR PROCEDURAL CHANGES: These changes will not go to the faculty floor for a vote. These are changes that include: revision of course descriptions including title, number or prerequisites, alternate year listing in the Catalog and the cross listing of courses.

I. List proposals with a one line abstract.

II. List current descriptions and new descriptions side by side.

Current Descriptions	New Descriptions
BIO 140 - Human Anatomy and Physiology II (4) The second semester of a sequence which examines the human body from an integrated perspective emphasizing the interrelationship of structure and function. Topics include endocrine system and reproduction, cardiovascular system, immune system, respiratory system, digestive system, and urinary system. Does not count for credit toward the Biology major. Lecture and lab. Offered every year. Prerequisite(s): BIO 130; CHE 103 , or CHE 152 .	BIO 140 - Human Anatomy and Physiology II (4) The second semester of a sequence which examines the human body from an integrated perspective emphasizing the interrelationship of structure and function. Topics include **sensory and autonomic nervous system**, endocrine system and reproduction, cardiovascular system, immune system, respiratory system, digestive system, and urinary system. Does not count for credit toward the Biology major. Lecture and lab. Offered every year. Prerequisite(s): BIO 130; CHE 103 , or CHE 152 .
BIO 210 - Cell Biology and Biochemistry (GE) (4) An introduction to the principles of cell biology and biochemistry. Topics to be discussed include the chemical basis of life, the structure and function of cellular organelles, basic metabolic pathways, the expression of the genetic material, recombinant DNA technology and models for the origin of cells. Lecture and lab. Offered every semester. Prerequisite(s): Must have a previous course in high school or university-level chemistry.	BIO 210 - Cell Biology and Biochemistry (GE) (4) An introduction to the principles of cell biology, **molecular biology**, and biochemistry. Topics include the chemical basis of life, **basic membrane functions and membrane transport**, basic metabolic pathways **including cellular respiration and photosynthesis**, **cell division**, and expression of the genetic material. Lecture and lab. Offered every semester. Prerequisite: Must have a previous course in high school or university-level chemistry.
BIO 315 - Microbiology (3) An in-depth exploration of the world of microscopic organisms, including their diversity, physiology, biochemistry and ecology. Emphasis is on prokaryotes, but also some discussion of microscopic eukaryotes. Lecture and lab. Offered every year. Prerequisite(s): BIO 210.	BIO 315 - Microbiology (3) An in-depth exploration of the world of microscopic organisms, including their diversity, physiology, biochemistry and ecology. Emphasis is on prokaryotes, but also some discussion of microscopic eukaryotes **and viruses**. Lecture and lab. Offered every year. Prerequisite(s): BIO 210 **and BIO345**.

BIO 350 - Advanced Cell Biology (3) A study of the structure and function of eukaryotic cells. Topics include various aspects of subcellular structure, the extracellular matrix, cellular signal transduction mechanisms, regulation of cell division and cancer. The laboratory provides exposure to important current methodologies. Offered every year. Prerequisite(s): BIO 210 and BIO 345.	BIO 350 - Advanced Cell Biology (3) An **in-depth** study of the structure and function of eukaryotic cells. Topics include various aspects of subcellular structure, **cytoskeleton dynamics and regulation**, **the mechanisms of cell motility and intracellular transport**, **cell adhesion**, cellular signal transduction mechanisms, regulation of cell division and cancer. The laboratory provides exposure to important current methodologies. Offered every year. Prerequisite(s): BIO 210 and BIO 345.
BIO 400 - Developmental Biology (3) An analysis of mechanisms of early development of invertebrates and vertebrates. Includes a study of the cellular, molecular, and genetic factors which influence the determination of the body plan as well as a study of the morphogenesis of selected organ systems. Lecture and lab. Offered every year. Prerequisite(s): BIO 380.	BIO 400 - Developmental Biology (3) An analysis of mechanisms of early development of invertebrates and vertebrates. Includes a study of the cellular, molecular, and genetic factors that influence **cell differentiation** and the determination of the body plan, as well as a study of the morphogenesis of selected organ systems. **The laboratory uses a variety of model organisms to study normal, and abnormal development.** Lecture and lab. Offered every year. Prerequisite: BIO 380.
BIO 420 - Vertebrate Physiology (3) A physiochemical analysis of life processes, as studied by a systemic approach. Lecture and lab. Offered every year. Prerequisite(s): BIO 211 and CHE 294, or instructor consent (Cell and Molecular Biology or Organismal minors). MTH 203 or MTH 362 recommended.	BIO 420 - Vertebrate Physiology (3) This course examines homeostasis and structural dynamism in different systems and in different vertebrate classes. The course specifically examines metabolism, the digestive system, the nervous system, the endocrine system, locomotion, respiration, the cardiovascular system, and the urinary system. Lecture and lab. Offered every year. Prerequisite(s): **BIO 212** and CHE 294, or instructor consent (Cell and Molecular Biology or Organismal minors). MTH 203 or MTH 362 recommended.

BIO 430 - Animal Behavior (3) An exploration of the behavioral biology of animals, including behavior genetics, physiological mechanisms, development, learning, neuro-physiology, ecology, reproduction, and social behavior; insights from ethology, psychology, behavioral ecology, and sociobiology are also studied. Labs emphasize various aspects of behavioral research in field settings and students conduct their own research projects. Lecture and lab. Offered Fall 2013. Prerequisite(s): BIO 360 or consent of instructor.	BIO 430 - Animal Behavior (3) An exploration of the behavioral biology of animals, including behavior genetics, physiological mechanisms, development, learning, neuro-physiology, ecology, reproduction, and social behavior; insights from ethology, psychology, behavioral ecology, and sociobiology are also studied. Labs emphasize various aspects of behavioral research in field settings and students conduct their own research projects. Lecture and lab. Offered Fall 2013. Prerequisite(s): **BIO211**.
BIO 470 - Neuroscience (3) A study of the nervous system at the molecular, cellular and intercellular levels with the goal of understanding the generation and control of thoughts and behavior. Laboratory exercises examine sensory transduction, CNS function, synaptic physiology, behavior and neuroanatomy. The relationship of brain and mind are examined in discussions of nervous system development, intelligence, memory, patho-physiology, sexuality and gender identity, and religious faith and ethics. Lecture and lab. Offered Spring 2013. Prerequisite(s): BIO 140 or BIO 420, or PSY 301 , or consent of instructor.	BIO 470 - Neuroscience (3) A study of the nervous system at the molecular, cellular and intercellular levels with the goal of understanding the generation and control of thoughts and behavior. Laboratory exercises examine sensory transduction, CNS function, synaptic physiology, behavior and neuroanatomy. The relationship of brain and mind are examined in discussions of nervous system development, intelligence, memory, patho-physiology, sexuality and gender identity, and religious faith and ethics. Lecture and lab. Offered Spring 2013. Prerequisite(s): BIO 140 **or BIO212** or BIO 420, or PSY 301, or consent of instructor.

III. Rationale.

Include such things as:

1. To make descriptions more efficient;
2. To align content with what is actually being taught;
3. To meet standards for……

Rationale:

BIO140, 210, 315, 350, 400: To align content with what is actually being taught.

BIO315: New pre-requisite of BIO345: Students who take the class without having taken BIO345 typically receive grades of D-F.

BIO430: Changing the pre-requisite to be the appropriate class, now that BIO360 will no longer be taught.

BIO420, BIO470: Adding BIO212 as a pre-requisite.

Final Check-off List:

_X_ The College Dean or appropriate administrator has been consulted.

_X_ All affected departments have been contacted and the results are indicated in the proposal. (Chemistry was contacted due to the joint major (Environmental Science) and they are fine with the proposed changes.)

_X_ The proposal has been voted on by the department.

_X_ Appropriate contacts have been made with the director of the library as well as media services. With whom have you spoken? **Not applicable**

_X__Staffing impact has been addressed.

_NA__For hybrid, online and video conferencing courses, instructional technology has signed off verifying appropriate pedagogical expertise.

_NA__Appropriate budget considerations have been reviewed.

_X__Office of Records has been consulted for appropriate course numbering sequences for traditional and/or hybrid and online courses.

Table I: Summary of marine courses at comparator and aspirant schools

SCHOOL	MAJOR/MINOR/ CONCENTRATION	OCEANOGRAPHY COURSE	MARINE BIOLOGY COURSE	OTHER MARINE COURSES	OFF-CAMPUS COURSES
Abilene Christian University					**BIOL 403 Marine Biology** (class trip)**; BIOL 377 Marine Invertebrate** (Au Sable)
Anderson University				**3420 Fish Biology and Ecology**	
Asbury College		NONE			
Azusa Pacific University		NONE			
Bethel University			**BIO321 Aquatic Biology**		
Biola University			**BIOS 352 - Marine Biology**	**BIOS 290 - Natural History of Marine Mammals** General Education Science Credit.	
California Lutheran University		**BIOL 352. Oceanography**	**BIOL 345. Marine Biology**	**BIOL 118. The Oceans; BIOL 115. Current Issues in Marine Biology**	
Chapman University			**BIOL 440 Marine Biology**		
George Fox University		NONE			
Gordon College	Marine Biology Concentration	**BIO230 Introduction to Marine Science**		**BIO331 Marine Biology Institute**	
Messiah College			**BIOL 362 Aquatic Biology**		
North Park University			**3890 Marine and Aquatic Biology**		
Northwest Nazarene University		NONE			
Olivet Nazarene University		NONE			
Palm Beach Atlantic University-West Palm Beach	Concentration in Marine Biology		**3201 Marine Biology**	**4203 Ichthyology; OCY 4113 Physical Oceanography; OCY 4123 Geological Oceanography; BIO4952 Natural Hist Everglades Watershed**	
Seattle Pacific University			**BIO 4735: Marine Biology**	**PHY 1145 Oceanography**	**BIO 1100: Bio Science: Marine Biology; BIO 4740: Marine Invertebrate Zoology; BIO 4744: Marine Botany; BIO 4810: Marine Ecology; BIO 4815: Aquatic Ecology (Blakely Island)**
Taylor University					**BIO 302 Limnology: Field Course; BIO 323: Fish Biology and Ecology** (Au Sable)
Trinity College (CT)				**BIOL 336 Marine and Freshwater Botany; BIOL 468 Marine Phytogeography**	
Union University			**Exdst/BIO396/Marine Biology** (Winter term)		
Westmont College			**BIO 104 Marine Biology**		**BIO 123 Aquatic Biology; BIO 139 Marine Mammals; BIO 140 Marine Invertebrates (**Au Sable)
Whitworth University			**BI 111 Marine Biology**		**BI 342 Field Marine Ecology** (Friday Harbor)

Text in blue indicate a non-majors course.
Text in red indicate a field research course of some kind.

SCHOOL	MAJOR/MINOR/ CONCENTRATION	OCEANOGRAPHY COURSE	MARINE BIOLOGY COURSE	OTHER MARINE COURSES	OFF-CAMPUS COURSES
Calvin College				In Geography & Geology: 251 Oceanography	
Gonzaga University					BIOL 473 Tropical Marine Ecology ; BIOL 477 Coastal Ecology (School for Field Studies Program)
Occidental College		369-569 - Biological Oceanography	105 - Marine Biology	356-556 - The Biology of Marine Fishes	
Pepperdine University			BIOL 450 Marine Biology and Ecology	BIOL 105 Introduction to Marine Biology	
Santa Clara University			180. Marine Physiological Ecology	6. Oceans	
Seattle University	BS in Marine & Conservation Biology		BIOL 275 - Marine Biology		BIOL 472 - Marine Ecology; BIOL 474 - Aquatic Ecology; BIOL 236 - Marine Invertebrate Zoology; BIOL 253 - Marine Botany (summer at Blakely Island Field Station)
Trinity University (TX)		NONE			
University of Portland			BIO 338 Marine Biology of the Pacific Northwest		
University of Redlands			346 Aquatic Biology. May Term	111 Introduction to Marine Biology; Environmental Studies 245 Marine Environmental Studies; BIOL 260 Marine Conservation of the Pacific (May Term)	Environmental Studies 281 The Palau Expedition: Explorations in Sustainable Development
University of San Diego	BA in Marine Science, MS in Marine Science	BIOL 451W Biological Oceanography		ENV 331W Coastal Environmental Science; MARS101 Physical Aspects of the Ocean; MARS120 Introduction to Physical Oceanography; MARS427 Marine Environment; MARS450 Geological Oceanography; MARS452 Physical and Chemical Oceanography; MARS468 Marine Ecology; MARS471 Near Shore Processes; MARS473 Climatology; MARS474 History of the Earth and Climate; MARS478 Boundary Layer Flow; MARS493 Methods in Marine Science; MARS494 Special Topics in Marine Science; ENV 121 Life in the Ocean	
Wheaton College			BIOL 365 - Marine Biology Lab w/field trip to the Caribbean over spring break		

Text in blue indicate a non-majors course.
Text in red indicate a field research course of some kind.

Table II: BA vs. BS at comparator and aspirant institutions

Institution	BA	BS	?
Abilene Christian University	72	72	
Bethel University	52	71-72	
***Calvin College**	50-52	60-68	
George Fox University	55-63	54	
***Gonzaga University**	39	61	
Gordon College	58	38+conc.	
North Park University	48	56	
Northwest Nazarene University	✓	✓	
Olivet Nazarene University	36	48	
***Pepperdine University**	57-58	69-72	
Seattle Pacific University	81	104-108	
***Seattle University**	✓	✓	
Taylor University	51-77	51-100	
Trinity College	✓	✓	
***University of Portland**	77-80	68-69	
***University of Redlands**	✓	✓	
Westmont College	48	64	
***Wheaton College**	✓	✓✓	
Whitworth University	45	58	
Azusa Pacific University		73-75	
Biola University		70+	
Chapman University		68	
Messiah College		66-70	
Anderson			48
Asbury University			63-65
California Lutheran University			40
***Occidental**			✓
Palm Beach Atlantic University			✓
***Santa Clara University**			✓
Union University			42-76
***University of San Diego**			✓