HSU Academic Program Criteria - Academic Program in Biology

I. The Vision for Humboldt State University (Limit: 2 pages) [15%]

Our program's curricular and co-curricular features provide outstanding support for the vision of HSU.

An understanding of the natural world is a prerequisite for informed, environmentally responsible action. Our entire curriculum is directly supportive of the HSU vision, in that it is focused on the natural world, the environment, and natural resources. Our curriculum provides students the foundation necessary for them to improve the human condition and our environment.

We are committed to increasing our diversity of people and perspectives, and we are exemplary partners with our communities, including tribal nations. We are dedicated to supporting and mentoring underserved populations. We have aggressively sought and obtained funding for training and research opportunities for students from groups that are traditionally under-represented in the sciences. We have been awarded funding (more than $5 million in the past 12 years) for this purpose from groups including the National Science Foundation's (NSF) Louis Stokes Alliance for Minority Participation Program, the NSF Research Experience for Undergraduates Program, the NSF Research at Undergraduate Institutes program, and the Howard Hughes Medical Institute (HHMI). For example, the funding from HHMI includes funding for a program designed to recruit, train and support local Native Americans that are interested in biomedical sciences. This program funds summer training and ongoing mentoring of high school sophomores, juniors and seniors from local reservations, to encourage talented Native Americans to attend college and study science. Native Americans participating in this program have successfully graduated from HSU and entered Medical Schools and Ph.D. programs. The Research Experience for Undergraduates (REU) program is targeted at groups under-represented in the sciences, and provides funds for mentored summer research projects focused on Ecology and Evolution. Our REU students have co-authored papers and talks, received academic awards, and been accepted into Medical and Graduate programs around the country. We have recently submitted a large grant to the California Institute for Regenerative Medicine, and we are in the process of resubmitting an NSF Undergraduate Research Mentoring Award, that also are targeted at recruiting and supporting underrepresented groups.

We are partners with our communities in their efforts to be stewards of the environment and its natural resources. Biology faculty and students serve on the boards of, and volunteer at numerous local groups and agencies that are focused on environmental responsibility and action, including The HSU Natural History Museum, Friends of Arcata Marsh, the Redwood Region Audubon Society, the North Coast Chapter of the California Native Plant Society, the North Coast Environmental Center, the Oiled Wildlife Care Network, the National Marine Fisheries Service, Siskiyou Field Institute, Bat Conservation International, the California Environmental Legacy Project and numerous other environmentally responsible groups. We also generate external funding for these groups; for example, the HHMI grant mentioned above provided eight years of funding for the Natural History Museum.

We maintain and support diverse outstanding facilities for the interdisciplinary study of the environment and its natural resources. These facilities are used by undergraduate and graduate students of many different departments, as well as community members and scholars from around the state and country. These facilities include the HSU greenhouse, which contains one of the largest teaching collections of living plants in California, and the HSU Vertebrate Museum. The Vertebrate Museum is an accredited museum that serves as a center for field and specimen-based research and teaching in ecology, evolution and conservation of vertebrates. The Museum is also a member of the Marine Mammal Stranding Network, a national organization charged with attending to stranded marine mammals. Other facilities include the Vascular Plant Herbarium, which is a collection of nearly 100,000 dried plant specimens for both teaching and research. This collection is the largest of its kind in the California State University System. The Department also hosts a Biotechnology Laboratory and Biotechnology Core Facility that are used by numerous groups at HSU.

As part of our commitment to our communities and to being stewards of learning, the Biology department has actively developed ties with K-12 schools and Community Colleges. One very successful outcome of this is the Redwood Science Project (RSP), founded in 2000 and directed by Dr. Jeffrey White. It is a significant regional entity supporting science education with funding from grants totaling $3.7 million. RSP projects include outreach to K-12 schools, teacher professional development, future teacher programs for undergraduates and credential program students, research and program evaluation, and media development. Although most of the programs focus on science, subjects such as mathematics, history, reading

& language arts, film and education are included. A major priority of the RSP is to support the educational aspirations of the diverse people of California. During the last 3 years, over 400 teachers and future teachers from 13 counties participated in RSP programs supported by colleagues in seven departments in all colleges at Humboldt State University.

II. Demand (Limit: 1.5 pages per option, not including tables) [20%]

A. Internal demand for the degree program and courses in the degree program

1. Headcount Data

Major Academic Year (Fall/Spring) Average Headcount Summary Majors_overview_BIOL report generated: 16-APR-08									
Major Code	**Major Description**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
BIOL	Biology	75	72	98	119	122	122	127	115
BICM	Biology (Cellular/Molecular)	89	71	87	78	89	84	83	98
BIDI	Biology (Biodiversity)	7	9	18	19	12	10	5	3
BIEC	Biology (Ecology)	0	0	0	6	12	20	21	28
BIEN	Biology (Environmental)	56	60	58	49	39	41	38	30
BIGE	Biology (General)	64	60	58	40	36	33	27	26
BIMA	Biology (Marine)	142	124	119	129	127	128	138	153
BIMI	Biology (Microbiology)	18	21	19	15	17	14	16	13
BINH	Biology (Natural History)-DefunctF03	2	3	3	1	0	0	0	0
BISP	Biology (Special)	3	3	4	11	14	9	12	15
BISS	Biol (Life Sci Education)-DefunctF96	0	1	0	1	1	1	0	1
BSSS	Biology (Science Education)	24	25	23	21	22	26	17	22
Total		**478**	**448**	**484**	**487**	**490**	**486**	**482**	**503**

Second Majors by Academic Year (exclusive of primary majors) Majors_overview_BIOL report generated: 16-APR-08									
Major Code	**Major Description**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
BIOL	Biology	2	2	2	2	2	2	2	2
BICM	Biology (Cellular/Molecular)	3	2	0	1	3	2	1	2
BIDI	Biology (Biodiversity)	0	0	0	0	0	0	1	1
BIEC	Biology (Ecology)	0	0	0	1	2	3	2	1
BIEE	Biology (Ecology, Evol, Syst)-Defunct	0	0	1	1	0	0	0	0
BIEN	Biology (Environmental)	6	5	2	3	3	0	2	3
BIGE	Biology (General)	5	3	6	4	3	0	1	3
BIMA	Biology (Marine)	10	10	14	12	12	10	8	12
BIMI	Biology (Microbiology)	1	2	2	2	1	1	1	0
BISP	Biology (Special)	0	0	1	0	0	0	0	0
BSSS	Biology (Science Education)	3	3	1	0	2	1	1	1
Total		**28**	**26**	**26**	**24**	**26**	**18**	**17**	**24**

Minors enrolled AY Average in Biology minors_enrolled_BIOL report generated: 06-MAR-08								
CLASS	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Frosh	0	0	1	0	1	0	1	1
Soph	1	0	1	0	0	0	0	1
Jr	3	2	2	1	0	1	1	1
Sr	6	5	4	7	4	3	1	5
	9	**7**	**6**	**7**	**5**	**4**	**3**	**7**

Majors by Sex and Ethnicity Majors_overview_BIOL report generated: 16-APR-08									
SEX	**Ethnicity**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Female	Asian	20	15	16	13	11	11	18	11
	Black	7	8	10	9	17	11	14	16
	Hispanic	29	24	33	31	28	29	27	38
	Native Amer	9	8	7	8	8	6	4	4
	Pacific Is	2	2	2	1	2	2	3	3
	White	177	163	181	175	168	161	134	142
	Other	9	7	8	8	12	17	30	45
	Unknown	45	50	52	50	34	33	33	27
sum		**296**	**275**	**306**	**295**	**279**	**269**	**261**	**285**
Male	Asian	6	6	11	9	9	8	10	12
	Black	4	4	4	2	3	5	3	3
	Hispanic	15	18	14	20	19	25	24	27
	Native Amer	7	6	9	6	7	3	2	2
	Pacific Is	1	1	1	0	2	2	1	1
	White	118	106	98	114	126	122	127	114
	Other	8	8	11	10	16	23	24	31
	Unknown	24	26	33	33	31	32	31	29
sum		**182**	**173**	**178**	**192**	**211**	**217**	**221**	**218**

Biology (with options) Degrees Awarded (incl. primary and second majors) degrees_awarded_B_BIOL report generated: 25-JUN-08								
MAJOR	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**
Biology	1	0	1	0	0	0	2	3
Biology (Cellular/Molecular)	18	28	18	15	20	26	21	21
Biology (Biodiversity)	2	2	1	0	4	1	4	1
Biology (Ecology)	0	0	0	0	0	0	7	2
Biology (Environmental)	22	12	20	11	17	12	13	12
Biology (General)	12	14	10	24	22	17	20	25
Biology (Marine)	16	21	21	14	16	16	18	19
Biology (Microbiology)	3	3	5	7	4	0	4	3
Biology (Natural History)-DefunctF03	0	1	0	0	0	0	0	0
Biology (Special)	3	1	3	5	7	5	4	2
Biol (Life Sci Education)-DefunctF96	0	1	1	0	1	0	0	0
Biology (Science Education)	4	7	9	5	8	4	3	7
sum	**81**	**90**	**89**	**81**	**99**	**81**	**96**	**95**

Biology Degrees Awarded by Sex and Ethnicity (incl. primary and second majors) degrees_awarded_B_BIOL report generated: 25-JUN-08									
SEX	**Ethnicity**	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**
Female	Asian	2	5	3	4	2	1	3	6
	Black	0	0	1	0	2	0	2	1
	Hispanic	4	4	4	4	5	2	4	6
	Native Amer	0	1	1	1	2	1	0	2
	Pacific Is	1	0	0	1	2	0	0	0
	White	37	31	33	32	33	36	45	34
	Other	0	2	0	0	3	4	4	0
	Unknown	4	10	9	7	9	8	7	11
sum		**48**	**53**	**51**	**49**	**58**	**52**	**65**	**60**
Male	Asian	2	2	1	0	4	1	3	2
	Black	1	0	0	0	0	0	0	0
	Hispanic	7	2	4	2	1	3	0	3
	Native Amer	0	0	1	1	0	2	0	0
	White	18	28	26	16	27	19	21	19
	Other	0	2	1	4	0	2	2	5
	Unknown	5	3	5	9	9	2	5	6
Sum		**33**	**37**	**38**	**32**	**41**	**29**	**31**	**35**

Minors Awarded by Year in Biology minors_awarded_BIOL report generated: 25-JUN-08								
MINOR	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**
Biology	10	2	3	1	1	3	2	0

2. FTES by Course Code

FTES taken in Biology classes by Majors (AY 02/03 - AY 07/08) course_ftes_smry_BIOL report generated: 30-JUN-08								
SUBJ	**Course level**	**Student Major**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
BIOL	Lower-div	Biology	11.5	11.3	13.3	13.7	9.8	11.8
		Nursing Pre-Major	2.9	4.8	9.5	13.1	10.9	11.7
		Wildlife	7.3	6.7	6.5	5.2	5.8	8.3
		Kinesiology	3.6	3.7	3.6	5.3	5.8	5.4
		Art	4.9	6.4	5.3	5.9	4.8	4.2
	Sub-total		**95.5**	**95.0**	**97.6**	**104.9**	**95.4**	**101.6**

FTES taken in Biology classes by Majors (AY 02/03 - AY 07/08) course_ftes_smry_BIOL report generated: 30-JUN-08								
SUBJ	**Course level**	**Student Major**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
BIOL	Upper-div	Biology	42.7	43.3	51.1	46.4	46.3	43.2
		Zoology	9.9	10.9	11.2	8.8	9.7	11.2
		Botany	5.3	4.7	4.0	4.6	5.0	5.4
		Nat Resources Plng & Interptn	4.1	3.5	2.2	2.4	2.6	2.1
		Environmental Science	1.4	1.8	1.9	1.3	1.6	2.0
	Sub-total		**77.8**	**78.0**	**88.6**	**79.7**	**85.2**	**86.6**

FTES taken in Biology classes by Majors (AY 02/03 - AY 07/08) course_ftes_smry_BIOL report generated: 30-JUN-08								
SUBJ	**Course level**	**Student Major**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
BIOL	All Levels	Biology	55.4	56.3	64.6	62.0	56.9	56.6
		Biology-Grad	17.2	17.8	14.9	19.5	18.7	18.2
		Zoology	13.4	14.3	14.6	13.0	12.1	15.2
		Nursing Pre-Major	3.0	4.9	9.7	13.4	11.8	12.7
		Wildlife	9.6	9.7	8.4	7.4	9.0	10.5
Total			**192.0**	**193.7**	**201.7**	**206.4**	**198.8**	**208.5**

3. Service to other HSU program/options

Document other HSU programs/options (including, GE) with required coursework from your program

Other HSU program/option name	Courses required List course number and units	Restricted elective courses List number and units
Biometry-Minor	BIO580 Vegetation Sampling (1-3)	
Botany	BIO105 Principles of Biology (4) BIO307 Evolution (3) BIO330 Principles of Ecology (4) BIO340 Genetics (4) BIO490/499 Senior Thesis (1-2)	BIO412 Bacteriology (4)
Chemistry (B.A.) Chemical Technology	BIO105 Principles of Biology (4)	
Chemistry (BS) - BioChemistry	BIO105 Principles of Biology (4) BIO340 Genetics (4)	BIO412 Bacteriology (4)
Chemistry (BS) - Environmental Toxicology	BIO105 Principles of Biology (4)	
Environmental Resources Engineering	BIO105 Principles of Biology (4) BIO330 Principles of Ecology (4)	
Environmental Science	BIO105 Principles of Biology (4) BIO330 Principles of Ecology (4)	
Fisheries Biology	BIO105 Principles of Biology (4) BIO340 Genetics (4) BIO430 Intertidal Ecology (3)	
Kinesiology	BIO105 Principles of Biology (4)	
Natural Resources - Master	BIO105 Principles of Biology (4)	
Natural Resources Planning& Interpretation GIS option	BIO105 Principles of Biology (4) BIO330 Principles of Ecology (4)	
Natural Resources Planning& Interpretation Marine Aquatic option	BIO105 Principles of Biology (4) BIO330 Principles of Ecology (4) BIO430 Intertidal Ecology (3)	
Nursing	BIO104 General Biology (3) BIO210 Medical Microbiology (4)	
Oceanography	BIO105 Principles of Biology (4)	
Pacific Basin Studies - Minor	BIO306 California Natural History (3)	
Physical Science	BIO105 Principles of Biology (4)	

Other HSU program/option name	Courses required List course number and units	Restricted elective courses List number and units
Rangeland Resource Science	BIO105 Principles of Biology (4)	
Social Work	BIO104 General Biology (3)	
Wildland Soil Science	BIO105 Principles of Biology (4) BIO330 Principles of Ecology (4)	
Wildlife	BIO105 Principles of Biology (4) BIO340 Genetics (4)	
Zoology	BIO105 Principles of Biology (4) BIO307 Evolution (3) BIO330 Principles of Ecology (4) BIO340 Genetics (4) BIO412 Bacteriology (4)	

4. **Comments on the internal demand FOR EACH OPTION of the Major.**

Biology - Overall

There has been a consistently high internal demand for Biology, and enrollment in most of our emphases has increased steadily over the last several years. Biology has consistently been the largest single major within HSU. Moreover, a recent (Fall 2008) report from the Office of Admissions lists Biology as the top declared major of both Freshmen and Transfer students. Additionally, the Noel-Levitz report listed the top 10 program areas reported by the College Board for college-bound California high school seniors to include Biology, with 7.2% of CA SAT takers indicating interest in this area.

Historical records of SANE requests on the Analytic Studies web site indicate evidence of unmet demand in Biology. Over the last two AY, an average of 13.7 BIOL courses per semester received SANE requests where the students were not able to be accommodated and did not enroll in the course.

Biology (Cellular/Molecular)

Internal demand for this option has been growing, as indicated by the headcount data above, and is expected to continue to grow. In addition to strong external demand, the Department used a Howard Hughes Medical Institute grant to hire a Bioinformatics specialist in 2006. This faculty member, whose startup and first four years salary are paid by the grant, is developing a Bioinformatics certificate program that should increase internal demand. The

Department was also recently awarded funding by the California State University Program for Education and Research in Biotechnology to fund the development of a Stem Cell Technology Training Certificate program. Finally, we recently submitted a grant to the California Institute for Regenerative Medicine, with HSU President Rollin Richmond as PI, to fund courses, equipment and administration associated with this certificate program. The new courses associated with Bioinformatics and Stem Cell Technology are expected to increase internal demand.

Biology (Biodiversity)

When our Department added the Ecology Emphasis (2003, see below), we believed there was too much redundancy between the Biodiversity, Environmental, and Ecology Emphases. Thus we streamlined our program by dropping the Biodiversity Emphasis. This explains the dwindling numbers of students enrolled in the emphasis.

Biology (Ecology) and (Environmental)

The Ecology Emphasis within Biology was first offered in 2003 and has been gaining in popularity over the past five years. The Ecology and Environmental Emphases, combined, account for ~13% of the students in our department. While the two are intimately related, there are some important differences. The Ecology Emphasis is newer, having been created specifically to target students wanting to pursue graduate school. The Ecology Emphasis has a stronger focus on theoretical and quantitative aspects of ecology, while the Environmental Emphases allows a stronger focus on organismal biology, environmental science, and practical applications. Given the strong interest in ecological and environmental issues among HSU students, we expect these two emphases to maintain significant internal demand. The Ecology Emphasis has grown continuously since its inception in 2003. Enrollment in Environmental Biology has decreased in recent years, perhaps as some of these students sign up for the Ecology emphasis, which has increased by a larger amount.

Biology (General)

Internal demand for majoring in general biology has gradually increased from 16% (75/478) in 99/00, to 23% (115/503) of our total majors in 07/08. This emphasis is generally

chosen by students who wish to keep options open for future job or graduate school prospects, or for students who have interests not captured by any of our current emphases.

Biology (Marine)

Students are attracted to our major by the pristine marine habitats in our area, the vessel and marine lab resources that are part of the major's experience, and by their awareness of marine conservation issues. With 188 majors in the marine biology emphasis, this is clearly the most popular emphasis within Biology, which in turn is one of the most popular majors across the HSU campus.

Biology (Microbiology)

As of 2006, we have three microbiologists in the department, making us relatively strong in this area. The emphasis is generally chosen by students who wish to pursue careers in health care professions, government public health agents, agricultural and food industries, and pharmaceutical companies. Demand for this major has been steady over the past several years. We expect internal demand to increase over the next few years, and we believe the microbiology program has the potential to grow significantly.

Biology (Special)

At the undergraduate level, most biology majors are well-served by our other options. This option provides a relatively small number of students with the ultimate in personally-tailored interdisciplinary curricula (centered around the core courses of biology). Demand has increased approximately threefold over the past 7-8 years. This may reflect rapidly growing public awareness of how advances in biology influence society as a whole. Examples of career interests among our Special Major students include: legal aspects of genetic counseling or biotech, economics of the biotech/pharmaceutical industries, evolutionary genetics of psychology, and ecosystems approaches to policy planning. Demand for interdisciplinary training in biology at the undergraduate level will almost certainly increase further.

Biology (Science Education)

This option is a California Commission on Teacher Credentialing (CCTC) approved major in preparation for credentialing in the Life Sciences for service in California's public secondary schools. The program is currently under revision for a new round of approval from the State in 2009. Internal demand for this option fluctuates because the pathway to life science teaching has several routes. This includes California Subject Exams for Teachers (CSET) testing, as well as degree equivalency petitions. The existence of this option at HSU is crucial for the continued support of a multiple-pathways approach to entering the teaching profession. Recently the Center for Science and Mathematics Teaching has received grant funding from the CSU Chancellor's office for the purpose of offering scholarships, test preparation tutoring, and other programs to increase the number of future science teachers in the career pipeline. It should be noted that some of these students will chose this option as part of their career development plans. Others will pursue alternative pathways as intended by the State of California. Nevertheless, we expect that internal demand for this major option will more than double in the next three years.

B. External demand for graduates from the program

Biology - Overall

Current trends indicate that external demand for Biology graduates will continue to increase over time.

The U.S. Department of Labor Occupational Information Network (O*NET) predicts that 'Life Scientist' positions will increase 14-20% from 2006-2016. The need for new hires will of course be much greater, due to retirement of current workers. The US Department of Labor Bureau of Labor Statistics, Occupational Outlook Handbook, 2008-9 edition (DOLBOLS) projects that employment of Biological scientists will grow about 9% from 2006-2016. Employment of Medical scientists is expected to grow about 20% during that timeframe. DOLBOLS also notes "People with bachelor's and master's degrees [in Biology] are expected to have more opportunities in nonscientist jobs related to biology. The number of science-related jobs in sales, marketing, and research management is expected to exceed the number of independent research positions."

The California Labor Market and Economic Analysis 2007 (CLMEA), prepared by the California State Labor Market Division of the Employment Development department, identifies Biotechnology as one of the growing jobs/occupations that are most critical to the State's economy. California has the nation's largest biotechnology employer base, with approximately 400 biotechnology companies. According to CLMEA, " Top growth occupations include bioinformatics specialists, sales representatives; medical scientists; veterinary technologists and technicians; biological technicians; and veterinary assistants and laboratory animal caretakers." They project a growth of 24,700 positions in California from 2004 to 2014 in the occupation of bioinformatics specialist alone. DOLBOLS states "Biotechnological research and development should continue to drive employment growth [for biological scientists]."

CLMEA also identifies Health Care as a High Growth Industry. It states "In California, employment in the top 20 high-growth occupations in the health care industry is expected to increase by more than 194,000 between 2004 and 2014. The projected demand and largest growth in health care careers will be for RNs; nursing aides; orderlies, and attendants; home health aides; medical assistants; and dental assistants. Employment in these top five occupations is expected to grow by 124,000 workers." Among Professional occupations, 4 of the top 5 professional positions that employ the most currently, and have the largest expected growth, are in the health care industry. CLMEA states " The fastest growing [professional] occupations include pharmacists, chiropractors, family and general practitioners, lawyers and surgeons." Pharmaceutical and Medicine Manufacturing is also identified in CLMEA as a one of the top 20 industries likely to experience labor shortages.

The drive to develop green technologies will also spur job growth for biologists in the coming years. According to DOLBOLS, "... efforts to discover new and improved ways to clean up and preserve the environment will continue to add to job growth. More biological scientists will be needed to determine the environmental impact of industry and government actions and to prevent or correct environmental problems such as the negative effects of pesticide use. Some biological scientists will find opportunities in environmental regulatory agencies, while others will use their expertise to advise lawmakers on legislation to save environmentally sensitive areas. New industrial applications of biotechnology, such as new methods for making ethanol for transportation fuel, also will spur demand for biological scientists."

Biology (Cellular/Molecular)

As indicated above, Biotechnology was identified by CLMEA as one of the growing jobs/occupations that are most critical to the state's economy. Biotechnology is also one of the top growth fields recognized in The United States *Presidents High Growth Job Training Initiative* (http://www.doleta.gov/Brg/JobTrainInitiative/). Graduates in Cellular/Molecular Biology are in demand for these positions. Additionally, most students interested in professional careers in the Health Care Industry, as pharmacists, chiropractors, family and general practitioners, dentists, and surgeons, pursue degrees in this option. CLMEA identifies the Largest Growing occupation requiring Doctoral Training to be that of Medical Scientists, and expects a growth of 5,400 positions at this level in California from 2004-2014.

According to DOLBOLS, ..." much of the basic biological research done in recent years has resulted in new knowledge, including the isolation and identification of genes. Biological scientists will be needed to take this knowledge to the next stage, which is the understanding of how certain genes function within an entire organism, so that medical treatments can be developed to treat various diseases. Even pharmaceutical and other firms not solely engaged in biotechnology use biotechnology techniques extensively, spurring employment increases for biological scientists. For example, biological scientists are continuing to help farmers increase crop yields by pinpointing genes that can help crops such as wheat grow worldwide in areas that currently are hostile to the crop. Continued work on chronic diseases should also lead to growing demand for biological scientists." Investment in Stem Cell Technologies, including the $3 billion that California is committing to the California Institute for Regenerative Medicine, will require thousands of scientists in the years ahead.

Biology, (Ecology), (Environmental)

O*NET predicts that the number of positions nationwide for Environmental Scientists and Specialists, Including Health, will grow by 21% between 2006 and 2016 (when combined with retirements this is an increase of 42,000 new positions, or 50% of the existing workforce). Likewise, CLMEA predicts a 30% increase in the number of positions for Environmental Technicians from 2006-2016 in California. According to DOLBOLS, "Employment of environmental science and protection technicians is expected to grow much faster than the average; these workers will be needed to help regulate waste products; to collect air, water, and

soil samples for measuring levels of pollutants; to monitor compliance with environmental regulations; and to clean up contaminated sites. Over 80 percent of this growth is expected to be in professional, scientific, and technical services as environmental monitoring, management, and regulatory compliance."

Biology (Marine)

Marine Biology is not reported as a separate category in the O*NET, CLMEA, or DOLBOLS, but the latter source does note that "There will continue to be demand for biological scientists specializing in botany, zoology, and marine biology." However, they also warn that "Prospective marine biology students should be aware that those who would like to enter this specialty far outnumber the very few openings that occur each year for the type of glamorous research jobs that many would like to obtain. Almost all marine biologists who do basic research have a Ph.D."

Nevertheless, the largest state and federal granting agencies in the country are asking the CSU system to step up and act proactively to ensure the health of California's marine ecosystems and economy. The solid link between economics and the marine environment has prompted an impressive variety of federal and state groups to call for both an increase in ocean literacy and the greater involvement of marine scientists. Some of the groups and documents describing this demand are The Pew Oceans Commission Report, the US Commission on Ocean Policy, The Department of Fish and Game, the Marine Life Management Act, The Governor's Ocean Action Strategy, The West Coast Governor's Agreement on Ocean Health, and the California Ocean Protection Council.

The CSU system agrees with these demand foci (ocean literacy, marine science) and feels that it is ideally placed to respond and expand its efforts in these nonexclusive arenas. The 23 CSU Presidents have recently agreed that the subject of ocean literacy needs to be raised to the same level as Math and English literacy, which is the reason they agreed to form COAST (Council on Ocean Affairs, Science and Technology). The National Science Foundation has recently identified specific ocean literacy benchmarks, and since the CSU trains 87% of the teachers in the state, it is the logical institution for incorporating and accomplishing these benchmarks. COAST is also placed to expand the training of marine scientists since 21 of the CSU campuses have marine related curricula and seven of those campuses have marine research

facilities. The CSU system itself is now part of the larger group encouraging specific CSU campuses to respond.

Demand on HSU to train marine biologists comes from both local and regional sources. We expect that the need for our undergraduates will increase due to the linkage between the economy and marine health. More of our students will get consulting jobs with private companies; with state and federal agencies to do identification and quantitative field survey work; with public aquaria to work as biologists and outreach personnel; and with large marine research teams like PISCO (Partnership for Interdisciplinary Studies of the Coastal Oceans). According to the American Institute for Biological Sciences, these kind of jobs have a starting salary of around $33,000 per year (2003 data), and top out around $60,000 in the public sector or $80,000 per year in the private sector.

Biology (Microbiology)

CLMEA predicts that in California the number of Microbiologist positions will increase ~38% from 2002-2012 (which equates to ~1100 position openings/year). O*NET predicts an increase in the number of Microbiologist positions from 7-13% from 2006-2016. . They classify this as an "in demand" occupation, defined as those which are found in "National High Growth" industries. High Growth industries are economically critical, projected to add substantial numbers of new jobs, and are being transformed by technology and innovation. Presently, microbiologists are employed in numerous occupations, including: clinical laboratories, biotechnology (e.g. pharmaceutical industry), food production/manufacturing, farming and agriculture, municipal wastewater and industrial waste treatment operations. Enhanced research and development in alternative biofuels will also provide future job prospects for trained microbiologists, as most of these developing technologies rely on microbial processes.
The median salary for Microbiologists in 2007 was $60,680.

Biology (Science Education)

CLMEA identifies 9 occupations that will exhibit the most growth from 2004-2014. Of the top-growth skilled occupations, two of them are in education. An expected 44,400 Elementary School Teacher positions will be added during this time, and 24,800 Secondary School Teachers. Nationwide, DOLBOLS estimates that between 2006 and 2016, about 479,000

new jobs will be opened up for teachers. They also note that job prospects are expected to be very favorable, with particularly good prospects for teachers in high-demand fields like math and science.

The current accelerating shortage of science teachers in California will increase the external demand for this option because it is a California Commission on Teacher Credentialing (CCTC) approved major in preparation for credentialing in the Life Sciences for service in California's public secondary schools.

III. Program Quality (Limit: 6 pages, not including tables) [30%]

A. Students

1. For undergraduate programs

Biology (with options) Mean GWPE Scores (incl. primary and second majors) degrees_awarded_B_BIOL report generated: 25-JUN-08								
MAJOR	**AY 99/00**	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**
Biology	19.0		16.0				17.0	17.3
Biology (Cellular/Molecular)	16.4	16.3	16.8	15.5	17.4	17.2	17.7	17.2
Biology (Biodiversity)	16.0	19.0	18.0		18.0	18.0	18.8	18.0
Biology (Ecology)							16.7	15.5
Biology (Environmental)	17.6	16.8	17.0	16.4	17.5	17.2	17.2	17.0
Biology (General)	16.6	16.8	16.7	17.0	16.6	16.1	17.0	16.8
Biology (Marine)	16.3	16.7	16.3	17.1	17.8	17.2	16.9	16.5
Biology (Microbiology)	17.3	16.3	17.0	16.9	16.0		18.0	16.0
Biology (Natural History)-DefunctF03		19.0						
Biology (Special)	14.3	17.0	16.0	18.3	18.0	17.0	16.5	18.0
Biol (Life Sci Education)-DefunctF96		16.0	14.0		18.0			
Biology (Science Education)	17.5	16.8	16.1	16.6	17.4	19.0	17.0	17.1
Overall	16.8	16.7	16.6	16.7	17.3	17.1	17.2	16.9

Provide evidence indicative of program quality related to student learning (e.g., patterns of student achievements in discipline-specific contexts such as special honors or awards, publications, presentations; passing rates on professional examinations; proportion of students who are admitted to graduate school and/or employed in a disciplinary field; and so on – as appropriate for your discipline).

The high quality of our undergraduate program in Biology is reflected by the experiences gained and successes of our graduates. Our students participate in a wide variety of discipline-related scholarship and service activities. We are committed to one-on-one undergraduate mentoring and to providing experience-based learning. Through these activities, our students regularly participate in statewide, national and international scientific meetings and workshops. Many of them have attended as co-authors on poster and oral presentations and have been recognized at these meetings for the quality of their work. These experiences have translated

into co-authorship with faculty on peer reviewed journal articles and presentations for 26 students in the past 5 years.

This level of involvement in their field has enabled many of our students to attend graduate schools and to be sought after for employment in their disciplinary fields. For example – students in our Cellular and Molecular Biology Program have attained an 80% acceptance rate to medical schools and other professional programs and 100% acceptance rate to graduate programs. In the past three years, this includes students accepted into MD programs at Harvard, Stanford and UCSF. Students from our Botany and Zoology and Marine Biology program are highly sought after for employment in their field due, in large part, to the employers' knowledge that the students have had the training, access to facilities and habitats, and the hands-on experience that set them apart from students from other universities. Not only are our students highly regarded outside of HSU, but hundreds of our students have been hired on as research assistants on grants awarded to faculty members within the department over the past 5 years.

As a Department, we are also dedicated to service to our community and our students gain valuable experience in this area as well. Student clubs (for example the Cell and Molecular Biology Club, Mycology Club, etc…) and their advisors are very active in the Department of Biological Sciences. Undergraduates in these clubs are actively involved in community environmental efforts (beach clean-ups, HSU Day of Caring, Dune Restoration etc…) as well as outreach to the community (Oceans' week – K-12 curriculum, HSU Natural History Museum presentations…) as well as bringing community members to campus to share their expertise with other students.

B. Faculty

1. Provide evidence of teaching effectiveness and commitment to continuous improvement of teaching.

The faculty within the Department of Biological Sciences are dedicated to teaching excellence. As such, all faculty regularly engage in a wide range of professional activities to strengthen their effectiveness in the classroom and to continually improve upon their teaching. Some of the professional development activities that faculty have been engaged in include diversity and accessibility training, and training on new classroom techniques (Moodle,

Photoshop, Powerpoint, Gallery, Response Cards/Turning Point). Several of our faculty have attended and presented CSU workshops on teaching (some examples include Patty Siering – CSU workshop on improving biology education; Sean Craig – the Teacher-Scholar Institute at San Luis Obispo; and Sharyn Marks the Spring Teaching Showcase at Cal Poly Pomona). Several of our faculty have been actively engaged in College and University level committees that address Campus themes on learning outcomes and diversity (i.e. WASC Action Team II – diversity, Learning Outcomes – College and Departmental Curriculum Committees).

Teaching effectiveness embodies not only the tools and skills that we are continually improving upon, it is also dependent upon faculty who are current and actively engaged in their discipline and who truly care about their students' learning. All faculty in our Department are actively engaged in scholarship and are committed to bringing current information to bear in their lectures – we are continually improving and updating course content. We are dedicated to bringing the excitement and vitality of the nature of science to our students. These are things not taught in workshops, but are the very essence of who we are and why we are here.

Teaching effectiveness is only truly measured by knowing how well students are learning what we are offering them. In addition to the assessment efforts underway, we respond to what the students tell us on mid-semester evaluations and we pay close attention to our formal student evaluations at the end of the semester. In addition, faculty under review value visiting faculty comments during the RTP process and we discuss and improve teaching pedagogy in formal (Departmental Retreats) and informal venues. For example, Dr. Michael Camann recently started an informal Departmental group to discuss pedagogical innovation in the classroom, including incorporation of active learning approaches.

2. **Evidence of faculty engagement in scholarship/creative activities and service. This table is to be completed by the department.**

Scholarship/Creative Activities/Service	05/06	06/07	07/08
At least one peer-reviewed publication or creative product	52%	58%	58%
At least one funded grant or contract related to scholarship	81%	76%	67%
Invited participant or leader of workshops, expert panels, or task forces	48%	44%	62%
At least one presentation (paper, poster, exhibition, etc.) given at a professional society meeting	71%	76%	80%
Professional service activities at a regional or national level	76%	76%	80%
Service on at least one university or college-level committee (at least 1 hour/wk avg.)	67%	71%	53%

3. **Provide explanations of the data above and/or descriptions of the patterns of faculty engagement in scholarly and/or creative activities and service as appropriate for your program.**

During the evaluative period Fall 2005 to Spring 2008, every faculty member in the Department of Biological Sciences (100%) who was employed full time at HSU both successfully secured research funding and published their work.

During the three year period above 99 peer reviewed papers were published, 212 presentations were given at state, national and international scientific conferences, and grant funds of $5,464,199 were obtained by full time faculty within the department of Biological Sciences. If spread evenly among faculty that would be an average of 1.7 publications/year, ~3 presentations/year at scientific conferences and over $86,000/year in funding acquired.

The faculty in this Department are service oriented and are regularly engaged in service to the community and to the profession. From talks to local K-12, to being guests on NPR, to recovering a dead whale from a State park beach or giving a seminar to the HSU Natural History Museum, Biologists at HSU are often called upon to serve by the community and our profession. Faculty in our Department are regularly called to serve as experts on panels and on review boards as well. In the past 3 years, faculty in our department have performed over 450 acts of service to the community and profession or an average of 7 events/year/faculty.

We are also a faculty engaged in campus wide governance with members regularly serving on Departmental, College and University committees.

4. **Provide evidence for faculty mentoring of students. Include, for example, approaches to advising, directed study or research, and/or clubs or student professional chapters that involve faculty mentorship.**

True mentoring occurs at all levels of the undergraduate experience in the Department of Biological Sciences. From freshman advising to the completion of a senior project, most students come to know and rely on their advisors in our department. This is no small task for a Department as large as ours – most of us have nearly 50 advisees! It is notable that at a recent department meeting when asked to relinquish freshman/sophomore advising to the advising center, the Department flatly refused as each of us understands the importance of getting to know our students from the beginning and developing a personal relationship with our students. Advising techniques vary among faculty members – but the unifying theme is that it is individually based. Our goal is to help each student reach their academic goals and potential and to enjoy their time at HSU.

Many of our classes involve experiential learning in the form of field- and lab-based laboratory experiences. This allows for one-on-one student/faculty interaction, which provides students the chance to get to know their professors and gives faculty the chance to identify the strengths and challenges of each student. In most of our classes, students are writing and presenting their findings and getting individualized feedback on their work – thus mentoring occurs in the classroom via creative teaching techniques.

More than 75% of our students are required to complete a capstone experience (a senior project or thesis) as part of their major requirement. This entails close consultation with a faculty member. This typically takes the form of a scientific study that is written in scientific format. During this time we seek to not only help the students get more experience in the field of his/her choice, but to help them plan for the next step. We appreciate that mentoring involves not only scientific instruction, but gentle guidance during a huge transition for these students. In the past 5 years, faculty have mentored 568 students with their capstone experiences (BIOL490/499).

In addition to the senior project, students in our Department are able to work closely with faculty members and gain valuable field and lab experiences associated with programs such as the NSF Research Experience for Undergraduates grants, MMERP (Marine Mammal Education and Research Program), the Redwood Sciences Project, Howard Hughes Medical Institute HHMI Scholars Program, LSAMP, and CSUPERB (California State University Program for Education and Research in Biotechnology), and the NSF Research at an Undergraduate Institution grant that will impact ~500 undergraduate students during five years at HSU (and another 300 undergraduates at CSU Chico, and Portland State University) through direct research opportunities and classroom experiences. Faculty have mentored 422 students through these venues in the past 5 years. Faculty encourage students to attend and present at state-wide, national and international meetings to introduce them to the scientific community of which they are a part. In the past three years, over 125 students have attended meetings with a faculty member. Over 225 students have been co-authors on posters or talks given at these conferences.

Another measure of faculty quality has been their dedication to training undergraduates by hiring high-quality students as research assistants on grant-funded projects. Over 280 undergraduates have been hired in the past 5 years. This type of mentoring does not come without a cost – in terms of faculty time and measures of Departmental efficiency (FTES, etc..). We feel that the benefit is well worth the cost.

Aside from academic advising and mentoring, faculty are actively engaged in student clubs in our Department. From the Pre-Med club to the Mycology (mushrooms) Club to the Fire Ecology Club to the Cell and Molecular Biology Club, our faculty are mentoring students in and out of the classroom by serving as advisors, by presenting talks and by guiding field excursions for student clubs at HSU.

5. Other evidence of quality indicators related to faculty that may not be listed elsewhere, including, for example, faculty diversity within the program.

Our faculty are truly dedicated to student learning. As a consequence, many faculty take on the significant responsibility and time commitment of planning and accompanying students on field trips. Faculty have taken students to Guyana to study fungi in the tropical rainforest and taken students to Baja to study whales in the Canal de Ballenas. Numerous faculty have brought

students to regional study sites such as the Angelo Reserve in Mendocino county, Lassen Volcanic National Park, etc.

Locally, faculty have routinely taught Freshman Interest Groups and supported undergraduate education either directly or indirectly through their extramural funding. Faculty have sought out and secured a number of diverse, significant external grants that were focused on supporting undergraduate research.

In conclusion, faculty within our Department offer a wide array of experiential learning opportunities to our students.

C. Curriculum (differentiate by option, if appropriate)

1. Writing and oral communication learning outcomes

Describe how written and oral communication skills are included in your program.

We seek to equip students with a sound academic and practical foundation for assuring productive participation in a society of citizens and scholars. This includes the ability to communicate effectively. In 2001, the Department carried out a lengthy assessment of how written and oral communication skills are integrated into courses taught by each of the faculty. This included a survey of writing assignments, poster presentations, and oral presentations, as well as review and resubmission procedures, feedback instruments, and assessment. As part of preparing this program prioritization document, we carried out a briefer survey in 2008. It is clear that all of our faculty are seriously committed to improving the communication skills of our students. As part of that commitment, most of our courses have frequent significant individual assignments that include assessment and feedback..

In our larger, lower division courses, this frequently takes the form of short (3-5 page) written assignments. Students are given scoring rubrics beforehand, and written feedback. An example is Principles of Biology (BIO105), in which students' laboratory results are written up in a Research Journal format. To make individual assignments more manageable, each assignment only requires portions of a formal research article, such as Results and Discussion. Students receive feedback via rubric (which students have ahead of time), and written comments on the essays. Feedback is from the instructor, but there is also a peer review stage that occurs during lab time. In upper-division courses, more diverse approaches are taken, which frequently include

peer review and instructor review followed by revision and resubmission. Several courses, such as Introduction to Undergraduate Research (BIO383), Intertidal Ecology (BIO430), Microbial Ecology (BIO433), and Evolution (BIO307), have students write research proposals. These proposals are evaluated using a standardized rubric on their rough draft and revised rough draft before accepting the final draft. Other courses, such as Cell Biology (BIO410) and Bacteriology (BIO412) have students write scientific papers reporting the students' independent research. These go through extensive review and revision. In BIO412, these are collected and printed as a research journal at the end of the semester.

Students receive feedback and review of oral presentations and poster presentations in almost all of our classes as well. For example, in BIO430 oral presentations of proposed research (early in the semester) as well as oral presentations of accomplishments at end of semester are required. In BIO412 students give talks on their laboratory research and have an accompanying poster session. Posters prepared for courses have been delivered at professional meetings. In addition, extensive field journals are a component of several upper division courses, and some courses prepare exhibits and demonstrations for the community.

2. Assessment

Progress: The Biological Sciences Department is current on all assessment activities associated with WASC accreditation. We have assessed 4 of the Department's 5 learning outcomes, primarily by using assessment questions embedded in the final exams of three to four upper division courses each semester. The assessment questions are reviewed by the Department Curriculum Committee prior to their inclusion in the final exams.

Provide 2 examples of how you have used results of assessment of your program's student learning outcomes to adapt, enhance, or affirm your program's curriculum.

One of our earliest assessment activities was to map our student learning outcomes to the courses offered in our Department. This process pointed out that Evolution, a fundamental biological process and the focus of one of our learning outcomes, was not given much explicit consideration in the majority of our options. We therefore changed the curriculum in 2007 to require the Evolution course in all options within the Biology Major. Prior to this, Evolution was

not required by Cell/Molecular Biology, Marine Biology, Environmental Biology, General Biology, or Special Major options.

We have carried out assessment of learning outcomes by including assessment questions embedded into final exams for upper division courses. Our assessment in Fall 2007 indicated our students had a relatively strong ability to interpret information in graphs, tables and diagrams, with ~72% of the students earning 67% or more of available points. To some extent this seemed to affirm ongoing curricular changes targeted at increasing active learning approaches in several courses, including Principles of Biology (BIO105) and Principles of Ecology (BIO330). Assuming that such strategies have in fact helped our majors develop these skills, the department is beginning to initiate curricular changes to focus on similar skills in our largest GE course as well, General Biology (BIO104). We recently proposed changing the structure of this course from 2 hours of lecture plus 3 hours of lab to 3 hours of lecture plus 3 hours of lab. The primary goal of this change was to introduce more active learning strategies; the content of the course was not going to be increased. However, this curricular change has not yet been .

Our most recent assessment indicated that the ability of our students to formulate hypotheses was not as advanced as we would like. Only about 50% of our students earned 67% or more of available points on the embedded final exam questions. Therefore, we initiated efforts to adapt our curriculum to increase the student opportunities to learn the skills associated with formulating hypotheses. At the Department faculty retreat in August 2008, we discussed the possibility that an over-emphasis in our core lower division curriculum of factual content, as opposed to specific skill sets, was at least partially to blame. We found that there were inconsistencies concerning how much time was devoted to developing this skill among different instructors teaching the same course. We agreed to increase emphasis on developing hypotheses in all of our lower division core courses. In upper division courses we agreed that this should include time developing and evaluating experiments to distinguish competing hypotheses.

3. Accreditation (not applicable)

4. Relevance and innovation

Provide evidence through examples that demonstrate a curriculum that is relevant, innovative, forward looking, responsive to changing trends, and equips students to function in a diverse, global context.

Our curriculum is relevant because Biology is front-page news, every day, and we teach students to make connections between what they learn in the classroom and what they see in everyday life. Our curriculum teaches not just scientific knowledge but also an understanding of the nature of science, the nature of scientific evidence and how risk is reasonably assessed. Most or all of our faculty continually incorporate current news events and primary research literature into their courses. We help our students think critically and this prepares them to function in a diverse, global context.

While several Biology faculty are embracing innovation in the classroom, such as the use of clickers, Moodle forums, active learning and group learning approaches, **our curriculum as a whole is innovative** by necessity because biological knowledge and understanding are in the midst of a dramatic revolution. The science of Biology is changing rapidly, perhaps more than any other science. Whole new fields are rapidly developing and expanding, including Genomics, Proteomics, Stem Cell Technologies, Pharmacogenetics, Transgenic Organisms, and Synthetic Biology. We have to be forward looking just to keep up. Our courses concentrate not only on what we know, but also on what we do not know. The students in our classrooms will be the ones to fill in the blanks of what we currently do not know. The goal we have for our students it to equip them with the skills they will need to successfully answer these challenges.

Biology is relevant to the challenges produced by environmental degradation; biologists are often in the lead in documenting these changes and proposing solutions. Biologists are the ones who come up with the solutions for human, animal and plant diseases. These challenges are faced not only by the United States, but by everyone on the planet. Being a biologist means you must have a global perspective.

Our curriculum is forward looking and responsive to changing trends. Our curriculum is continually updated and our faculty are active scholars pursuing modern research programs that both inform their courses and engage their students. Some specific examples include the recent hire of a Bioinformatics specialist (and the development of Bioinformatics

courses) and funding from the California Institute for Regenerative Medicine to develop a Stem Cell Training Certificate program.

Our curriculum equips students to function in a diverse, global context because it prepares students to grapple with the interdisciplinary nature of twenty-first century problems. Our focus on biology as an inquiry process teaches students to apply creative and critical thinking to new and unfamiliar problems.

5. Interactions between graduate and undergraduate programs

Our graduate and undergraduate students interact in significant ways which enhance both the graduate and undergraduate experience. Graduate TA's bring additional and complementary expertise as well as considerable enthusiasm into the classroom. They model the graduate experience for undergraduates and can serve as a resource for UG seeking this path. Graduate TA's offer the department flexibility in teaching and enable us to serve many more undergraduates than we could without their assistance. Undergraduates often intern for graduate student projects, solidifying the skills that they have been introduced to in many of their classes by doing it in a research context. Undergraduates gain valuable, marketable experience in areas such as field-identification of organisms, GPS techniques, radio-telemetry techniques, cell and molecular techniques. These opportunities often translate into a spark being ignited for the undergraduate student that is often flamed into their senior project. Aside from valuable field and lab techniques, students also gain experience in data collection, analysis and presentation either in connection with a larger project and often for their own senior capstone experience. In this way both the graduate student and the undergraduate student benefit from working together. The graduate student gains valuable experience in mentoring and training and assistance in completion of their work, and learns a lot from the undergraduates who often contribute in unexpected ways to projects. Undergraduates gain valuable hands-on, marketable experience and guidance in their academic path.

6. Program uniqueness

If your program provides unique educational opportunities or course content that is found at few or no other CSU institutions, please describe this uniqueness.

Biology - Overall

Although all CSUs have a Biology program, our strength lies in the resources we have available. We have the largest greenhouse teaching collection of any CSU. Our herbarium is also the largest in the CSU system. Having a professional quality systematics collection just a few doors away from our teaching labs provides unparalleled instructional opportunities. An extensive living plant collection is also maintained on campus, including the largest conifer collection (perhaps in the world). Being able to take specific classes in mycology, phycology and lichens and bryophytes is a unique aspect of our curriculum because these courses at other universities are either not offered at all or are combined into one course.

Likewise, with over 15,000 specimens, the HSU Vertebrate Museum is home to one of the premier research and teaching collections of mammals, amphibians and reptiles in western North America. This unique museum serves as a center for field and specimen-based research on the ecology, evolution and conservation of vertebrates.

Relative to many CSU campuses that are located in urban centers, or are landlocked, biologists at HSU can take advantage of a wide range of terrestrial (high and low elevation) and aquatic (freshwater and marine) habitats for classes, almost all with 60 minutes of the campus. The ecosystem diversity (ocean, bay, tidepool, marsh, forests, alpine, etc.), and climate, in NW California provides unique and outstanding opportunities for field courses and field learning. This allows us to teach unique courses (in some cases, year-round). These unique ecosystems improve the quality of all of our courses. For example, many of the standard marine invertebrate species highlighted in invertebrate zoology texts are found locally, and the fungal fruiting season persists through the winter.

Because of a unique faculty commitment and institutional tradition, our undergraduate students get to carry out the level of hands-on research that, at other universities, is typically only done by graduate students. Examples include advanced uni- and multivariate statistics, writing at the level of a practicing scientist, use of field equipment, small boat (motorized, kayak) training and use during field research projects in the bay, use of Scanning Electron Microscopes and

Transmission Electron Microscope, genetic marker analysis, cell culture, automated DNA sequencing equipment, real time polymerase chain reaction analysis.

Biology (Cellular/Molecular), (Microbiology)

Stem Cell Training and Bioinformatics Training Certificate programs are in development; both of these are relatively unique within the CSU. Teaching both scanning and transmission electron microscopy (EM) to undergraduates, and allowing undergrads to conduct independent research utilizing the EM labs after they have completed EM course, is exceptional relative to most undergraduate training programs. Hands-on use of sophisticated equipment including EM, automated DNA sequencer, real time polymerase chain reaction equipment, and epifluorescent microscopy, by undergraduates, is also exceptional.

Biology (Marine)

Humboldt State is the only institution in the United States with both a fully equipped Marine Laboratory (the Telonicher Marine laboratory) and an marine research vessel dedicated solely to undergraduate education (the R/V Coral Sea). Small ocean-going boats are also used extensively by undergraduates while studying marine mammals, as well as marine and estuarine processes. The Vertebrate Museum is home to one of the premier research and teaching collections of Marine Mammals in the state. The Museum is accredited by the American Society of Mammalogists, and is also a member of the Marine Mammal Stranding Network.

Biology (Science Education)

The Biology Science Education program at HSU is a unique training center in the field due its connection to the Redwood Science Project housed in the Humboldt Science and Mathematics Center. Advanced undergraduates have opportunities for stipend supported outreach mentoring and activities in public schools, scholarships, tutoring, and special classes, as well as access to enrollment on professional development institutes for teachers during the summer.

Biology (Special)

We are the campus ideally situated to train professional biologists whose careers include interdisciplinary expertise in legal, economic, historical, or political aspects of our unique environment, especially relating to coastal, redwood forest, tribal, and rural community issues.

7. Opportunities for undergraduate scholarship/creative activities/service

All of our students are offered the opportunity to engage in undergraduate scholarship/creative activities and service. For the majority of students in the Biological Sciences, it is not only an opportunity, but a requirement as more than 75% are required to complete a capstone experience as part of their major requirements. We have multiple avenues for undergraduate scholarship such as Directed Studies (BIO490) and Field and Laboratory Problems (BIO335) classes. These activities are completed with close interaction with a faculty member and the student receives academic credit.

D. Affiliations/Equipment/Facilities/Environment

1. Affiliations

The Biology Department has strong connections to affiliated units on and off campus. We have listed the name, purpose, nature of our affiliation and the benefits that accrue our program of the some of our affiliations with centers, units or institutes in the table below.

Name	Purpose	Nature of Affiliation	Benefits to program/major
FOAM – Friends of the Arcata Marsh	The purpose of the FOAM (Friends of the Arcata Marsh) is to stimulate understanding of the Arcata Marsh and Wildlife Sanctuary, its relationship with Arcata's integrated wastewater treatment system, the surrounding watersheds and bay, and their link with the earth's water cycle. FOAM is a non-profit organization contracted by the City of Arcata to provide this information to the public.	Board members	Research grant program, docent opportunities, community service
HSU - Natural History Museum	To inspire in North Coast residents and visitors of all ages an understanding and appreciation of the dynamic natural world and to provide a learning laboratory for Humboldt State University students.	Board Members, exhibitors	Student outreach, public presentation, community service
NCIMS – Northern California Institute of Marine Sciences	To facilitate and promote an interdisciplinary approach to marine sciences at Humboldt State University	Board Members	Integration and information transfer among the marine science departments on campus
NMML – National Marine Mammal Laboratory	Conservation and Management of Marine Mammal Stocks	Integral collaborator in coast-wide marine mammal monitoring programs	Student interns trained in survey techniques and become a part of a long-term project
National Marine Fisheries	Manages the marine mammal stranding network for responding	Marine mammal Stranding center	Students get to assist in

Name	Purpose	Nature of Affiliation	Benefits to program/major
Service	to stranded marine mammals	for northern California	conducting necropsy's on stranded whales
Oiled Wildlife Care Network	Rehabilitate and treat oiled wildlife	Assist in coordinating field effort	Students are trained in recovery of seabirds in the event of a spill and they can volunteer to assist in the recovery of oiled wildlife
Marine Mammal Center	Rehabilitation of stranded marine mammals	We assist MMC on live strandings and we have given talks to their training groups and supplied interns for their rehabilitation program	Students can get marine mammal handling and rehabilitation experience
Bureau of Land Management	Conservation and Management of Public Lands	Member of working group to rehabilitate an offshore seabird/sea lion rookery	Student employment, experiential learning
Yurok Tribal Council	Governing branch of local Yurok Tribe	Consultant with local tribe on marine mammal issues	Student employment, experiential learning, exposure to different cultures and perspectives
Moss Landing Marine Laboratory	Marine Laboratory of a number of central California State University Campuses	Part of collaborative group studying coast -wide marine mammal initiatives	Students gained valuable hands-on experience handling seals, and tracking them via radiotelemetry from the air, sea and shore. Students worked with some of the top researchers in the field.

Name	Purpose	Nature of Affiliation	Benefits to program/major
Long Marine Lab – UCSC	Marine Laboratory for University of California at Santa Cruz	On the board to coordinate state-wide Marine Mammal Research Symposium	Experiential learning, introduction to experts and grad students in MM science
Whale Watching Spoken Here	Train docents in whale biology	Serve as an expert to train interpreters	Students are interpreters and interns
Redwood National and State Parks	Preserve and protect natural resources	Co-operative long-term projects on fungi and marine mammals and marine invertebrates	Contributes to research and teaching – student experiential learning
Siskiyou Field Institute / Deer Creek Field Station	Field-based environmental education and research	Faculty Board member and Co-founder	Student experiential learning through teaching and research opportunities
HSU Vertebrate Museum	Support the educational and research missions of faculty and students at HSU through maintaining and supporting a collection of vertebrates for study The Vertebrate Museum is also an active member of the California Marine Mammal Stranding Network.	Contributing faculty member and advise students	Student experiential learning through teaching and research opportunities
Redwood Science Project	Improve science literacy and k-12 science educational outcomes	Founded by Department Faculty, Director	Scholarships, mentoring and advising, outreach opportunites
CSUPERB – California State University Program for Education and Research in Biotechnology	CSUPERB promotes biotechnology workforce development by supporting innovative coursework and programs, real-world research experiences, and core resources for faculty and students at all 23 CSU campuses.	Board member, Grant review panels, students award committees, attend annual meetings, strategic planning council member, faculty consensus group member, Travel	Provide grant money, serving on panels and committees allows us to mentor faculty and students re: granting process

Name	Purpose	Nature of Affiliation	Benefits to program/major
		grant committee member, grants review committee member	
CICORE - Center for Integrated Coastal Observation, Research, and Education	To provide the coastal public with free real time access to measures of marine water quality and climate, to be used in K-12 classes, for university teaching and scholarship, resource agencies, and private companies.	Principal Investigator; Board Member	Multiple CNRS classes have used these data, senior theses, graduate theses, major class projects like those described in BOT 353 and Intertidal Ecology.
MMERP	Marine Mammal Education and Research Program – An undergraduate and graduate research program dedicated to the study of local marine mammal populations.	Director	Student experiential learning through teaching and research opportunities
USDA Forest Service		Training workshops, Pacific NW Bat Grid, Technical Support	Supports student research
Bat Conservation International		Training workshops	Supports student experiential learning
Bats and Wind Energy Cooperative	Research initiatives to reduce bat mortality at wind energy facilities	grant	Supports student research
DoD Legacy Program		Training workshops, technical support	Supports student research and experiential learning
SERDP (Strategic Research and Development Program)	Research initiative to develop software and hardware for automated monitoring and species classification of bats	grant	Supports student research and provides stipend
CALTRANS	Research initiative to develop software and hardware for automated monitoring and species classification of birds	grant	Supports student research and provides stipend
Texas	Research initiative to assess	grant	Supports student

Name	Purpose	Nature of Affiliation	Benefits to program/major
Department of Transportation	impact of highway construction noise on federally listed golden cheeked warblers		research and provides stipend
INRSEP	Provides support for Native American students planning a career in science.		Faculty grants (HHMI, CSU-LSAMP) provide support for INRSEP & its students
Humboldt Bay Harbor, Rec., and Cons. District		Marine Mariculture Monitoring Committee Interact with agency and university professionals on developments and impacts of mariculture in HB	Student experiential learning – bringing awareness of local issues into the classroom

2. Facilities and resources

Provide a brief listing of your most important facilities, equipment and information/library resources, and describe the degree to which the current facilities, equipment and information/library resources affect program quality.

As noted above our Vertebrate Museum and Herbarium house among the largest, highest quality and most well-known collections within the CSU and they are central to the conduction of our classes and to other experiential opportunities for our students. These collections are critical to the quality of our programs. They enable us to train students in the evolution, identity and relationships of plants and animals.

Vertebrate Museum – The Vertebrate Museum is the fulcrum of the mammalogy training at HSU. It is a fully accredited museum used primarily for teaching, but also for research. We educate over 80 students a year on the biology and identification of mammals of the world. Independent study students use this facility extensively to articulate skeletons, prepare specimens and to learn the skills of museum curation. This facility is critical to the Wildlife program for the management of mammals and allows for a highly-sought-after class for our zoology majors. With increasing enrollment in the Zoology program, even more use will be placed on the museum, which houses not only our accredited mammal collections, but also a teaching collection for the herpetology (frogs, snakes and lizards), fish, and bird teaching collections, and a frozen tissue collection for molecular studies.

Humboldt State University has the largest botany collection greenhouse in the California State University System. Opened in 1982, the greenhouse consists of 11,500 square feet of instructional display space and supporting facilities. The collection contains over 1,000 species of plants in 187 families. The Greenhouse serves as a resource for faculty and students in the Department of Biological Sciences. The facility provides faculty access to live materials essential to the study and teaching of Botany and Biological Sciences.

The Vascular Plant Herbarium consists of nearly 100,000 dried plant specimens, with a strong emphasis in the flora of northwest California and southwest Oregon. Established in 1960, the Herbarium serves as a botanical resource for students and faculty, as well as community members and professional botanists. The Herbarium includes reference specimens and teaching collections for our courses in agrostology, bryology, mycology, phycology, and plant taxonomy.

Our botanical collections offer excellent opportunities to learn more about the rich diversity of our native flora, local unique and rare plant species, and exotic and invasive weeds. The Herbarium also participates in loan and exchange programs with other herbaria throughout the country.

In addition to our emphasis in experiential learning in the terrestrial realm, our marine program is buoyed by the presence of two key facilities – the Research Vessel Coral Sea and the Telonicher Marine Laboratory. The Coral Sea is the only RV dedicated to undergraduate education and classes. Invertebrate Zoology, Mammalogy, Marine Mammal Biology and other classes conduct class-room exercises at sea using this resource. It is the only way that students can get to sea to study the invertebrates, the whales, seals and sea lions. The ocean in these parts is unpredictable and dangerous and only a vessel of this size and magnitude could make such a valuable experience possible for students. The Telonicher Marine Laboratory is also a key component to our Marine program – it serves as a classroom close to the pristine rocky intertidal of Trinidad Bay and as a resource for students to conduct their own research for the completion of their degree.

In addition to our collections and our marine program and facilities, our third area of strength is in cell and molecular biology. This focus is supported by the Biotechnology Laboratory and Core Facility, and the scanning and transmission electron microscopes.

The Biotechnology Laboratory was remodeled with funds from the State and the Howard Hughes Medical Institute in 1998. The laboratory supports instruction in Cell Biology, Genetics Laboratory, Immunology, and Biotechnology. Major equipment and facilities include, ultrafreezers, walk-in cold room, thermal cyclers, microplate reader, laminar flow hoods, inverted microscopes, and computers. Additionally, a newly established Core Molecular Facility houses two real time PCR machines, thermal cyclers, and an automated DNA sequencer. Students are able to produce monoclonal antibodies, construct cDNA libraries, clone genes, sequence DNA, perform quantitative PCR and produce proteins using the baculovirus expression system

The SEM (Scanning Electron Microscope) makes high magnification images with a scanning electron beam and is used by faculty and advanced students in the Biological Sciences, Geology, and Natural Resources to examine the surface structure of organisms and other natural objects. The TEM (Transmission Electron Microscope) is an instrument that generates

extremely highly magnified images of small objects (such as bacteria or viruses) or of ultra-thin sections of larger material through the use of a concentrated electron beam. The conventional light microscope allows magnifications of up to about 1000x.The TEM is capable of producing magnifications of greater than 100,000x. All of these facilities are critical to the quality of our program and central to the conduction of our classes and enable us to offer hands-on opportunities for our students.

3. Unique local and regional environment

In the Department of Biological Sciences we take full advantage of the rich regional environment to strengthen our program and enhance the educational experience for our students (and ourselves). We use these 'living classrooms' frequently in our classrooms and find that it is one of the most exciting parts of our classes and one of the biggest draws for students to Humboldt State. Students in our Mycology class can be found collecting fungi from the King's range to the Trinity Alps while the Invertebrate Zoology and Intertidal Ecology classes are studying anemones in the extensive rocky intertidal zone. Students have studied lichens high in the redwood canopy and pitcher plants along the serpentine rocks in southern Oregon. The Arcata Marsh serves as a living laboratory for our Introductory Biology Students, our advanced Comparative Animal Behavior students as well as students studying the pollutant-degrading microorganisms in Humboldt Bay – each class experiencing the biology of one place from very different perspectives. Plant Ecology students can be found studying in the Arcata Community Forest or the Lanphere Dunes. The local rivers are exciting destinations for laboratory classes where students can study the interactions of seals and salmon or of frogs and salamanders. Along the Mattole River, students have camped while on Phycology (study of seaweeds) field trips while others have caught bats in the canopy a few miles to the south. Indeed, there is not a better place to be a biologist – or a biologist in training. We take every opportunity to learn with the students in the amazing local and regional environment.

IV. Investments, Revenues, and Efficiencies (Response Limit: 2 pages of narrative, not including tables) [20%]

A. Program Investments

1. Program Investment – Degree Requirements

Enter the total number of required course units (as listed in the catalog) for this academic program, and then the number of required course units for this academic program that are from the primary course code associated with your program. Provide a total for each option if appropriate.

Student Units

Option (Emphasis)	Total required SCUs	Required Program SCUs in the primary Course Code
Cellular/molecular Biology	64	19
Ecology	72	33
Environmental Biology	75	17
General Biology	65	30
Marine Biology	70	25
Microbiology	71	31
Science Education	63	22
Special Major	59	23

Note: GE and other University-wide graduation requirements are not included in these calculations.

Weighted Teaching Units (WTU's)

Total the number of WTUs required to teach 1 section of each of the required courses in the program. If there are lists of restricted electives (e.g., take 1 of the following 3 courses), then choose a representative course from the list. For required S-factor courses, estimate the typical number of WTU's assigned to a faculty member who teaches the course. Again, differentiate by option if appropriate.

Option (Emphasis)	Total required Program WTUs	Required Program WTUs in the primary Course Code
Cellular/molecular Biology	80	26
Ecology	86	24
Environmental Biology	102	21
General Biology	75	21
Marine Biology	89	25
Microbiology	82	29
Science Education	93	28
Special Major	68	30

Assumption used to calculate these numbers: WTU cost is for lecture (NOT including large lecture assigned time or TA coordination assigned time) and teaching one lab section. A number of our courses have large lectures with multiple lab sections, such as Biology 105.

2. Program investment – by Minimum Weighted Teaching Units required to offer coursework so students can make reasonable progress toward their degree.

Complete the table below using the definitions that follow. Include additional columns as needed for additional options.

Total WTU in Course Code	WTU for GE and service to other academic Programs	WTU for Major	WTU for Major Option 2	WTU for Major Option 3
399	202	197	Biology courses are interwoven across all options	I.e., the courses we offered over the past two years are needed for progress toward degree in all Biology options, Botany, and Zoology.

Assumptions used while calculating these numbers: WTU cost is for lecture (NOT including large lecture assigned time or TA coordination assigned time) and teaching one lab section. Our normal frequency of offering is maintained. For example, we regularly offer a number of Biology courses every semester, but it is possible that our Biology majors would only need certain courses to be offered once per year. Counting the WTU cost each semester does make the program more expensive, but this allows students more reasonable opportunities for making progress toward their degrees.

3. Program Investments – by staff allocations.

Estimate the percent of departmental expenditures for staff positions that can be attributed to this academic program. Provide an explanation, as appropriate.

	Major Program
Percents of Staff FTEF	45%

Staff FTE

		1/31/2004		1/31/2005		1/31/2006		1/31/2007		1/31/2008	
Description	CBID	Count	Sum	Count	Sum	Count	Sum	Count	Sum	Count	Sum
BIOLOGICAL SCIENCES	R07	1	1.00	1	1.00			1	1.00	1	1.00
BIOLOGICAL SCIENCES	R09	10	7.00	11	7.40	10	7.18	11	7.50	13	8.47
Total		11	8.00	12	8.40	10	7.18	12	8.50	14	9.47

Biology is the largest major on campus (F'08 census, headcount data: 569), is internally diverse (8 emphases), and serves a large number of other programs (see above). Staff positions associated with the Biology program include office support, stockroom support, laboratory preparators, a half-time equipment technician, and support for specialized facilities such as the Vertebrate Museum, the Animal Rooms, and the Herbarium. The cost of providing a lab and field-based curriculum for this number of students both requires and justifies the staff costs shown in the tables above.

4. Program Investments – Other annual costs.

Provide dollar estimates for other program costs by the following categories. Annualize periodic costs (equipment purchases or facilities upgrades) as necessary. Include an explanation, if appropriate. Do not include costs for commonly used items (smart classrooms, faculty workstations, etc.).

Category	**Estimated Cost**
Equipment (including maintenance)	$19,186
Instructional Supplies	$8,462
Temporary Help (graders, lab assistants, GA's, etc.)	$44,678

Note: figures are averages based on past three years.

Equipment costs vary widely from year to year and include expensive items such as classroom sets of microscopes, autoclaves, centrifuges, incubators and other large equipment that needs to be serviced. The temporary help item represents mostly the cost of Teaching Associates, graduate students who teach many of our lower division laboratory sections.

While there is significant equipment funding provided by the campus (for example, items such as growth chambers; laboratory space; gas, air, vacuum lines; etc.), a tremendous amount of expensive, specialized equipment is provided by faculty grants (see next table and section on Revenues). Our students benefit greatly from the past and current external grant-writing successes of our faculty. As described under facilities, such high-tech equipment is central to our programs, in which students are given hands-on experience with this equipment. The result is a highly trained graduate who is ready to compete for top jobs in biology, attend graduate school, or enter professional schools (medicine, veterinary, etc.).

5. Program Investments – accreditation [notapplicable]

B. Gross Revenues

Revenue DEPARTMENTS COMPLETE THIS SECTION	05/06	06/07	07/08
Fundraising/donations	$4,405	$4,186	$5,102
Extended Education	$1,772	$1,329	$1,071
Student fees	$28,613	$30,623	$28,849
Instructionally Related Activities (IRA)	$563	$2,663	$59
Instructionally-related grants	0	0	0
Grants and contracts to P.I.s	~1.8 M	~1.6 M	~2.1 M
Other revenues	$80	0	$756

Provide an explanation for how these revenues support the academic program.

The biology program generates significant additional resources through external and internal grants. Faculty in Biology are very active and successful in obtaining grants bringing in nearly $2 million in awards for each of the past three years. The benefits of these funds are seen in many aspects of undergraduate life in the department. Grants enable the faculty to stay current in their disciplines and active in their research. This is related to

students in the classroom and through increased opportunities for experiential learning in the field and laboratory. These funds also support major equipment purchases and supplies which have a direct affect on the quality of the program we can offer undergraduate students. Finally, portions of these grants go directly to students in the form of stipends and travel to scientific meetings. They represent a key element contributing to the success of our program. The total budget provided by the state/CSU/CNRS for Biological Sciences is approximately $3 million, grantsmanship in the department is equal to approximately 2/3 of this amount.

Modest additional revenue is generated from fund raising and Extended Education. Fund raising has recently (past year and coming year) increased thanks to large donations from two individuals/families. These funds (donations and Extended Education) are used toward general program costs, student employment (well-paid student assistant positions), and scholarships.

Student lab fees make up the largest portion of non-grant departmental revenue. These lab fees are used for expendable instructional materials and their use is tightly regulated by a student lab fee committee. It would impossible to operate our program without the student lab fees.

C. Efficiency

1. Efficiency – By SFR for course code

Academic Year Averages	Subject	02/03	03/04	04/05	05/06	06/07	07/08
SFR	BIOL	13.62	15.78	15.94	14.86	13.88	16.33
FTEF	BIOL	14.10	12.28	12.66	13.89	14.33	12.76

SFR SUMMARY	02/03	03/04	04/05	05/06	06/07	07/08
AHSS	20.36	22.05	21.94	20.61	21.19	22.91
CNRS	15.66	16.90	17.17	16.04	16.82	18.28
CPS	15.12	16.29	15.68	15.22	20.80	25.33
UNIVERSITY TOTALS	17.28	18.65	18.57	17.52	19.32	21.43

Explain any substantial changes in SFR. Also explain why this SFR differs from the college and/or university SFR. What efforts have been made over the past few years by the program to improve this measure of efficiency? Use the data under part IV.E. as appropriate.

The Student Faculty Ratio in Biology has increased from 13.6 to 16.3 over the past 5 years. Yearly fluctuations are largely due to changes in FTEF due to sabbatical leaves. In response to budget constrictions and pressure from the College of Natural Resources and Sciences, the Biology Program has taken a number of extreme measures to increase our efficiency / SFR. These sacrifices included purging classes from the catalogue, reducing the number of emphases in the major, reducing laboratory time for our lower division Botany and Zoology classes, and increasing class size. Some of these changes (e.g., the reduction in labs in Botany and Zoology) took effect only in Fall '08, and so their effect is not yet apparent in the data above. Other proposed changes are still undergoing review; for example, we have not yet been approved to increase the amount of lecture time in Introductory Biology (BIOL 104), which will help increase SFR. Finally, we have increased our flexibility by hiring part-time and full-time lecturers to teach some of our service and lower-division major classes and we have reduced many class offerings. These cuts were not easily made and the effect on curricular quality is yet to be determined, but the sacrifice was necessary in these economic times. We believe that the SFR target of 18 for Biology set by the Provost and Dean of CNRS would already have been achieved if all of our curricular proposals had been accepted by the University Curriculum Committee, and we are confident that we can yet meet this goal. The unfortunate loss of three tenure-track faculty during the past academic year – reducing our course offerings even further – will certainly aid in improving SFR. However, while the increasing number of majors this year is a positive sign, without further hires to replace some of our lost teaching power (see Section V); we will be unable to offer sufficient educational opportunities for these students.

2. Efficiency – Other views.

   The Prioritization Task Force will examine the data given under section IV.A and B in terms of the overall production (e.g. number of majors, number of graduates) in the program. Please comment if appropriate.

Overall production of graduates in Biology is just under 20% of majors. This figure is slightly lower that one would expect if students completed their degrees in four years and about

what is predicted for completing the degree in five years. This can be explained by students simply choosing to stay longer to gain additional hands-on experience in the field. It is also likely that declining budgets and subsequent curricular sacrifices may be taking a toll on our students by making it more difficult for them to get the classes they need in the standard four year time frame. Finally, it is important to note that in Biology, the goal of improving SFR has conflicted with improvements in terms of other possible measures of efficiency, such as cost/FTES. The push to reduce the number of lecturers has led to many senior faculty being assigned to laboratory sections in introductory courses, for example in non-majors Introductory Biology (BIOL 104), which is certainly not efficient by this alternative measure of efficiency, nor in terms of taking best advantage of the expertise of our faculty to offer a rich and rewarding curriculum for our students. Our graduate TAs also gain valuable experience in teaching these laboratories, and do so at a pittance. By reducing the number of laboratories in lower level courses in the department we are reducing our capacity to train graduate students. While we are cognizant of the difficulties of the current economic situation, a focus on efficiency rather than education is demoralizing both for faculty and students.

D. Budget cut impacts

Indicate how your program has been affected by recent (since 2002-2003) budget cuts that have directly affected resources for your program (faculty, staff, operating expense) and course offerings (class size, reduced course offerings or options for the major.) Refer to the data included under section IV. E. or in the departmental report as appropriate.

The impacts of the continued budget cuts have been profound on every level, and it is surprising to us that they are not more apparent in the tables below. Some of this may be due to the fact that some changes have occurred very recently. In the past year we have lost three faculty members, due, in part, to budget cuts. We have not yet been approved to replace any of these positions. We have had to reduce our offerings by offering NO elective classes in the major, limiting the offerings of others and increasing class sizes by combining sections (e.g., of Genetics, BIOL 340). Our upper division GE offerings have been reduced to one large lecture class per semester, increasing overall UD GE FTES, but reducing diversity of course offerings: courses such as History of Biology (BIOL 301), and Environment & Culture: How People Transformed a Continent (BIOL 308), which routinely had enrollments

of 30-40 students, have not been offered for a several years. Students are being forced to alter degree contracts in order to graduate in a timely fashion as we cannot afford to offer classes as frequently as they need. Our operating expenses have remained flat or decreased, which has significantly altered the way that we offer our classes (labs in particular). If not for the student lab fees, we would have trouble buying basic course supplies. We have had to make difficult financial decisions that are counter to our curricular vision and to our agreement with the students. Some of these changes were positive and led to a more efficient department, but the cuts have gone past that now. These cuts have begun to contribute to the degradation of our programs and our students' experience at HSU.

E. Additional Data

Course Offerings Profile in Biology (AY 00/01 - AY 07/08)
class_offerings_BIOL report generated: 27-JUN-08

	AY 00/01	AY 01/02	AY 02/03	AY 03/04	AY 04/05	AY 05/06	AY 06/07	AY 07/08
Distinct Courses Enrolled	25	24	25	20	21	20	23	23
Sections Enrolled	96	87	93	86	90	90	94	91
Average Section Enrollment	16	17	17	19	18	19	17	19

Distinct Courses Enrolled in Biology by Level (AY 00/01 - AY 07/08)
class_offerings_BIOL report generated: 27-JUN-08

Course Level	AY 00/01	AY 01/02	AY 02/03	AY 03/04	AY 04/05	AY 05/06	AY 06/07	AY 07/08
Lower-div	5	5	5	4	4	4	4	4
Upper-div	14	14	13	11	12	11	13	12
Graduate	7	6	7	6	5	6	7	8
Total	**25**	**24**	**25**	**20**	**21**	**20**	**23**	**23**

Sections Enrolled in Biology by Level (AY 00/01 - AY 07/08)
class_offerings_BIOL report generated: 27-JUN-08

Course Level	AY 00/01	AY 01/02	AY 02/03	AY 03/04	AY 04/05	AY 05/06	AY 06/07	AY 07/08
Lower-div	31	30	30	28	29	31	30	31
Upper-div	43	40	40	36	43	38	42	37
Graduate	22	17	24	22	19	22	22	24
Total	**96**	**87**	**93**	**86**	**90**	**90**	**94**	**91**

Avg Section Enrollment in Biology by Level (AY 00/01 - AY 07/08)
class_offerings_BIOL report generated: 27-JUN-08

	AY	AY	AY	AY	AY	AY	AY	AY

Course Level	00/01	01/02	02/03	03/04	04/05	05/06	06/07	07/08
Lower-div	24	25	28	30	29	30	28	29
Upper-div	15	15	17	17	16	17	16	19
Graduate	5	4	5	6	5	6	5	5
Total	**44**	**45**	**50**	**53**	**51**	**53**	**50**	**53**

FTES in Biology by Course Level (AY 00/01 - AY 07/08)
class_offerings_BIOL report generated: 27-JUN-08

Course Level	AY 00/01	AY 01/02	AY 02/03	AY 03/04	AY 04/05	AY 05/06	AY 06/07	AY 07/08
Lower-div	84.0	86.1	95.5	95.0	97.6	104.9	95.4	101.6
Upper-div	79.4	74.3	77.8	78.0	88.6	79.7	85.2	86.6
Graduate	16.2	12.3	18.8	20.6	15.5	21.8	18.3	20.3
Total	**179.7**	**172.7**	**192.1**	**193.7**	**201.7**	**206.4**	**198.8**	**208.5**

NOTE: In the above tables all class sections have 2 or more students enrolled. This is done to minimize the influence of independent student sections.
Distinct Courses count each distinct SUBJ/Course-number combination enrolled.
All figures are Fall/Spring term averages. Due to the rounding of average Academic Year counts, the various breakouts may not add to the exact same amounts.

Other Class Offering Breakouts

These examine independent study sections, and sections by different modes of instruction. The Lecture-only sections have only a C1 through C6 mode. The Lab/Activity-only sections have only a C7 through C-16 mode. Other modes and combinations contain the remaining modes or combinations of lecture and lab/activity modes.

Other Special breakouts in Biology (AY 00/01 - AY 07/08)
class_offerings_BIOL report generated: 27-JUN-08

	AY 00/01	AY 01/02	AY 02/03	AY 03/04	AY 04/05	AY 05/06	AY 06/07	AY 07/08
Sections with 1 student enrolled	27	21	22	22	27	20	29	22
Lecture only sections	23	20	20	17	19	19	21	19
Lab/Activity only sections	45	41	41	37	38	40	39	39
Other modes and combinations	28	27	33	32	34	32	34	33

Service Courses

The following shows sections that are considered service for either General Education, CWT (Communication and Ways of Thinking), DCG (Diversity and Common Ground), or Institutions Requirements.

Service Course Sections Enrolled in Biology (AY 00/01 - AY 07/08) class_offerings_BIOL report generated: 27-JUN-08								
Course Level	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Lower-div	23	22	22	20	20	22	21	21
Upper-div	3	3	2	1	2	2	2	1

Service Course FTES in Biology (AY 00/01 - AY 07/08) class_offerings_BIOL report generated: 27-JUN-08								
Course Level	**AY 00/01**	**AY 01/02**	**AY 02/03**	**AY 03/04**	**AY 04/05**	**AY 05/06**	**AY 06/07**	**AY 07/08**
Lower-div	78.0	79.6	87.2	83.6	86.0	92.7	84.5	87.5
Upper-div	10.0	10.1	8.0	7.6	10.3	7.1	10.6	18.8

V. Potential (Limit: 2 pages per option) [15%]

A. Program capacity with existing resources.

1. What is your program's maximum capacity with current resources?

(Completed by the department)	Seats	FTES in the major option per year
Existing (seats filled at census)	3132	808.4
Maximum capacity with existing resources	3376	863.8

Note: Per our conversation with Dr. Oliver, we calculated 07/08 values of seat capacity (total sections, seats / section) for each course required for the major (BIO General option + other CNRS courses) versus actual census enrollment.

Using the General Biology option as an example, the table values indicate some potential for increasing capacity, but finer scale examination of each 07/08 course shows that many upper division BIO courses were at or close to capacity. We can't definitively say which of the courses required for our major are truly impacted even when they are at capacity, because we know that some courses have historically been able to add more sections. Courses significantly below capacity included BIOL 105, PHYX 118, ZOOL 110/210, whereas several other lower division courses like BOT 105 were moderately below capacity. Instructors for most lower division classes over-enroll each section, but students still drop the course too near the census date for new students to be added. This reality still applies even though the new F08 curricular structure of ZOOL 110 and BOT 105 theoretically raises capacity. More teaching power and sections of upper division BIO courses (and others like CHEM 109 and BIOM 109) would have to be added in order for the Biology major to grow significantly.

2. If you have capacity to grow with existing resources, what steps have been taken to increase enrollment? What have been the effects of these steps, and what results are still anticipated?

In general, our program is at maximum capacity. There are flexible components in some emphases that would allow for expansion if other roadblocks, primarily a lack of faculty, were removed. For an example, we look at the Marine Biology emphasis:

Biology (Marine Biology). There is capacity for our emphasis to expand physically with existing resources. The Telonicher Marine lab is underutilized and the Research Vessel Coral Sea is underutilized as a teaching platform. Enrollment has increased dramatically over the past few years to a high of 153 – the largest group of students in our department (188 students in F'08). This increased enrollment may be due to increased recruitment efforts (i.e., informative recruiting pamphlets, enhanced internet presence, recruiting outreach) and Administrative support of infrastructure (R/V Coral Sea, Telonicher Marine Lab), as well as the national and state-wide focus on marine-related issues. With the spread of marine conservation issues to northern California and the CSU-wide COAST program, there has obviously been increased interest in our Marine Biology program. While we have the ability to increase enrollment physically and curricularly (see below) we cannot move forward very far without support for new tenure-track or full-time temporary lines.

B. Opportunities for future growth or substantial curricular changes

1. What opportunity does the program have for future expansion? Provide evidence for your response.

Biology - Overall

Clearly, investment in the Biology program will improve the University's ability to be the premier center for the interdisciplinary study of the environment and its natural resources. An understanding of the natural world is a prerequisite for informed, environmentally responsible action. Investment in Biology will enable HSU to find new ways to support its vision. Because we serve such a broad spectrum of departments, and we play such an important role in attracting students to the University, investment in our program will subsequently strengthen a variety of other academic programs.

The Biology program has significant opportunity for expansion. HSU recently commissioned a study for strategic marketing by the Noel-Levitz consulting firm. The actions that they recommended (2005) included the following: " Four programs to promote because they enjoy both high demand and high market share are zoology, biodiversity, biology (general), and cellular-molecular biology." It is noteworthy that the only four programs they recommended for

promotion *are all within the Department of Biological Sciences.* While we realize that it is beyond the University's means to expand all of our emphases, we elaborate below on opportunities for expansion within several individual emphasis, and how these expansions support the University's mission.

Biology (Cellular/Molecular Biology)

Because of the exceptional demand for graduates in the Biotechnology industry, and the current high-profile discoveries within the field, the Cellular/Molecular Biology program has significant opportunity for expansion. The need and opportunity for expansion in this area is indicated by the success the Department has had in attracting external funding for expansion. This external funding includes startup monies and four years of salary for a recent bioinformatics faculty position hire (Howard Hughes Medical Institute), funding for expansion of the curriculum to offer Stem Cell Technology courses (California State University Program for Research and Education in Biotechnology, and pending from California Institute for Regenerative Medicine), as well as funds for support of laboratory curriculum enhancements in our Cell Biology course (Howard Hughes Medical Institute).

Biology (Ecology and Environmental Biology)

Because of the growing demand for environmental scientists, and the expected increased investment in green technologies, as well as the high level of personal commitment to environmental stewardship, the prospects for expansion of these options is excellent. This is shown by the growth in enrollment in our Ecology emphasis since its inception in 2003.

Biology (Marine Biology)

We believe there is great opportunity for expansion of the Marine Biology emphasis. Evidence to support the potential for enrollment growth includes the following: 1) Current high and increasing enrollment. With current HSU recruiting policies and the increasing visibility of marine biology on the national and state scale, our enrollment has increased in the past years to the highest in the Department- 188 students in Fall '08. 2) Program Uniqueness. HSU is one of only two campuses in the CSU system to offer a Marine Biology option. It is the only marine biology program in the county to offer undergraduates access to an ocean-going research vessel

designated for undergraduate education as well as a marine laboratory. 3) Increasing external demand for trained marine scientists. With increased national and statewide support for marine science as it relates to global warming, invasive species, declining marine populations, etc… there is a growing demand for trained marine scientists. As state-wide initiatives spread to northern California, HSU has increased visibility and opportunities to attract students. As funding is secured by the faculty within marine biology, the opportunities for experiential learning increases for undergraduate students. 4) Physical opportunity to expand. Our teaching facilities (Telonicher Marine Laboratory and the R/V Coral Sea) have the physical capacity to accommodate additional laboratory sections and field experiences, up to perhaps 25% over current enrollment in the program. 5) Proximity to remarkable marine resources – We are positioned along 300 miles of relatively unexplored coastline with habitats ranging from rocky intertidal to river mouths, to bays to continental shelf and deep ocean habitat. It is this physical location that is the outstanding resource that can drive enrollment increases. 6) Ability to increase retention rates. Although enrollment in the major has remained high, the percent graduating each year is relatively low. Increasing faculty advising power could improve retention rates in the emphasis (there are currently only 3 marine oriented faculty for advising 188 students).

Biology (Microbiology)

The Microbiology emphasis has potential to expand both because of strong external demand and current faculty expertise. Many microbiologists contribute significantly to the recent most important scientific discoveries. It has been estimated that one-third of the Nobel Prizes in medicine and physiology have been awarded to microbiologists since 1910. Clinical microbiology, medical microbiology and epidemiology are growing in importance in the twenty-first century. Microbiology is central to numerous green technologies such as the development of biofuels, and is important in global ecosystem processes including global warming. Because we currently have several faculty members with diverse backgrounds and research programs in Microbiology (Drs. Siering, Wilson, and Zhong), there is the potential to mentor students in a variety of research projects and to expand the curriculum somewhat. However, all of these faculty members teach (mostly lower division) service and core courses as a significant portion of their load, which means that they are not currently able to teach courses for majors.

Biology (Science Education)

The Redwood Science Project and affiliated programs with the Humboldt Science and Mathematics Center have external funding to provide additional support for undergraduates who are pursing science education careers. These resources are mainly supplementary services and opportunities. They are not available for regular course offerings.

2. Describe curricular changes / staffing increases required to accomplish an expansion?

We are unclear on what the baseline should be for describing curricular and staffing changes needed to expand our programs given that within the past year, the Biology Department lost three faculty (a Full, an Associate, and an Assistant Professor). The Department metrics detailed above (FTES, grants obtained, # students mentored, University Committee participation, etc) were accomplished with the full time input from these faculty members. Therefore, with '08/'09 funding levels, we can't maintain current levels of achievements. For the discussion below, we are using a baseline for expansion that assumes two of the three faculty positions we lost have been regained. The Department believes the two positions described below are critical across our emphases and are our first priority. While we realize that the University is not in a position to make numerous new hires, re-establishing our baseline faculty allows us to explore how individual emphases might be targeted for expansion with augmented funding.

- **Terrestrial Mammalogist / Systematist and Curator of the Vertebrate Museum** - This position is needed to integrate modern molecular approaches to evolution, biogeography, conservation and systematics, particularly with regard to mammals. Additionally, this position will provide curatorial experience and skills with teaching and research collections. This hire is critical to the Ecology and Marine Biology emphases, and greatly impacts the Zoology program as well.
- **Marine Systems Biologist** - This position is needed to integrate quantitative population and community level into our program, to strengthen the Marine Biology program, to strengthen Departmental capabilities in statistical analyses and experimental design, and to integrate scientific diving into the curriculum. This hire is critical to the Ecology and Marine Biology emphases, and greatly impacts the Zoology program as well. This hire is particular critical to our graduate program.

Biology (Cellular/Molecular Biology)

To expand the Cellular/Molecular Biology Program will require additional faculty positions. All of the faculty associated with this program have full teaching loads that include teaching core curriculum courses, which doesn't allow the Department to offer upper division courses targeted at majors. To some extent, even maintaining the Cellular / Molecular program may require additional resources, as an external grant has been paying the salary of Dr. W. Bryan Jennings, but that external grant is due to expire at the end of 2010.

From a curricular perspective, there are several needs. There is a need for courses in Developmental Biology (which would also serve the Zoology program, as well as other emphases in Biology), Immunology, and Virology (which would also serve the Microbiology emphasis). We have not offered our Biotechnology course for years, or an Advanced Genetics course, because of lack of faculty. Only very rarely have we been able to offer a course that would be appropriate for graduate students in this field, and as a result, we have very few graduate students (and very few qualified TAs). Additionally, our BIO340 Genetics course, which is primarily taken by Biology majors, has been combined with our BIO345 Genetics with Population Emphasis course because of budget cuts. BIO345 was primarily taught as a service course (for Wildlife and Fisheries) and the combined course is problematic because a) the material is difficult for students and not amenable to large lecture courses, and b) the different groups of students have different needs and levels of interest. It would be to the students benefit to separate these courses and offer both BIO340 and BIO345.

Positions:

1. Evolutionary Developmental Biologist - that could integrate modern evolutionary development at a cellular and molecular level into our curriculum. This would strengthen the Cellular/Molecular aspects of our program, enhance Marine Biology emphasis, and depending on the hire, strengthen the Zoology or Botany programs.

2. Immunologist/Virologist This hire would integrate immunology and virology into the curriculum, and provide training opportunities for students interested in biomedical careers. This hire would greatly impact the Cellular/Molecular and Microbiology emphases within the Biology major.

Biology (Ecology, Environmental)

One of the three tenure track faculty members that left the Biological Sciences Department last year was Dr. Megan Donahue. Dr. Donahue taught BIO330 (Principles of Ecology), which is taken by *all* of the Biology emphases except Cellular/Molecular Biology. She also taught BIOL432 (Community Ecology), a required course for all Ecology Emphasis students. Her loss necessitated canceling upper division courses to cover BIO330 and combining two required upper-division courses temporarily (BIOL431 Population Ecology and BIOL432). She also was a central resource for the Department on quantitative and statistical methods and analyses, which are central to most of the research in the Department. There is consensus in the Department that it is urgent that to have a hire in this area. The major curricular change needed in the Ecology emphasis is simply to be able to offer the courses required by our majors that allow them to graduate on time.

Biology (Marine Biology)

To expand the Marine Biology Program, we plan to change the marine biology emphasis into a major. To do this, we critically need to have additional faculty lines. Our rationale :
Marine Biology Major **–** Current curricular changes for the marine biology emphasis are focused on converting the emphasis into a major within the Department. It currently surpasses all of our majors and emphasis in terms of enrollment and that popularity is only expected to increase. By converting to a major, we are working with other departments to have a more inter-disciplinary approach to marine biology – including more mandatory classes outside our Department and offering a more modern biological training to our students. These discussions are ongoing with other departments within the CNRS and as such, the full extent of the effects of the changes to our program is not clearly defined. At the very least, however, this curricular change will require support of Oceanography and Fisheries as they would be a more integral part of our revised Marine Biology Major.

Staffing Increases - We have experienced a significant reduction in faculty in the past 10 years – a reduction from 10 dedicated marine biology faculty to 4. Faculty retirees over the last ten years have not been replaced, and one is currently in the FERP program. Due to the budgetary climate and lack of staff we have had to significantly reduce course offerings, particularly at the

upper division and 500 level, reducing program quality. In addition, we lost one critical- faculty member and one associated faculty member in the 2007/2008 year. The loss of Dr. Megan Donahue – a marine community ecologist who used scuba and advanced analytical techniques in her work - left a large hole in our marine zoology area. The loss of Brian Arbogast – the curator of the vertebrate museum – left the future of the vertebrate museum (and the best marine mammal collection in the CSU) in jeopardy. His expertise in using molecular techniques to address ecological problems is sorely missed by students in the marine biology emphasis.

Marine Vertebrate Systems Biologist – This person would use advanced tracking techniques (satellite telemetry, and ocean sensing equipment) to study the biology of marine vertebrates and to use them as monitors of critical oceanographic characteristics. We envision this hire to work between departments, uniting some common themes in the marine sciences, but supporting the Marine and Zoology programs in the Biology Department.

Biology (Microbiology)

The curriculum needs to be expanded to include courses in Microbial Physiology, Microbial Genetics, Immunology and Virology (many of these courses were taught in the past by now-retired faculty). These courses haven't been taught for several years, and this has caused significant problems for students wishing to pursue advanced training in fields such as medicine and clinical microbiology. This would require a faculty hire, as we do not currently have faculty able to teach Immunology or Virology, and the current microbiology faculty (Zhong, Wilson, Siering) have half of their teaching loads taken up by service courses (BIOL 105, BIOL 210, BIOL 340).

Immunologist/Virologist This hire would integrate immunology and virology into the curriculum, and provide training opportunities for students interested in biomedical careers. This hire could also rotate into some of the service courses mentioned above, allowing present faculty to offer needed additional courses needed for training in microbial biology. This hire would greatly impact the Cellular Molecular and Microbiology emphases within the Biology major.

Biology (Science Education)

Currently, Dr. Jeffrey White is the Director of the Redwood Science Project (RSP) and affiliated programs. These endeavors provide a wealth of opportunities for our regional teachers

and HSU future teachers resulting in enrollment in HSU courses. However, course offerings and program management have stretched the science education group to its capacity. Fortunately, the RSP has resources to partially pay for a new faculty position for the next few years. The recent departure of Dr. Andreana Ososki has exacerbated the challenges. She was initially hired as a post-doctoral fellow with the RSP and as a science education instructor for our programs. She was with the program for three years at 80% time.

C. Impact of augmented resources

Suppose that your program were ranked in a category that recommended augmentation of resources. What would be the impact of augmented resources? (Answer for a 10% augmentation and a 20% augmentation.)

Biology

Augmented Resources

Because the Biology Department lost three full-time tenure track faculty last year we need at least two faculty positions simply in order to maintain levels of current capabilities. The discussion of augmentation below assumes that we have made hires in these two areas.

1) Terrestrial Mammalogist / Systematist and Curator of the Vertebrate Museum - This position is needed to integrate modern molecular approaches to evolution, biogeography, conservation and systematics, particularly with regard to terrestrial mammals. Additionally, this position will provide curatorial experience and skills with teaching and research collections. This hire greatly impacts the Ecology and Marine Biology options, and is critical to the Zoology program as well.

2) Marine Systems Biologist - This position is needed to integrate quantitative population – community level analyses into our program, to strengthen the marine biology program, to strengthen departmental capabilities in statistical analyses and experimental design, and to integrate scientific diving into the curriculum. This hire is critical to the Ecology and Marine Biology options, and greatly impacts the Zoology program as well.

10% augmentation.

With 10% augmentation, there is consensus in the Department that our first priority would be to hire a faculty member with strengths in evolutionary developmental biology.

Evolutionary Developmental Biologist. This would strengthen the Cellular/Molecular aspects of our program, and depending on the hire, could enhance the zoological part of the Marine Biology emphasis of the Biology major, and take advantage of the important resources offered by the Telonicher Marine Lab, or support the Botany program.

Other Areas to Enhance:

1) Improved Laboratory Facilities and Support. Many of our facilities are aging and need updated equipment; increased staff support for labs would also strengthen the curriculum. In particular we would like to improve the Biotechnology Core Facility and maintain strong support for Marine Facilities.

2) Increased Course Offerings. We are currently offering a "bare bones" curriculum, with no electives and almost no 500 level courses to serve advanced undergrads and grad students.

20% augmentation

In addition to the position listed above, there are several faculty hires that we believe would allow us to expand enrollment, enhance the reputation of HSU, attract significant external funding, and improve student learning. These include:

Marine Vertebrate Systems Biologist – This person would use advanced tracking techniques (satellite telemetry, and ocean sensing equipment) to study the biology of marine vertebrates and to use them as monitors of critical oceanographic characteristics. We envision this hire to work between departments, uniting some common themes in the marine sciences, but supporting the Marine and Zoology programs in the Biology Department.

Immunologist/Virologist - This hire would integrate immunology and virology into the curriculum, and provide training opportunities for students interested in biomedical careers. This hire would greatly impact the Cellular Molecular and Microbiology emphases within the Biology major.

D. Impact of reduced resources

Suppose that your program were ranked in a category that recommended reduction of resources. What would be the impact of reduced resources? (Answer for a 10% reduction and a 20% reduction.)

(10%-20%) Reduced Frequency of Course Offerings. This would negatively impact program quality and time to degree, and would also likely reduce overall capacity in the program. Given recent budget cuts, it will be difficult to achieve a 10% reduction with this approach alone.

(10%-20%) Reduced Number of Laboratories. HSU has always prided itself on hands-on instruction, and personal interaction between faculty and students. We are loathe to go further down this road (having already cut the number of labs in our introductory Core Curriculum classes in half).

(10%-20%) Shed More Tenure-Track Faculty, replace with Lecturers and/or Graduate Student TAs. In the extremely short term, this is a cost-saving measure, but would seriously and negatively impact the program through the loss of faculty expertise, undergraduate and graduate advising, research sponsorship, committee contributions, shared governance, ability to obtain grants, etc. However, if resources are further reduced, we are certain to lose more tenure-track/permanent faculty; if not approved to replace them, we would have no choice but to do this.

E. Impact of program elimination

Suppose that your program were recommended to be discontinued. What would be the impact of program elimination? Clearly, the Biology program as a whole could not be discontinued. Not only does it provide essential service courses for other majors, but it is mandated to be offered by the CSU. Thus we address only the impact of elimination of individual emphases.

Biology (Cellular/Molecular Biology)

Very little savings could be achieved by eliminating this emphasis. With the exception of the Cell Biology course (which is offered once per year, and is typically overenrolled past the 36 student capacity), all of the courses in this emphasis are central core courses for all or most of the emphases in Biology. In addition, this emphasis has a high enrollment (98 majors in '07/'08; an average of 23 degrees awarded/yr for last three years) and program elimination would be accompanied by a mass emigration of students (and faculty) associated with this program.

Biology (Ecology, Environmental Science)

These emphases are heavily integrated into the biology program in our Department, with either no (Environmental) or only 1 (Ecology) course that is uniquely required by these emphases. Hence, it seems unlikely that any savings could be afforded the University by program elimination. Of course, there would be significant negative effects.

Biology (Marine Biology)

HSU is an agent of the people of California. The people of California have invested millions of dollars in HSU's Marine Science Programs via the personnel and infrastructure. Failure to use these resources at maximum capacity would be an abdication of this trust. In addition, this emphasis has a high enrollment (153 majors in '07/'08) and program elimination would be accompanied by a mass emigration of students (and faculty) associated with this program. The Marine Biology emphasis is heavily integrated into the biology program in our Department, with only 1 course that is uniquely required by this major (BIOL 430 = Intertidal Ecology).

Biology (Microbiology)

Very little savings could be achieved by eliminating this emphasis. With the exception of the Microbial Ecology course, all of the courses in this emphasis are central core courses for all or most of the emphases in Biology. Microbial Ecology is only taught once every other year.

Biology (Special)

Given that this emphasis provides recruitment advantages, but no unique courses are associated with this emphasis, no positive effects would result from program elimination.

Biology (Science Education)

Given the shortage of science teachers in California's schools, the elimination of this program would be socially irresponsible. In addition, the significant external funding generated to support programs such as the Redwood Science Project (RSP) would no longer come to HSU. This would affect not only the Department, but the many other programs supported by the RSP.

VI. Additional Information (Limit: 1 page)

The significance of science literacy cannot be underestimated in today's world. We serve over 700 students in our Department, in the College of Natural Resources and Sciences and in the University as a whole. The biological perspective is one that is based on critical thinking and an empirical understanding of life's processes. Familiarity with this perspective is fundamental to making informed and responsible decisions in our world.

Supplemental Courses -

For the last twelve years, Humboldt State students enrolled in core classes in the sciences have had opportunities to enroll in Supplemental Instruction that offered small group learning and peer tutoring to reinforce other class activities. The funding for these courses has been borne by grants from the Howard Hughes Medical Institute secured by Dr. Jacob Varkey of the Biology Department. Thousands of students have enrolled in these courses and found them critical to academic success. Supplemental Instruction is widely regarded by faculty throughout the College of Natural Resources and Sciences as improving retention, increasing student success rates, enhancing timely progress towards degrees, and helping recruitment. The Supplemental Courses have become a core part of the academic culture of the College. The list of affected courses is large (Biology 105, Biology 340, Botany 105, Zoology 110/210, Chemistry 109, Chemistry 110, Chemistry 321, Chemistry 322, Math 105, Math 109, Math 110, Math 210, Physics 106, and Physics 107), as is the number of students enrolled (400 students annually, 27 FTES).

Co-Operative Institute for Biodiversity –

Working with members from other departments (e.g., Fisheries Biology, Wildlife), we have begun the process of creating an Institute for Biodiversity, with the goal of strengthening existing collections-based biodiversity research on campus. Planning is in its earliest stages, but we hope to form an administrative structure that will support the biodiversity activities across our diverse departments, and build on our existing strengths to create an academic focus that can aid recruitment, as well as serving as a resource for the local community. This effort directly supports HSUs vision of being a premier center for the interdisciplinary study of the environment and its natural resources.