

UNIVERSITY OF HAWAI'I
CODE REQUEST FORM FOR ACADEMIC PROGRAM CODES

REQUESTOR CONTACT INFORMATION	
Date: August 2, 2012	Effective term of request (Semester-Year): Fall 2012
Name: Stuart Lau	Title: University Registrar
Campus: Manoa	Office/Department: Office of the Registrar
Phone: 956-5322	Email: stuartl@hawaii.edu

1. PROGRAM CODE, MAJOR CODE, CONCENTRATION CODE		Banner forms: SMAPRLE, SOACURR, STVMAJR	
Institution: UH Manoa (MAN) <input checked="" type="checkbox"/>	College: 50	Department: MB (Marine Biology)	
<input checked="" type="checkbox"/> New program code <input type="checkbox"/> Change/replace existing program code:			
Level: <input type="checkbox"/> Undergraduate <input checked="" type="checkbox"/> Graduate <input type="checkbox"/> First-Professional <input type="checkbox"/> Post-Baccalaureate <input type="checkbox"/> Other:			
Degree: Doctor of Philosophy (PhD)		Certificate:	
If requesting an existing Major code and/or Concentration code in Banner:			
Existing Major: MB	Marine Biology	Existing Concentration:	
<small>Code</small>	<small>Description</small>	<small>Code</small>	<small>Description</small>
If requesting a new <input type="checkbox"/> Major code or <input type="checkbox"/> Concentration code that does not exist in Banner:			
New Code [4 char/space limit]:		Description [30 char/space limit]:	
If a similar major/concentration code exists in Banner, please list the code:			
Is this major/concentration code being used the same way at other UH campuses?			
Is 50% or greater of the classes in this program offered at a location other than the Home Campus? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <small>(Please consult your Financial Aid Officer on Program Participation Agreement impact)</small>			
Is this program/major/certificate financial aid eligible? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <small>(Financial Aid Officer consultation required for all new program codes)</small>			
Should this program be available for applicants to select as their planned course of study on the online application? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <small>(If yes, students may select the code as their <u>only</u> program of study.)</small>			

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Replacing or eliminating an existing program code:

If replacing an existing program code, are current students "grandfathered" under the old code? Yes No

Should the old program code be available for use in Banner? Yes No

Will the old program code be available for:	Banner Module	Yes	No	Ending Term (Semester-Year)
	Online Application	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Recruitment	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Admissions	<input type="checkbox"/>	<input type="checkbox"/>	_____
	General Student	<input type="checkbox"/>	<input type="checkbox"/>	_____
	Academic History	<input type="checkbox"/>	<input type="checkbox"/>	_____

2. CERTIFICATES ONLY:

Does this certificate qualify as a Gainful Employment Program (Title IV-eligible certificate program)? Yes No
(Please consult your Financial Aid Officer or see: <http://www.ifap.ed.gov/GainfulEmploymentInfo/index.html>)

For new certificates approved by the Chancellor, the related BOR authorized academic program is:

3. NEW CAMPUS, COLLEGE, DIVISION, OR DEPARTMENT CODE

Banner forms: STVCAMP, STVCOLL, STVDIVS, STVDEPT

Campus code [3 char]:	Campus description [30 char/space limit]:
College code [2 char]:	College description [30 char/space limit]:
Division code [4 char/space limit]:	Division description [30 char/space limit]:
Department code [4 char/space limit]:	Department description [30 char/space limit]:

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4. NEW COURSE SUBJECT CODE (Subject Alpha)		Banner form: STVSUBJ
College:	Department:	
Subject code [4 char/space limit]:	Subject description [30 char/space limit]:	

5. NEW MINOR (Minor codes are listed on the Major code table)		Banner form: STVMAJR
Minor Code [4 char/space limit]:	Minor Description [30 char/space limit]:	

Please briefly describe your request and explain why you are requesting the code(s):

SUPPORTING DOCUMENTATION

Please see the **Code Request Guide** for the required supporting documents to be submitted. Documents submitted with this form:

- Board of Regents meeting minutes and supporting documents provided to the BOR
- Memo from UH President
- Memo from Chancellor / *OVCAA*
- Curriculum (required for requests for new programs/majors/minors/certificates)
- Gainful Employment Program notification to the US Department of Education
- Other: _____

UNIVERSITY OF HAWAI'I
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CAMPUS VERIFICATION

Requestor Signature JDR Date 8/2/12

Registrar (If different from Requestor)

Print name _____ Signature _____ Date _____
Email/memo in lieu of Registrar's signature may be attached

Financial Aid Officer (Financial Aid Officer consultation required for all new program codes)

 JODIE KUBSI *[Signature]* 8/3/12
Print name _____ Signature _____ Date _____
Email/memo in lieu of Financial Aid Officer's signature may be attached

For Community Colleges, verification of consultation with OVPCC Academic Affairs:

Print name _____ Signature _____ Date _____
Email/memo in lieu of signature may be attached

Send completed form and supporting documentation to:

Institutional Research and Analysis Office (IRAO)
1633 Bachman Place Email: iro-mail@lists.hawaii.edu
Sinclair Annex 2, Room 4 Fax: 808-956-9870
Honolulu, HI 96822 Phone: 808-956-7532

After **all** required forms and supporting documents have been submitted, please allow at least two weeks for processing by IRAO and Banner Central.

FOR INTERNAL USE ONLY	Date form/docs received:
Program code [12]:	Program Description [30]:
CIP code [6]:	CIP description [30]:

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Level: <input type="checkbox"/> Undergraduate <input checked="" type="checkbox"/> Graduate <input type="checkbox"/> First-Professional <input type="checkbox"/> Post-Baccalaureate <input type="checkbox"/> Other:	
Degree: Master of Science (MS)	Certificate:
If requesting an existing Major code and/or Concentration code in Banner:	
Existing Major: MB <small style="margin-left: 100px;">Code</small>	Marine Biology <small style="margin-left: 100px;">Description</small>
Existing Concentration: <small style="margin-left: 100px;">Code</small> <small style="margin-left: 100px;">Description</small>	
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Requestor Signature _____ <i>JTR</i>	Date <u>8/2/12</u>	
Registrar (If different from Requestor) _____		
Print name	Signature	Date
Email/memo in lieu of Registrar's signature may be attached		
Financial Aid Officer (Financial Aid Officer consultation required for all new program codes)		
<u>JODIE KUBA</u>	<i>Jodie Kuba</i>	<u>8/3/12</u>
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Division code [4 char/space limit]:	Division description [30 char/space limit]:
Department code [4 char/space limit]: MB	Department description [30 char/space limit]: Marine Biology

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UNIVERSITY
of HAWAII
MĀNOA

July 23, 2012

MEMORANDUM

TO: Alan Yang
Associate Vice Chancellor
for Students and Enrollment Management,
and Director of Admissions

FROM: Reed Dasenbrock 
Vice Chancellor
for Academic Affairs

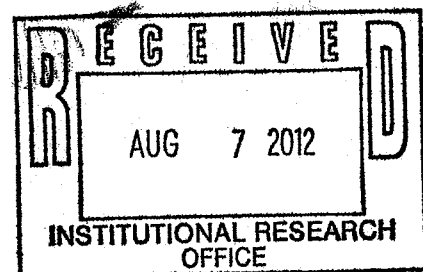
SUBJECT: Establishment of the Master of Science and Doctor of Philosophy Degrees
in Marine Biology, College of Natural Sciences and School of Ocean and
Earth Science and Technology

This is to inform your office that the Board of Regents has approved the establishment of the Master of Science and Doctor of Philosophy Degrees in Marine Biology. The effective term is Fall 2012. The new degree programs are to be placed in a new unit called "Marine Biology". The appropriate pages from the Board minutes are attached for your information.

If you have any questions concerning this new provisional degree programs, please contact my office at ext. 68447. Thank you.

Attachment

c: Dean Ditto
Dean Taylor
✓ Registrar Lau
FAO Director Kuba
Catalog Coordinator Nakashima



University of Hawai'i at Mānoa

Approval of Revisions and Updates Including Additional Donor Recognition Naming Opportunities for University of Hawai'i Cancer Center Building

University of Hawai'i Cancer Center Director, Dr. Michele Carbone, said that an amendment to a request that was approved by the Regents a year ago would adjust some of the amounts and eliminate some of the naming opportunities that were previously approved.

Regent Gee said that it is a great idea to provide funding through naming opportunities, but asked how the amounts of the naming opportunities were determined. UHF President Vuchinich said that the UHF did a peer comparison to ensure that the amounts were equitable to National Cancer Institute comparatives. Regent Gee said that he hopes that there would be opportunities for donors to give smaller amounts (i.e. bricks or plaques). Dr. Carbone thanked Regent Gee for the suggestion, and said that he has discussed with UHF President Vuchinich this possibility and would like to pursue it.

Regent Hirota moved and Regent Gee seconded the motion, and UH Mānoa's request for Revisions and Updates Including Additional Donor Recognition Naming Opportunities for University of Hawai'i Cancer Center Building was unanimously approved.

Approval of the Establishment of a Provisional Marine Biology Ph.D. and Master of Science Jointly Administered by the College of Natural Sciences and School of Ocean and Earth Science and Technology

UH Mānoa Vice Chancellor for Academic Affairs, Reed Dasenbrock, said that people study Marine Biology at the graduate level, but it is a specialization within four graduate degrees. UH Mānoa is one of the top four best places to study Marine Biology in the U.S.

Regent Dahilig moved and Regent Hirota seconded the motion.

Regent Dahilig asked if academic advising would be assigned to the College of Natural Sciences or the School of Ocean and Earth Science and Technology (SOEST). Vice Chancellor Dasenbrock said that doctoral students tend to be advised by their major professor, who are distributed across a range of departments. UH Mānoa is trying to make this degree a model for genuinely joint administration degrees and will come to the Board in the future about other proposals in the sciences that will have similar structures. Regent Dahilig asked if academic advisors in both colleges will be versed in the degree requirements and Vice Chancellor Dasenbrock confirmed.

Regent Gee said that this proposal excited him. He asked about faculty resources to supervise thesis candidates at the Master's and Doctoral level. Hawai'i Institute of Marine Biology Director, Jo-Ann Leong, said that there is already a large number of students in the Marine Biology specialization and about 10 to 20 students will be added.

College of Natural Sciences Dean, William L. Ditto, and SOEST Dean, Brian Taylor, have promised new faculty hires in the Marine Biology program.

Regent Matayoshi said that the Regents don't have enough context in which to judge program and degree proposals. She proposes that the Regents have these discussions in a larger context per campus. It would be more helpful to understand the bottom line. President Greenwood said that UH can look at a new template to make things easier to understand. However, the System Administration expects the Deans to be able to account for resources.

Dean Taylor said that the UH Mānoa program will be one of the top programs in the nation the day that it is declared.

Regent Sullivan said that the vision for the program is to be one of the top programs in the nation and could thus be a great opportunity to have facets that are unique to Hawai'i. She asked if there is anything to establish a forward-looking program that is tied to workforce development, innovation, and technology, as it connects to the future of Marine Biology. Vice Chancellor Dasenbrock said that much of what the program does is very content specific – for example, many of the SOEST researchers study the Hawaiian Islands. Dean Taylor said that there is an opening track in partnership with the Hawai'inuiākea School of Hawaiian Knowledge and that this is an attractive area for local students. Director Leong said that they are working hard to bring in local and Native Hawaiian students into the graduate program. They also make a concerted effort to hire Native Hawaiians. Dean Ditto added that the program will not make sense if it is not intimately woven into the cultural and geographic fabric of the Hawaiian Islands, not only in terms of research, but in terms of cultural enrichment, community outreach, and the creation of marine-based jobs. Dean Taylor said that the program provides a graduate degree for all three four-year colleges in the UH System.

Regent Gee said that he was taken with the applied research component of the proposal. He asked about the future of the Kewalo Marine Laboratory, and if there is a plan if that facility closes. President Greenwood said that there is a back-up plan, and that UH is in the process of evaluating its facilities.

With a motion on the floor, the Regents unanimously approved UH Mānoa's Establishment of a Provisional Marine Biology Ph.D. and Master of Science Jointly Administered by the College of Natural Sciences and School of Ocean and Earth Science and Technology.

**Approval of Request to Confer the Title of University Distinguished Professor
Upon Dr. Samuel C. C. Ting**

UH Mānoa Chancellor Hinshaw said that the Board approved an amendment to Board of Regents' Policy at the April 19, 2012 meeting to confer the title, "University Distinguished Professor" as an honorary designation. She requested that Dr. Samuel C.C. Ting receive the inaugural honor. A member of the UH Mānoa faculty, Dr. Ting is a Nobel Prize Winner in Physics, and has already made enormous contributions.



UNIVERSITY
of HAWAII
MĀNOA

UNIVERSITY OF HAWAII
BOARD OF REGENTS

12 MAY 10 4:57

April 17, 2012

MEMORANDUM

TO: Eric K. Martinson
Chairperson, Board of Regents

VIA: M.R.C. Greenwood
President

VIA: Virginia S. Hinshaw
Chancellor

FROM: Reed Dasenbrock
Vice Chancellor for Academic Affairs

BOR APPROVED 5/17/12
xc: Pearl Imada Iboshi
Joanne Itano
David Mongold

SUBJECT: Establishment of a Provisional Marine Biology PhD and Master of Science Program jointly administered by the College of Natural Sciences and School of Ocean and Earth Science and Technology, University of Hawai'i at Mānoa

SPECIFIC ACTION REQUESTED:

It is requested that the Board of Regents establish the PhD and Master of Science degree program in Marine Biology as a provisional program, jointly administered by the College of Natural Sciences (CNS) and the School of Ocean and Earth Science and Technology (SOEST) at the University of Hawai'i at Mānoa.

RECOMMENDED EFFECTIVE DATE:

August 1, 2012

ADDITIONAL COST:

For the initial four (4) years of the program, additional courses required by the proposed PhD and MS program in Marine Biology will be taught by existing faculty. Support for a Program Coordinator (APT) will be provided by reallocation of internal funds jointly and equally by SOEST and CNS. When the program is permanently established, anticipated enrollment will require from 3 to 5 new positions. Total expenses for the program are estimated at \$65,000 to \$75,000 per year (2012-2016). Revenue projections based on an enrollment of 30 to 50 degree-seeking students are estimated to increase from \$12,640 in 2012 (30 students) to \$46,176 in 2016 (50 students). Additional sources of support for the program and graduate students will be sought from extramural grants and private funds.

PURPOSE:

The purpose of the graduate program in Marine Biology is to train future leaders in the marine biological sciences that include fisheries, coral reef biology, marine ecological and evolutionary genetics, marine biosensory and physiological processes and marine resources management as they relate to tropical marine life and systems. The program addresses state and national workforce needs, anticipating the demand for scientifically trained leaders who can identify, investigate, and solve problems related to ocean and coastal resources. Specifically, the program will provide advanced professional training in Hawai'i and help to meet the need for technically trained scientists, policy-makers, and mid-level managers in both the public and private sectors. Additionally, the program will prepare future college-level faculty for entry into the rapidly expanding field of marine ecosystem research.

BACKGROUND INFORMATION:

Pursuant to the Board of Regents Policy 5-1, the Board of Regents has the authority to approve new degree programs upon the recommendation of the President.

Nearly 40% of the world's population resides in the continental coastal zones and many of these coastal residents depend directly on the ocean and/or coastal ecosystems for their livelihoods. Marine resources, especially seafood, are the primary sources of income and food for more than a billion people, many of whom live in developing countries. The demand for ocean and coastal ecosystem goods and services is likely to increase as the human population continues to grow and as more people move to coastal areas. Thus, there is a critical need to build capacity to ensure the future of ocean and coastal communities and the supporting ecosystem services. Capacity building for stewardship of the oceans and coasts is a complex, multidimensional challenge, and the University of Hawai'i must participate.

Fortunately, the University of Hawai'i at Mānoa is uniquely positioned to excel in offering a graduate program in Marine Biology. The University is situated in the Hawaiian Archipelago, which contains the largest coral reef habitats in the United States and one of the largest marine refuges in the world. The coastal and open waters surrounding the archipelago provide a natural laboratory for the study of marine ecosystems, marine geochemical processes, reef and oceanic fisheries, and human/marine interactions. The University of Hawai'i at Mānoa currently employs a large number of researchers and faculty in various departments whose expertise is related to the marine environment.

There has been consistently high demand by incoming graduate students for training in marine biology both because of the aforementioned natural advantages with respect to geographical location and due to the abundance of research opportunities and infrastructure on the UH Mānoa campus. Currently, the only official academic opportunity in this field at UH Mānoa is a specialization in marine biology offered as a supplement to a graduate degree in Microbiology, Oceanography, Botany, or Zoology. There are no other doctoral programs in Marine Biology in

Eric K. Martinson
April 17, 2012
Page 3

Hawai'i. As of 2011, only six institutions in the U.S. offered the MS and PhD in Marine Biology: University of Alaska at Fairbanks, University of California in San Diego (Scripps Institution of Oceanography), University of Miami (RSMAS), University of Maine, The University of North Carolina at Wilmington, and University of Oregon at Eugene.

The proposed program has the support of the deans and faculty of the College of Natural Sciences and the School of Ocean and Earth Science and Technology. The program has been reviewed and recommended for approval by the Graduate Council of the Graduate Division and the Mānoa Faculty Senate. The program has the endorsement of the Systemwide Council of Chief Academic Officers.

Board of Regents Policy 5-1(a) provides that all new academic programs, once approved, shall have provisional status until a review is conducted. The required review would be scheduled to take place during the 2017-2018 academic year.

ACTION RECOMMENDED:

It is recommended that the Board of Regents establish the Marine Biology PhD and MS degree program as a provisional program jointly within the College of Natural Sciences and the School of Ocean and Earth Science and Technology at the University of Hawai'i at Mānoa, to be effective August 2012.

Attachments

c: Executive Vice Provost Linda Johnsrud
Vice Chancellor Gary Ostrander
Dean William L. Ditto
Dean Brian Taylor
Interim Dean Patricia Cooper
Director Jo-Ann Leong

Marine Biology Graduate Degree Program Plan

- 1) How was the number of enrolled students determined?

Since 2003, the number of applicants for the marine biology graduate program specialization has ranged from 67 to 186 for an average of 114 applicants each year. The number of students admitted from this pool is an average of 15 % or 17 students annually. By offering the Marine Biology Graduate Degree Program we feel that the number of accepted applications can be raised to 30 in the first year and grow to 50 students after 5 years.

- 2) Explain why the number of faculty are 1 – 4.

No new faculty are proposed to be hired for this new program since the University already has a wealth of faculty capable to offer classes under this new degree program.

In addition, Dean Ditto of the College of Natural Sciences has pledged full support of the program in terms of future strategic faculty hires and sufficient administrative and clerical support (letter attached).

The planned faculty requirements are to offer the following courses. The program plans to offer two courses for 4 credits each in the first year. The next year four classes for 4 credits each will be offered. For the next four years the curriculum will offer six classes for 4 credits each.

- 3) How did the calculation for Non-Resident/Resident come out to \$713.00 per credit?

The tuition rate per credit was calculated using the average rate of residents and non-resident enrollments for the Spring and Fall of 2011. The number of residents enrolled is 67.7% and non-residents are 32.3%. The actual rate of tuition for the Marine Biology Graduate Degree will probably average higher than calculated since the majority of graduate students are non-residents but transfer to the resident rate as they continue in the program.

- 4) Explanations on the other income in line H. – are there commitments for the 6 years shown in the budget?

Financial commitments from external sources have been identified for the first five years through a grant from the National Marine Fisheries Service. This grant which has already been established at HIMB is specifically supports the hiring of a faculty member specializing in marine population dynamics. Recruitment for this position is currently in process. Future funding is anticipated due to a NOAA study in 2008 which identified the need for high quality scientific research in stock assessment and fisheries population dynamics.

RESIDENT TUITION ONLY

Academic Cost and Revenue Template - New Program (adjust template for appropriate number of years) (Updated 09/06/11)										
ENTER VALUES IN YELLOW CELLS ONLY CAMPUS/Program	Mānoa / Marine Biology Graduate Dg						Year 5			Year 6
	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	Masters Degree, 5 yrs for Doctoral Degree			
Students & SSH	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6				
A. Headcount enrollment (Fall)	30	35	40	45	50	50				
B. Annual SSH	240	560	960	1,080	1,200	1,200				
Direct and Incremental Program Costs Without Fringe										
C. Instructional Cost without Fringe	\$ 90,000	\$ 180,000	\$ 270,000	\$ 400,000	\$ 400,000	\$ 400,000				
C1. Number (FTE) of FT Faculty/Lecturers	1.00	2.00	3.00	4.00	4.00	4.00				
C2. Number (FTE) of PT Lecturers										
D. Other Personnel Costs	\$ 65,000	\$ 65,000	\$ 70,000	\$ 70,000	\$ 75,000	\$ 75,000				
E. Unique Program Costs										
F. Total Direct and Incremental Costs	\$ 155,000	\$ 245,000	\$ 340,000	\$ 470,000	\$ 475,000	\$ 475,000				
Revenue										
G. Tuition	\$ 115,920	\$ 287,840	\$ 529,920	\$ 640,440	\$ 764,400	\$ 764,400				
Tuition rate per credit	\$ 483	\$ 514	\$ 552	\$ 593	\$ 637	\$ 637				
H. Other	\$ 200,000	\$ 300,000	\$ 400,000	\$ 500,000	\$ 600,000	\$ 600,000				
I. Total Revenue	\$ 315,920	\$ 587,840	\$ 929,920	\$ 1,140,440	\$ 1,364,400	\$ 1,364,400				
J. Net Cost (Revenue)										
	-160,920	-342,840	-589,920	-670,440	-889,400	-889,400				
Program Cost per SSH With Fringe										
K. Instructional Cost with Fringe/SSH	\$ 506	\$ 434	\$ 380	\$ 500	\$ 450	\$ 450				
K1. Total Salary FT Faculty/Lecturers	\$ 90,000	\$ 180,000	\$ 270,000	\$ 400,000	\$ 400,000	\$ 400,000				
K2. Cost including Fringe of K1	\$ 121,500	\$ 243,000	\$ 364,500	\$ 540,000	\$ 540,000	\$ 540,000				
K3. Total Salary PT Lecturers	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -				
K4. Cost including fringe of K3	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -				
L. Support Cost/SSH	\$ 435	\$ 435	\$ 435	\$ 435	\$ 435	\$ 435				
Non-Instructional Exp/SSH	\$ 507	\$ 507	\$ 507	\$ 507	\$ 507	\$ 507				
System-wide Support/SSH	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56				
Organized Research/SSH	\$ 128	\$ 128	\$ 128	\$ 128	\$ 128	\$ 128				
M. Total Program Cost/SSH	\$ 941	\$ 869	\$ 815	\$ 935	\$ 885	\$ 885				
N. Total Campus Expenditure/SSH	\$ 970	\$ 970	\$ 970	\$ 970	\$ 970	\$ 970				
Instruction Cost with Fringe per SSH										
K. Instructional Cost/SSH	\$ 506	\$ 434	\$ 380	\$ 500	\$ 450	\$ 450				
O. Comparable Cost/SSH	\$ 1,617	\$ 1,617	\$ 1,617	\$ 1,617	\$ 1,617	\$ 1,617				
Program used for comparison.	Zoology, MS/PHD									
Reviewed by campus VC for Administrative Affairs:	(signature and date)									
Instructions	V.S. Carlson 3/9/12									
Please include an explanation of this template in your narrative.										
A.	Headcount Enrollment: Headcount enrollment of majors each Fall semester. Located at url: http://www.hawaii.edu/iro/maps.php?category=Enrollment Campus data may be used when majors are a subset of enrollment reported in IRO reports.									
B.	Annual SSH: Course Registration Report located at url: http://www.hawaii.edu/iro/maps.php?title=Course+Registration+Report Add the SSH for the Fall and Spring reports to obtain the annual SSH. This is all SSH taught by the program, including to non-majors. Adjust if majors are subset of SSH reported.									

RESIDENT & NON-RESIDENT TUITION

Academic Cost and Revenue Template - New Program (adjust template for appropriate number of years) (Updated 09/06/11)										
ENTER VALUES IN YELLOW CELLS ONLY	CAMPUS/Program						Mānoa / Marine Biology Graduate Degree			
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Provisional Years (2 yrs for Certificate, 3 yrs for Associate Degree, 6 yrs for Bachelor's Degree, 3 yrs for Masters Degree, 5 yrs for Doctoral Degree)			
ENTER ACADEMIC YEAR (i.e., 2011-2012)	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018				
Students & SSH										
A. Headcount enrollment (Fall)	30	35	40	45	50	50				
B. Annual SSH	240	560	960	1,080	1,200	1,200				
Direct and Incremental Program Costs Without Fringe										
C. Instructional Cost without Fringe	\$ 90,000	\$ 180,000	\$ 270,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 400,000	
C1. Number (FTE) of FT Faculty/Lecturers	1.00	2.00	3.00	4.00	4.00	4.00	4.00	4.00	4.00	
C2. Number (FTE) of PT Lecturers										
D. Other Personnel Costs	\$ 65,000	\$ 65,000	\$ 70,000	\$ 70,000	\$ 75,000	\$ 75,000	\$ 75,000	\$ 75,000	\$ 75,000	
E. Unique Program Costs										
F. Total Direct and Incremental Costs	\$ 155,000	\$ 245,000	\$ 340,000	\$ 470,000	\$ 475,000	\$ 475,000	\$ 475,000	\$ 475,000	\$ 475,000	
Revenue										
G. Tuition	\$ 171,120	\$ 416,640	\$ 773,760	\$ 907,200	\$ 1,107,600	\$ 1,107,600	\$ 1,107,600	\$ 1,107,600	\$ 1,107,600	
Tuition rate per credit	\$ 713	\$ 744	\$ 806	\$ 840	\$ 923	\$ 923	\$ 923	\$ 923	\$ 923	
H. Other	\$ 200,000	\$ 300,000	\$ 400,000	\$ 500,000	\$ 600,000	\$ 600,000	\$ 600,000	\$ 600,000	\$ 600,000	
I. Total Revenue	\$ 371,120	\$ 716,640	\$ 1,173,760	\$ 1,407,200	\$ 1,707,600	\$ 1,707,600	\$ 1,707,600	\$ 1,707,600	\$ 1,707,600	
J. Net Cost (Revenue)										
	-216,120	-471,640	-833,760	-937,200	-1,232,600	-1,232,600	-1,232,600	-1,232,600	-1,232,600	
Program Cost per SSH With Fringe										
K. Instructional Cost with Fringe/SSH	\$ 506	\$ 434	\$ 380	\$ 500	\$ 450	\$ 450	\$ 450	\$ 450	\$ 450	
K1. Total Salary FT Faculty/Lecturers	\$ 90,000	\$ 180,000	\$ 270,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 400,000	\$ 400,000	
K2. Cost Including Fringe of K1	\$ 121,500	\$ 243,000	\$ 364,500	\$ 540,000	\$ 540,000	\$ 540,000	\$ 540,000	\$ 540,000	\$ 540,000	
K3. Total Salary PT Lecturers										
K4. Cost Including fringe of K3										
L. Support Cost/SSH	\$ 435	\$ 435	\$ 435	\$ 435	\$ 435	\$ 435	\$ 435	\$ 435	\$ 435	
Non-Instructional Exp/SSH	\$ 507	\$ 507	\$ 507	\$ 507	\$ 507	\$ 507	\$ 507	\$ 507	\$ 507	
System-wide Support/SSH	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	\$ 56	
Organized Research/SSH	\$ 128	\$ 128	\$ 128	\$ 128	\$ 128	\$ 128	\$ 128	\$ 128	\$ 128	
M. Total Program Cost/SSH	\$ 941	\$ 869	\$ 815	\$ 935	\$ 885	\$ 885	\$ 885	\$ 885	\$ 885	
N. Total Campus Expenditure/SSH	\$ 970	\$ 970	\$ 970	\$ 970	\$ 970	\$ 970	\$ 970	\$ 970	\$ 970	
Instruction Cost with Fringe per SSH										
K. Instructional Cost/SSH	\$ 506	\$ 434	\$ 380	\$ 500	\$ 450	\$ 450	\$ 450	\$ 450	\$ 450	
O. Comparable Cost/SSH	\$ 1,617	\$ 1,617	\$ 1,617	\$ 1,617	\$ 1,617	\$ 1,617	\$ 1,617	\$ 1,617	\$ 1,617	
Program used for comparison.		Zoology, MS/PHD								
Instructions	Reviewed by campus VC for Administrative Affairs: (signature and date) <i>[Signature]</i> 3/9/12									
Please include an explanation of this template in your narrative.										
A.	Headcount Enrollment: Headcount enrollment of majors each Fall semester. Located at uri: http://www.hawaii.edu/iro/maps.php?category=Enrollment Campus data may be used when majors are a subset of enrollment reported in IRO reports.									
B.	Annual SSH: Course Registration Report located at uri: http://www.hawaii.edu/iro/maps.php?title=Course+Registration+Report Add the SSH for the Fall and Spring reports to obtain the annual SSH. This is all SSH taught by the program, including to non-majors. Adjust if majors are subset of SSH reported.									

**Proposal for the Development
of a Graduate Degree program in
MARINE BIOLOGY
at the
University of Hawai`i at Mānoa**

14 November 2011

**Committee: Jo-Ann Leong, HIMB, Chair
Sean Callahan, Microbiology
Kathleen Cole, Biology
Jeff Drazen, Oceanography
Stuart Donachie, Microbiology
Celia Smith, Botany
Grieg Steward, Oceanography
Tim Tricas, Biology**

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**UNIVERSITY
of HAWAII***
MĀNOA

COLLEGE OF ARS AND SCIENCES
COLLEGE OF NATURAL SCIENCES
OFFICE OF THE DEAN

Memorandum

December 12, 2011

To: Reed Dasenbrock
Vice Chancellor, Academic Affairs
Cc: Krystyna Aune, Wendy Pearson

From: William Ditto, Dean, College of Natural Sciences
Brian Taylor, Dean, School of Ocean & Earth Science & Technology

Brian Taylor 

Re: Proposal for Marine Biology Ph.D. and M.S. degree program at UH Manoa

The proposed Ph. D. and M.S. degrees in Marine Biology as a joint program offered by faculty in the College of Natural Sciences and the School of Ocean & Earth Science & Technology has been reviewed and approved by the Graduate Council. The Chairs and faculty of the Departments of Botany, Microbiology, Oceanography, and Zoology, as well as the Director and faculty of the Hawaii Institute of Marine Biology, have reviewed the proposal and have indicated their support of an advanced degree program in Marine Biology by their signatures. In addition, the document contains the support letters of Richard Lim (DBEDT), William Aila (DLNR), and Samuel Pooley (PIFSC).

We provide this document for review by your office and request that you forward it on in the process that will lead to the adoption of the Ph. D. and M.S. degrees in Marine Biology at the University of Hawaii at Manoa.

MARINE BIOLOGY GRADUATE PROGRAM

1.0 Introduction

The University of Hawai'i at Mānoa (UHM) is uniquely positioned to excel with a graduate program in Marine Biology. The university is situated in the Hawaiian Archipelago, which contains the largest coral reef habitats in the United States, and one of the largest marine refuges in the world. The coastal and open waters around the archipelago are a natural laboratory for the study of marine ecosystems, marine biogeochemical processes, reef and oceanic fisheries, and human/marine interactions. The university also currently employs a larger number of researchers and faculty in various departments whose expertise is related to the marine environment. There has been consistently high demand by incoming graduate students for training in marine biology, because of the natural advantages of location and the abundance of relevant research opportunities and infrastructure at the UHM campus. Unfortunately, the university has been unable to adequately serve the needs of these students. The only official academic opportunity in this field at this university is a specialization in marine biology offered as a supplement to a graduate degree in Microbiology, Oceanography, Botany, or Zoology. Because marine biology exists only as a specialization, students must meet the requirements of one of these four graduate programs, which severely restricts the marine biology training they can receive. A separate graduate program in Marine Biology would allow students to receive advanced training that is specifically tailored to their interests. Such a program would also address the growing need, locally and globally, for technically trained scientists, managers, and policy makers who understand the processes that govern tropical marine ecosystems. Sound management of marine resources is becoming critical as these resources come under mounting pressure for exploitation from a growing human population and increasing stress from global climate change.

In light of the high demand for graduate training in marine biology, the societal needs for specialists in this field, and the advantages of providing such training at this institution, it is hereby proposed that a graduate degree program in Marine Biology be established at the University of Hawai'i at Mānoa. The proposed program brings to this graduate training, the considerable expertise in Marine Biology in the College of Natural Sciences and the School of Ocean and Earth Sciences and Technology.

2.0 Program Objectives

The objective of the Ph.D. and M.S. degree programs in Marine Biology is to train future leaders in the marine biological sciences that include fisheries, coral reef biology, marine ecological and evolutionary genetics, marine biosensory and physiological processes, and marine resource management as they relate to tropical marine life and systems. The world's oceans are facing increasingly higher sea surface temperatures, increased CO₂ saturation, and rising sea levels. These changes are expected to have profound effects on marine ecosystems, affecting coral reefs with increased bleaching episodes and changing the food web dynamics that regulate the productivity of our fisheries. We will need scientifically trained leaders who can identify, investigate, and solve problems related to ocean and

coastal resources. The program will provide advanced professional training in Hawai'i and help to meet State and national needs for mid-level managers in both the private and public sectors. Additionally, the Ph. D. programs will prepare future college-level faculty for entry into a rapidly expanding field in marine ecosystem research. The program will be an important bridge between University researchers, industry, and government via the Marine Biology Advisory Council (described later under Program Administration).

This inter-college/school, collaborative Ph.D. and M.S. program will admit highly qualified students with a background in biological sciences and a desire to be at the forefront of research and development in marine biological sciences. Prospective students will be the doctoral and master's degree candidates who now apply for the Marine Biology specialization in Botany, Microbiology, Oceanography, and Zoology (Table 2). Since 2003, the number of applicants for the marine biology graduate program specialization has ranged from 67 to 186, and the number admitted from this pool has ranged from 5.6% to 20% with an average admittance rate of 11%. There is a great demand for this program, which is currently administered as a graduate specialization in which students are first admitted into the respective academic departments and then are accepted into the graduate specialization. Once accepted into one of the four academic homes, the student must abide by the graduate degree requirements of Botany, Microbiology, Oceanography, or Zoology before establishing their graduate research effort.

The College of Natural Sciences (CNS) and the School of Ocean and Earth Science and Technology (SOEST) have brought their faculty together in this collaborative effort to provide a Doctoral and Master's degree program that will allow graduate students to work with scientists in both units to design a graduate research program that makes use of the marine science expertise in CNS, SOEST, and the University of Hawai'i industry, state and federal agency partners.

The proposed graduate program will prepare graduates for leadership and innovation in marine biological sciences by fostering their development as critical thinkers, interdisciplinary scholars, communicators, educators and researchers. They will understand the research process, the engagement of cross-disciplinary teams in problem solving, and they will learn to communicate their findings to all audiences. To accomplish these goals, the program will ensure that graduates demonstrate:

1. A comprehensive understanding of marine biological systems including the organisms, their habitats and biodiversity. In particular, this program seeks to expose students to organisms, systems, and processes that occur in both offshore (oceanic) and near shore (coast and reef) environments with an emphasis on the important links between these habitats.
2. Expertise in the quantitative and qualitative methods for field and laboratory research.
3. A working, in-depth understanding of research methodologies and developed skills in competitive grant writing and the publication and dissemination of research findings in professional and practical applications.

4. Experience in industry, state and federal agency working environments.

These program goals will be accomplished through the collective expertise of the graduate faculty of CNS and SOEST and their partners in marine biological sciences at state and federal agencies, and the oceanic and coastal industries.

3.0 Program Justification

Nearly 40% of the world's population is concentrated in the continental coastal zones and many of these coastal residents depend directly on the ocean and coastal ecosystems for their livelihood. Marine resources, especially seafood, are the primary source of income and food for over a billion people on the globe and many are in developing countries. The needs for the ocean and coastal ecosystem goods and services are likely to increase substantially as the human population continues to grow and as more people move to coastal areas. As a consequence, the degradation of coastal and marine ecosystems is expected to worsen and there is a critical need to build capacity to ensure the future of ocean and coastal communities and the supporting ecosystem services. Capacity building for stewardship of the oceans and coasts is a complex multidimensional challenge and the University of Hawai'i must take part in building that capacity. We describe here a program of graduate training that should strengthen the University's efforts in developing a workforce that will participate in community, federal and state efforts to 1) anticipate and manage unprecedented changes in coastal ecosystems; 2) monitor marine ecosystems; 3) effect change in attitudes and knowledge about ocean and coastal ecosystems; 4) effect policies that ameliorate the impacts of land-based activities on coastal resources and ecosystem services; and 5) protect and respect the cultural and ecological knowledge of the Hawaiian people.

There are no other doctoral programs in marine biology in Hawai'i. Hawai'i Pacific University offers an M.S. degree in Marine Sciences and the University of Hawai'i at Hilo offers an M.S. degree in Tropical Conservation Biology and Environmental Sciences in which a marine biology focus is possible. In the Pacific, the University of Guam offers an M.S. in Biology at the University of Guam Marine Laboratory. In 2011, there were only six institutions in the United States that offered a Ph. D. degree in Marine Biology: University of Alaska at Fairbanks, University of California in San Diego (Scripps Institution of Oceanography), University of Miami (RSMAS), University of Maine, The University of North Carolina at Wilmington, and University of Oregon at Eugene (Table 1. U.S. Institutes of Higher Education with Doctoral Programs in Marine Biology). Similarly, these are the same institutions that offer M.S. degrees in Marine Biology.

Table 1. U.S. Institutes of Higher Education with Doctoral degree Programs in Marine Biology

Institution	Department	Ph. D.	M.S./M.A.
University of South Alabama	Marine Science (oceanography)	Mar. Sci.	M.S. in Mar.Sci.
University of Alaska Fairbanks	School of Fisheries & Ocean Sci	Mar. Biol.	M.S. in Mar.Bio.
University of Calif. Berkeley	Earth & Planetary Science + Integrative Biology	Mar. Sci	MA in Mar. Sci
University of Calif. Los Angeles	Ecology & Evolutionary Biol	EEB	
University of Calif. Santa Barbara	Biology, Evolution, & Marine Biology	Mar. Sci	MA in Mar. Sci
University of Calif. San Diego	Marine Biodiversity & Conservation	MBC, Oceanog	M.S. in MBC, Mar.Sci
Scripps Institute of Oceanography	Marine Biology	Mar. Biol.	MS in Mar. Biol (UCSD)
University of Southern Calif.	Biological Sciences/Mar. Biol. & Biol. Ocean	Biological Sci	MS in MEB
Florida State University	Biological Sciences w/Ecology & Evolution	Biological Sci	MS in Biological Sci
University of Guam	Marine Biology Laboratory		MS in Biology
Hawai'i Pacific University	College of Natural Sciences, Marine Science		MS in Mar. Sci.
University of Hawai'i at Mānoa	Zoology, Botany, Microbiology, Oceanography	In academic discipline w/Mar.Biol specializ.	MS in discipline
University of Miami RSMAS	Marine Biology and Fisheries	Mar. Biol. & Fisheries	MS in MBF
University of Maine	School of Marine Sciences	Mar. Biol.	MS in Mar. Biol.
University of Maryland	Marine-Estuarine Environ Sci	MEES	MEES
University of Southern Mississippi	Marine Science (Oceanography)	Mar. Sci.	MS in Mar. Sci. (MS in Biolog Sci)
Boston University	Marine Science	Mar. Sci	MA in Mar. Sci
Harvard University	Organismic & Evol. Biol	OEB	MA in OEB
University of Mass Dartmouth	Marine Science	Mar. Sci	MS in Biology
University of Miss	Marine Science	Mar. Sci	MS in Mar. Sci.
University of New Hampshire	Marine Science	Mar. Sci.	MS in Mar. Sci.
Rutgers Inst. Marine & Coastal Sci	Marine Science (Oceanography)	Oceanog	MS in Oceanog
Cornell University	Ecology or Evolutionary Biol.	E or EB	MS in E or EB
State University of New York	Marine Science	Mar. Sci	MS in Mar. Sci.
Duke University	Marine Science & Conservation	MSC	
University of North Carolina	Marine Science (specialization in Mar Biol/Ecol	Mar. Sci.	MS in Mar. Sci.
UNC - Wilmington	Biology/Marine Biology	Mar. Bio.	MS in Mar. Biol
Univ. Oregon, Oregon Inst. Marine Biology	Marine Biology	Mar. Bio.	MS in Mar. Biol.
Univ. Rhode Island	Biological Sciences (Marine Biol. Research)	Biol. Sci	M.S. in Biol. Sci.
University of South Carolina	School of Earth, Ocean, & Environment	Mar. Sci.	M.S. in Mar.Sci.
Texas A&M University Corpus Christi	Biology/Marine Biology track	Biology	MS In Biology
University of Texas Austin	Marine Science	Mar. Sci	MS In Mar. Sci.

4.0 Needs Assessment

Demand for the Program

The need for a graduate degree program in Marine Biology is demonstrated by the annual requests for admission into the marine biology program specialization. There were 125 applicants in 2003, 154 in 2004, 186 in 2005, 67 in 2006, 101 in 2007, 75, in 2008, and 96 in 2009. In the case of botany, the requests remain at a very low rate of the total departmental doctoral applicant pool (3-7%), in Microbiology from 9-67%, in Oceanography from 18-36%, and in Zoology from 50-64% (Table 2. Marine Biology Graduate Applications for 2003-2010). The program has maintained a steady number of approximately 100 applicants for the doctoral program. The number accepted, however, indicates that there is an unmet need. In Oceanography, the number admitted ranged from 9-12% and in Zoology, from 15-33% of the applicant pool. In Botany, the single doctoral candidate admitted into the marine biology specialization in 2005-6 was one of two applicants. The Marine Biology graduate specialization program has never engaged in any recruitment efforts and potential graduate students have to make a real effort to understand the process of applying for a graduate specialization in marine biology that is hosted by four academic homes. Often students are confused by the process that requires each potential applicant to first gain admittance into one of the four academic departments before they can be admitted into Marine Biology.

The four academic departments that currently train graduate students in marine biological sciences have their own graduate degree requirements that take precedence over the marine biology courses that would provide a broader, more comprehensive training in the field. The academic disciplines also require a majority of the advisory committee to be composed of members of the academic discipline so that a truly interdisciplinary committee is not possible. For instance, Biological Oceanography students must have at least 3 of 6 Ph. D. committee members in the Oceanography Department. This requirement, often, does not meet the need for interdisciplinary training of many Marine Biology students. Clearly, the justification of this program is the interdisciplinary training of marine biology graduate students. This program would bring together faculty across departments and schools to serve equally in graduate training. They would also participate in a comprehensive survey course in Marine Biology.

The proposed graduate program will also bridge the professional development of students across University of Hawai'i campuses. The University of Hawai'i at Hilo has a very active undergraduate program in Marine Science (College of Arts and Sciences). This bachelor's degree is designed to provide students with a comprehensive understanding of the world's oceans and an appreciation of the importance of marine ecosystems to the global environment and human life. This includes basic and advanced training in oceanographic and marine biology, including marine fisheries. Bachelors of Science degree specializations are offered in both Aquaculture and Coastal Resources & Watershed Management (College of Agriculture, Forestry & Natural Resource Management). These tracks prepare many students with undergraduate training in the biology, management, conservation and policy issues

relative to coastal marine ecosystems, including fisheries and aquaculture. Masters of Science degrees in Tropical Conservation Biology and Environmental Science are also offered at UH Hilo that involve many faculty from these colleges. The establishment of the proposed Marine Biology graduate program at UH Mānoa would provide additional degree opportunities at the MS and PhD levels for students at UH Hilo. Furthermore, the program can potentially facilitate future cross-campus collaborations in marine biology, fisheries, aquaculture and other promising areas of marine research (see letters of support).

Demand for Ph. D. and M.S. Graduates in Marine Biology

In the 2010-2011 Occupational Outlook Handbook, employment opportunities for biological scientists are projected to grow 21% over the 2008-2018 decade, much faster than the average for all other occupations. There were 91,300 employed biological scientists in 2008 and in 2018, there is expected to be 110,500 jobs for biological scientists (21% increase; 1920 new jobs each year). Largely fueled by biotechnological research and development, the job growth is expected in the environmental and marine sciences. It is clear, however, that graduates in marine biology should gain training that allows them to consider a wider choice of employment opportunities in government and industrial research and development, regulatory agencies, as well as academic research programs. In Hawai'i, the job outlook for life sciences employment excluding agricultural biotech in 2007 was 7,970 positions with a growth rate of 2.3% (2002-2007) as compared to a growth rate of 1.4% in the U.S. (Innovation & Technology in Hawai'i: An Economic & Workforce Profile, October 2008).

In 2008, NOAA undertook the study "The Shortage of the Number of Individuals with Post-Baccalaureate Degrees in Subjects Related to Fishery Science" and found that the market for stock assessment scientists is increasing (Boremann, 2008). The Magnuson-Stevens Fisheries Conservation and Management Reauthorization Act of 2006 had projected an increasing need for careful scientific assessments of the managed fisheries stocks in the United States. Scientists with "the ability to conduct high-quality scientific research in stock assessment, fishery population dynamics, and related fields" were not going to be available to meet a minimally estimated need of 180-340 nationwide over the next 10 years. The results of the study indicate that the gap between supply and demand will widen as the current proportion of faculty working on population dynamics and other fields related to stock assessment training is expected to decrease in the foreseeable future. The National Marine Fisheries Service has initiated partnerships with academic institutions to recruit faculty who will assist in the training of future scientists by offering graduate courses in marine population dynamics/stock assessment. The University of Hawai'i is the recipient of one of these positions.

Table 2. MARINE BIOLOGY GRADUATE APPLICATIONS FOR 2003-2010

Applied	Marine Biology specialization applicant pool										Total applicant pool per department					% depart. applicants in Marine Biol			
	2003-4	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2005-6	2006-7	2007-8	2008-9	2009-10	2005-6	2006-7	2007-8	2008-9	2009-10		
	BOT MS	3	2	4	4	3		5											
BOT PHD	2	5	2	1	1			27	29	33	21	15	7.41%	3.03%	4.76%				
MICR MS	2	8	5	2	7	5	3	9	5	11	12	12	66.67%	20.00%	9.09%	16.67%	16.67%		
MICR PHD	2	5	6	1	1	2	2	91	56	59	60	64	36.26%	23.21%	33.90%	18.33%	34.38%		
OCN MS	25	27	37	10	19	16	15	118	52	53	52	33	53.39%	40.38%	50.94%	46.15%	63.64%		
OCN PHD	22	31	33	13	20	11	22												
ZOOL MS	39	37	36	16	23	16	28												
ZOOL PHD	30	39	63	21	27	24	21												
total	125	154	186	67	101	75	96												

Admitted	Marine Biology specialization applicant pool										Total applicant pool per department					% of MB applicants accepted			
	2003-4	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2005-6	2006-7	2007-8	2008-9	2009-10	2005-6	2006-7	2007-8	2008-9	2009-10		
BOT MS			1	1	1		1												
BOT PHD			1					50%											
MICR MS	1	4	2					17%											
MICR PHD	1	2	1			1	1												
OCN MS			2	1		1													
OCN PHD	1	4	4		3	1	4	12%											
ZOOL MS	3	4	3		4	4	7												
ZOOL PHD	1	3	13	5	4	8	7	21%	24%	15%	33%	33%							
Total	7	18	27	7	12	15	19												

Enrolled	Marine Biology specialization applicant pool										Total applicant pool per department					% of MB applicants accepted			
	2003-4	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2005-6	2006-7	2007-8	2008-9	2009-10	2005-6	2006-7	2007-8	2008-9	2009-10		
BOT MS			1	1	1		1												
MICR MS			3	1															
MICR PHD	1	1	1			1													
OCN MS		1	2	1		1													
OCN PHD	1	3	3		1	1	4												
ZOOL MS	3	4	2		2	4	7												
ZOOL PHD	1	3	8	5	1	4	6												
Total	6	15	18	7	5	11	18												

5.0 Program Description

The Graduate Program in Marine Biology will provide an integrated graduate education for students seeking careers in research and teaching with emphasis on recent advances in understanding of coastal reef and open ocean marine systems at the ecological, organismal, and cellular-molecular levels. It will be housed in the College of Natural Sciences and the School of Ocean and Earth Science and Technology. The program will allow students to become specialists in the marine field of their choice by selecting courses, advisors, and research opportunities from many disciplines, including aquaculture, behavior, biosystematics, marine botany, ecology, genetics, virology and marine microbiology, molecular biology, fisheries, coral reef biology and zoology. This graduate degree program includes faculty whose research interests are focused in these areas and who provide a program of special excellence at the University of Hawai'i at Mānoa. The University is based in a tropical setting on geographically the most isolated archipelago in the world. The Pacific Ocean location and volcanic origin of the islands are key factors to many of the unique research opportunities available at the University of Hawai'i in marine biology.

Admissions

Applications to the Marine Biology graduate program will be accepted in the fall semester and processed for admission for the following fall semester. Admissions will involve a careful evaluation and selection process by an admissions committee composed of Marine Biology graduate faculty and led by the Marine Biology graduate chair. The admissions committee will involve faculty from participating departments and research units that include the Departments of Biology, Botany, Microbiology, Oceanography, the Hawai'i Institute of Marine Biology (HIMB), and the Kewalo Marine Laboratory. The admissions criteria and procedures will conform to the Graduate Division's standards for all Mānoa Master of Science and Doctorate programs. To ensure consistent quality of training and financial support, the number of applicants admitted will be limited by the availability of advisors and support (i.e., funding to support the student for 2 years). No student will be admitted by the admissions committee without a plan to support them and evidence of a good "fit" between the student's needs and interests, and a graduate faculty member's ability to serve as an advisor and mentor. It is anticipated that 5-10 doctoral students will be admitted into the program each year reaching a total enrollment of 30-70 students in 3-5 years assuming that some of the 29 students currently enrolled in the Marine Biology graduate specialization transfer to the degree program.

Applicants should have a B.S., B.A. or M.S. degree in the biological sciences including Zoology, Biology, Microbiology, Botany, Biological Oceanography, and Marine Biology. However, highly motivated students with other degrees may be considered if they have strong academic backgrounds and demonstrated experience in the biological sciences. Students without evidence of adequate preparation in mathematics, physics, and biochemistry will be required to make up these prerequisites prior to or after admission. Applicants apply directly to the M.S. or Ph.D. degree programs and the admissions committee will determine the students readiness for their chosen program. Any course deficiencies in an applicant's background will be identified and provided to the student and potential advisor in the

letter of acceptance. Newly enrolled students who select the Ph.D. track will be required to demonstrate doctoral-level proficiency in the two Marine Biology core courses for advancement (see Degree requirements section below).

Additional admission requirements include a minimum cumulative grade point average of 3.2 out of 4.0, submission of GRE General Subject Test scores, three positive letters of recommendation, and a completed Graduate Admissions Application including a personal statement of objectives and resume. Foreign applicants must obtain a TOEFL score of 600 or above. Interviews (in person or by phone by members of the graduate selection committee) will be required of all applicants deemed acceptable by the admissions committee. In selecting applicants for admission, particular attention will be paid to the quality and depth of the personal statement, the student's potential in research, the strength of the letters of recommendation and the professional qualities and academic depth presented in the interviews.

Degree requirements

Students admitted to the Marine Biology graduate program will come from a wide range of undergraduate and MS majors that include oceanography, environmental science, marine science, marine biology, zoology, microbiology, botany, biology and other life science majors. All applicants are expected to have a strong background in math, chemistry, physics and life sciences but will have clear differences in their undergraduate training. The first teaching goal is to present all first-year students with a comprehensive overview of the many abiotic and biotic processes that influence the dynamics of biological systems in marine environments. This will involve sequential fall and spring semester introductory courses entitled "Marine Biology – Environments and organisms" and "Marine Biology – Processes and Impacts", respectively. These courses will involve formal lectures, guest speakers and rigorous examinations. Students will also participate in a concurrent laboratory section that will provide practical exposure to a diversity of marine organisms, relevant research methods and field experience. Basic descriptions of these two courses are provided below. Further details for each are provided in the accompanying UHM-1 Forms for the addition of new courses (see Appendix). Their basic content is provided below.

1. Course: Marine Biology – Environments and Organisms (BIO 601, 4 Credits, 3 h lecture and laboratory). Required of all new students, but can be waived on demonstration of equivalent proficiency prior to the start of the first year.

Course Objectives and Goals: This first semester course will introduce students to the diversity of marine organisms and the many specialized habitats in which they live. This will include three main themes in lecture: 1) "Features of the oceans" will cover the abiotic physical, geological, and chemical processes that affect the biology and distribution of marine organisms. This will include lectures on topics such as plate tectonics, geography, volcanic processes, ocean currents, tides, chemistry and geomagnetism. 2) "Habitats" will review in detail the primary

environments in which marine organisms occur. Students will receive lectures on the open ocean, coastal and reef habitats in polar, temperate and tropical latitudes. 3) "The diversity of marine life" lectures will provide students with a comprehensive survey of marine life from microbes to macro-organisms. Lecture material will be complemented by laboratories and research experiences that are focused into three modules: 1) surveys and sampling of marine habitats, 2) survey of marine organisms, and 3) molecular investigations. Students will be expected to complete assignment reports for each laboratory session. Laboratory sessions will expose students to laboratory and field work associated with selected lecture topics. Fieldwork will include at least one 2-day cruise in Hawaiian waters, during which student will learn how to measure physical, chemical and biological features of the open ocean. They will also participate in sampling and analyses of pelagic and benthic marine microbes, plankton, vertebrate, invertebrate and benthic organisms. Students will also investigate organisms associated with nearshore reef habitats through field trips to HIMB and other sites around O'ahu. Laboratory demonstrations and exercises will be conducted at HIMB and the Departments of Biology, Botany, Microbiology, and Oceanography.

2. Course: Marine Biology – Processes and Impacts (BIO 602, 4 Credits, 3 h lecture and laboratory). Required of all new students with BIO 601 as a prerequisite. Can be waived on demonstration of equivalent proficiency by examination prior to the start of the first year.

This second semester course will build upon previous semester course in which the students were familiarized with the diversity of marine organisms and their habitats. This course will primarily investigate biological phenomena and processes, and is grouped into four main themes: 1) "Productivity and food webs" section will present students with detailed lectures on photosynthetic and other primary pathways of autotrophic energy fixation. 2) "Community structure and ecology" theme will involve spatial patterns of biomass and temporal patterns of populations and communities, 3) "Adaptations and physiology" will present students with specific examples of how marine organisms have evolved morphological, biochemical, behavioral and physiological adaptations to their marine habitats, and 4) "Human activities and their impacts" that will familiarize students with the interpretation of relevant contemporary issues such as overfishing, ocean acidification and global climate change. Students will also receive training on the main issues with overexploitation of natural fisheries resources and their conservation. Lecture materials in these areas will be complemented by laboratories, field trips and research experiences that are focused into three modules: 1) marine productivity, 2) populations and communities, and 3) anthropogenic impacts. Students will be expected to complete assignment reports for each laboratory session.

In this course, students will be responsible for a report and oral presentation to their classroom audience on a research topic in Marine Biology. Students will conduct an independent literature research over the course of the semester and prepare a 15 minute presentation on an approved topic. Fellow students and the instructor will 'judge' each presentation through comments

sheets. All comments will be collated into a personal one-page summary: Students will receive a summary of all comments, with constructive advice (if needed) on how to improve (if necessary) their future presentations. Students will submit a term paper on their research topic that will be graded for its content.

Significance – This core course sequence will deliver to new students both basic and advanced information in important areas of contemporary marine biology research. Each one-semester course will be led by one instructor (for a total of two new faculty members) who will be responsible for the design and implementation of the course, arranging guest speakers (up to 1 per week) and administration of exams. This format is preferred over a course with a rotation of multiple instructors because of the many organizational details required to develop consistent lecture, lab and field components across years. In addition, a single course instructor provides a point of contact for students.

These core courses will also serve an important function for student advancement. Written exams will be considered as “Qualifying Exams” that are used to determine the performance and writing proficiency of each student. At the end of the spring semester, the performance of each student will be assessed by a Marine Biology assessment committee of participating faculty and the two course instructors. Graduate course requirements will also be designed so that Master’s students can complete the majority of their formal coursework by the end of the first year of study. The committee will assess each student’s performance according to pre-defined criteria, such that qualifying students can be advanced to the Ph. D. track at the conclusion of their first year of study. Students who fail to pass these courses at the Master’s level will be dismissed from the program.

There are several courses that are not currently taught at UH Mānoa and are needed to provide a balanced curriculum for graduate training in Marine Biology. These courses will be considered as electives selected by the students based on their particular interests and area of study. The new program will develop the following courses that will be offered as electives to graduate students in the Marine Biology and potentially other relevant graduate programs. These will be formally developed and faculty positions provided by the College of Natural Sciences (see letters of support).

3. Course – Marine Molecular Ecology and Bioinformatics (3 Cr, 600 level) - This course will focus on problems, methods, and advances in the analysis of marine prokaryotic and eukaryotic genes and genomes. Molecular methods, those based largely on the analysis of nucleic acids, or the proteins they encode as genes, are prominent in fields from biogeochemistry to population recruitment and dynamics. Every student in the life sciences, and particularly those in any aspect of ecology, should be familiar with the range and applicability of such methods, as well as the analysis of the data they generate. Students here will learn how to collect samples from various marine organisms for such analyses, and also how to select and apply the correct analytical tools. They will then apply these lessons in a laboratory class, wherein they will have opportunities to work with material of the type they plan to study in their graduate research.

4. Marine Fisheries (600 level, 3 Cr) – Marine fisheries provide a critical protein supply and represent a multi-billion dollar industry. This course will focus on the various fisheries across the world presently and historically. The biology of exploited populations and the ecology of exploited systems will be explored. The effects of fishing on habitats, exploited stocks, and indirect top down effects will all be lecture topics. With this background the various methods to manage fisheries will be explored and will include classic single species stock assessment, models which include by catch and multi-species interactions, marine protected areas, and other recent techniques which hope to achieve federally mandated ecosystem based management. Guest lectures will also include fisheries law and fisheries economics provided by affiliate faculty in NREM and the Richardson School of Law.

5. Coral Reef Ecology (600 level, 3 Cr) – Coral reefs are built from colonies of small animals that secrete calcium carbonate exoskeletons. They are widespread in warm, shallow, oligotrophic waters, and are considered among the most diverse ecosystems on Earth. Coral reefs are also crucial in tourism, fisheries and protection of coastal habitats and human populations. This course will provide students with a strong theoretical background of various coral reef systems, knowledge of past and recent empirical studies, and also current and future problems that face coral reef habitats. These include damage by climatic changes in weather, microbial diseases, shipping and recreational activities, and longer term threats such as changes in water temperature and pH, i.e., 'ocean acidification'.

6. Marine Conservation and Habitat Restoration (600 level, 3 Cr) – Many marine habitats have experienced change or degradation of their biotic communities caused by anthropogenic activities. This course will address sources of environmental degradation caused by coastal development, industrial pollution, fresh water run-off, ocean dumping of waste, climate change and others. These factors will be investigated in relation to models of ecosystem function, science-based strategies for recovery and modern means of implementation. Students will study developments in policy and law that govern research, such as the United Nations Convention on the Law of the Sea (UNCLOS), and emerging legislation that will affect marine research and associated activities at sea. This course is intended to provide both a solid scientific basis for marine conservation but also an important 'stepping-stone' for future involvement in marine legislation and policy by scientists.

In addition to the one-year core course and new courses above, students will take additional relevant courses to fill out their course requirements. Since the program for a Marine Biology graduate specialization already exists, there are several other courses regularly offered by instructional faculty that will serve as supplemental course work for the marine biology graduate degree (see Appendix). In addition, there are many research faculty and agency partners who will participate in the teaching efforts of this program (see SOEST letter of support). This can include the formation of new formal courses in their area of expertise or formal seminar courses that will enrich the learning experience for all graduate students in the biological sciences.

Master's of Science degree. The requirements for the M.S. degree will align with the requirements of the Graduate Division's Master's Plan A. A minimum of 30 credits is required, including at least 18

credits of course work and between 6 to 12 credits of Research (699) or Thesis (700) work. All candidates will be required to enroll in and pass with a "B" or better grade, the introductory graduate core courses in Marine Biology (BIO 601 and 602 4 credits each). The MS degree candidate will provide a graduate seminar on their thesis proposal to their graduate committee at which time they will be subjected to an oral examination. The approved proposed thesis research must result in an M.S. thesis that is a scholarly contribution based on original research conducted by the student under the supervision of the thesis committee chair. A final thesis examination and the approval of the thesis by the student's committee will be required. A Plan B Master's degree will not be offered.

Doctor of Philosophy degree. The requirements for the Ph. D. degree will align with the requirements of the Graduate Division for doctoral degrees. The principal requirements are: 1) enroll in and pass with a grade of "B" or better in the introductory graduate courses in Marine Biology (BIO 601 and 602), 2) complete additional relevant coursework as indicated by the dissertation committee, and 3) defend a doctoral dissertation that presents original, independent research. In addition, all PhD candidates will be required to participate in a teaching project with a graduate faculty mentor during at least one semester of their program.

a. Doctoral Research proposal. Students will be required to present their research progress and dissertation research proposal to their committee and take an oral comprehensive exam testing general knowledge of their chosen area of study. To advance to candidacy, the student must successfully complete this exam administered by their committee as specified by the Graduate Division's standards for all Mānoa doctoral programs. After admission to candidacy, each student must provide an annual research progress seminar to their committee.

b. Required course work. Ph. D. students entering without a M.S. degree will be required to take a minimum of 30 graduate course credits, including at least 18 credits of course work and between 6 to 12 credits of Research (699) or Dissertation (700) work. An incoming student with a M.S. degrees must meet the requirements of the Graduate Division. Students entering the program with a M.S. degree will also be required to take the core courses (BIO 601 and 602) unless they can demonstrate equivalent proficiency by exam to the course instructors.

c. Dissertation. All Ph. D. candidates must conduct scholarly, independent, original research that contributes new knowledge to the field. The candidates develop and conduct research projects under the direction of their dissertation advisor and committee. At the conclusion of the research, students write a dissertation, i.e. a scholarly presentation of their research in publication form. The student's dissertation committee then conducts a final examination to assess the student's ability to orally present their dissertation in a public defense of their research and dissertation. The final exam by the committee is repeatable once after successful petition to the Graduate Dean. The final exam criteria and procedures will conform to the Graduate Division's standards for all Mānoa doctoral programs. Ph. D. students who are

advanced to candidacy, passed their oral comprehensive exam and demonstrated publication of their thesis work can apply for an 'en route' M.S. degree.

This degree is designed to facilitate completion of formal course requirements in the first two years of study. A summary of courses completion is listed in the Table below.

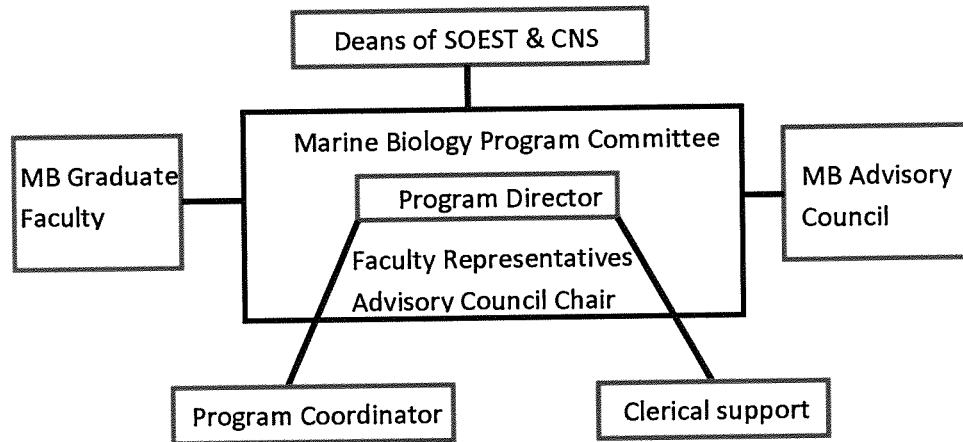
Course of study for Marine Biology graduate degree program

Year 1	Comments	Credit Hours
BIO 601/602 series	All students with Bachelors degree enter on M.S. or PhD track. Core courses are required of all 1 st year students. Those entering with M.S. degree can take course or demonstrate equivalency by exam. Students with Bachelor's degree are advanced to either M.S. or PhD track at conclusion of second semester.	8
Elective courses Form thesis/dissertation committee		8
Year 2		
Complete elective courses		6

6.0 Program Administration

The Marine Biology Graduate program will be an inter-college/school program supported and housed by the School of Ocean and Earth Science and Technology and the College of Natural Sciences. The administrative structure of the program will be composed of three components: a Marine Biology Program Committee, a Marine Biology Graduate Faculty and a Marine Biology Advisory Council. These are described below.

Central to the degree program will be the Marine Biology Program Committee. This committee will be chaired by a dedicated Program Director appointed jointly by the Deans of SOEST and CNS, and approved by the Marine Biology graduate faculty. From 2005-2007, the Marine Biology graduate specialization program was administered by Dr. David Karl of the Oceanography Department, and before that by Dr. Julie Brock of the Zoology Department. Dr. Jo-Ann Leong, Director of the Hawai'i Institute of Marine Biology, is currently chair of the Specialty and will serve until the proposed Graduate Degree Program is approved. The Program Committee will also include at least two faculty representatives from each of CNS and SOEST. The Faculty representatives and Director will be responsible for design of the Marine Biology Degree Program and participate in program decisions in concert with the Program Coordinator and Advisory Council Chair (see below) during the implementation phase.



The Program Director will organize and chair regular meetings of the Committee and carry recommendations of the Committee directly to the Deans of SOEST and CNS. Director will oversee duties of a Program Coordinator. The Program Coordinator will be an administrative, professional, technical (APT) position to assist the Program Director and other committees (e.g., day-to-day academic administrative functions of the program as well as some student services). Clerical functions and student services will be absorbed by existing staff until the program is converted from provisional to established status. Thereafter, dependent on program growth, additional funds may be required to hire additional faculty, full-time clerical and/or student services staff.

The Admissions Committee will consist of, at least, two faculty each from SOEST and CNS and will be responsible for screening applicants, defining deficiencies in an applicant's background, and determining if students are admitted to the program. This information will be provided to the student and potential advisor in the letter of acceptance.

The program will include a Marine Biology Graduate Faculty body that consists of tenured/tenure-track faculty in marine biology oriented academic and research units at UH Mānoa. More than 40 faculty conduct research or teach in marine biology in the College of Natural Sciences [Departments of Botany (2), Microbiology (2), Biology (5), Geography (1), Cell and Molecular Biology (1)], Pacific Bioscience Researcher Center (PBRC) [Kewalo Marine Laboratory (4)], SOEST [Department of Oceanography (11), Geology & Geophysics (2) and Hawai'i Institute of Marine Biology (16)] and College of Agriculture and Human Resources (CTAHR) [Molecular Biosciences and Bioengineering (1)]. Marine Biology Faculty members from these units are the crucial components of the proposed program. They already teach many marine biology-related graduate courses and supervise graduate student projects. Members of the Marine Biology Graduate Faculty will be expected to work with their Faculty Representative to address the development of new courses and changes in courses as the Marine Biology graduate program becomes established.

A Marine Biology Advisory Council, which will consist of non-University partners, will be created to provide information on the employment and research needs of the region. The Marine Biology Program Director and representatives from the Department of Business, Economic Development and Tourism (DBEDT); Department of Land and Natural Resources, Division of Aquatic Resources; National Marine Fisheries Service; representatives of the Deans of SOEST and CNS who provide resources for the program; will serve on the Advisory Council. The chair of the Advisory Council will have a two-year rotation among the members. The Advisory Council will review current issues, and provide recommendations to their Chair for presentation at MB Program Committee meetings. This Council will be responsible for identification of important issues in the community, state, nation and beyond that are directly applicable to development and operation of the degree program. We should also expect members of the Council to facilitate learning and research opportunities for graduate students in the proposed Marine Biology program. As with all graduate programs, overall administrative leadership will come from the Graduate Division.

7.0 Relationship to University and Campus Mission, Plans and Needs

This is a joint program in the College of Natural Sciences and the School of Ocean and Earth Science and Technology. It addresses the System Strategic Plan Goal 2 [objectives 1 (*to excel in basic and applied research for the discovery and dissemination of new knowledge*) and 2 (*to support Hawai'i's economy, workforce development, and improved access and flow of education in Hawai'i from preschool through a life time of learning by building partnerships with the University and with other public and private educational, governmental, and business institutions*)], and Goal 3 [objective 2 (*to establish the University of Hawai'i and the state of Hawai'i as the research, service, and training hub of Oceania, with bridges to the Asia-Pacific region, the Americas, and the rest of the world*)]. The program also supports the UH-Mānoa strategic plan core commitment to research and Chancellor Hinshaw's investment criterion No. 2, *building academic excellence, especially to meet cross-campus needs*.

The program will be multidisciplinary with core faculty in the Departments of Biology, Botany, Microbiology, and Oceanography, as well as research faculty in the Hawai'i Institute of Marine Biology. The program has also engaged State and Federal agencies to enhance the education and research training of Marine Biology graduate students. The program is intended to be Pacific-wide, and during its third year, will seek appropriate approvals to develop exchange agreements and agreements for joint degree offerings in the Western United States, Canada, Mexico and Central America, New Zealand and other Pacific Island Nations, U.S. Territories, Japan, Korea, China, Southeast Asia, and Australia. Ultimately, graduates of the Marine Biology graduate program will provide a workforce to serve scientific, management and policy needs in marine biology for the State of Hawai'i, federal government and international agencies.

8.0 Description of Resources required

Faculty

A new one-year course required of all first year students is proposed and two, temporary faculty members funded by CNS will teach this course over two sequential semesters (described above). In addition, four other graduate courses in need of development are Marine Molecular Ecology and Bioinformatics, Marine Fisheries, Ecology of Coral Reefs, and Marine Conservation and Habitat Restoration. These new courses will be complemented by existing marine courses taught by the current marine biology graduate faculty (discussed above in 5.0 Degree requirements).

Based on current enrollment of 29 students, we estimate use of existing faculty and staff resources at approximately 2.5 FTE annually in terms of administration (0.5 FTE), student services (0.5 FTE), and Faculty (1.5 FTE) distributed across the participating institutes and academic departments at UH Mānoa (Primarily SOEST, CNS, and PBRC). There are 27 proposed graduate faculty from SOEST and 12 from CNS, 4 from PBRC and 1 from CTAHR. These faculty members will make up the bulk of the Marine Biology graduate faculty. The Marine Biology survey course for graduate students will be taught by two, temporary faculty hires supported by CNS. However, there will be a critical need for a Program Coordinator during the implementation phase of the program. A marine fisheries population dynamics faculty is being recruited now at HIMB as part of a 5 year grant to Jo-Ann Leong. This faculty member may contribute to the new Marine Fisheries course. A new endowed chair in Biology may also contribute to the teaching effort in the proposed Marine Biology program. In addition, proposed affiliate graduate faculty from USGS, FWS, NOAA, and DLNR will contribute to the teaching program by serving on graduate committees, participating in lecture and laboratory courses, and training graduate students directly. We expect that there will be increased demand for this course and, we will seek reassignment of resources to hire additional faculty to meet this increased demand.

Library resources (including an evaluation of current resources and an estimate of the cost of additional resources required).

The library currently maintained by the University of Hawai'i (Hamilton Library) is adequate to support the graduate program. Hamilton Library offers major research engines for research publications as well as a fully services and well-subsidized interlibrary loan program for all books and research papers that are not held within the UH system. Head Librarian Paul Mochida has provided a survey of the Library resources as they relate to Marine Biology (see Review of Library Marine Biology Resources section).

Physical resources (space, equipment, etc.)

Laboratories: Participants will have access to state-of-the-art laboratories operated by SOEST (http://www.soest.hawaii.edu/soest_web/soest.research.htm) and other UH academic and research units. HIMB will provide access to an NSF-funded laboratory-classroom, which can host about 20 students and has lab benches and seawater flow-through. Graduate student research is carried out in

the laboratories of the graduate faculty. These include home laboratories for the future MB faculty in the soon-to-be renovated Edmondson and Snyder Halls, the St. John Laboratory (botanical sciences), SOEST facilities in Marine Science Building and HIMB, the Bekesy Laboratory, and the Kewalo Marine Laboratory.

Computing Facilities: SOEST academic departments and research units have excellent computing facilities. In addition to equipment located in their offices and laboratories, faculty and staff have 24-hour access to work stations distributed among 3 computer labs. All are networked and have open access to the Internet and a number of free-use peripherals, such as postscript laser printers and digital scanners. SOEST faculty and research staff members have another 1000+ workstations of various types in their offices and laboratories, including several clusters in 2 datacenters. UH is also responsible for the Maui High-Performance Computing Center (<http://www.mhpcc.hpc.mil/>). Network connectivity is excellent. UH currently uses several channels to provide data, video and voice communications between campuses and research facilities. In addition, T-1 subchannels are also utilized for telemedicine projects, private branch exchange links (voice), general data, and distance learning. The Hawai'i Interactive Television System (HITS) is on the state SONET network and provides continuous service. Some of this bandwidth is designated for distance learning.

Office and Classroom Space. Office space for participating faculty, students, and staff will be provided by their home units. The renovated Edmondson and Snyder Hall will be available and the planned repair of the Pauley residence into offices and small laboratories will also make space available for the program. UH will provide meeting places for the advisory council and for specialized workshops, as necessary. SOEST and CNS have A/V capable classroom facilities seating from 50 to 120 persons each on the University of Hawai'i at Mānoa Campus available for classroom instruction. At HIMB, the two Pauley classrooms are A/V capable and can host about 40 persons.

Specialized Equipment. HIMB has a fleet of Boston Whales, 17-ft small boats from which participants can conduct field activities. The larger 40-ft *Honu Kai* vessel, based on Coconut Island, which is used for transportation to and from the institute, can also be used for plankton tows. SOEST maintains a fleet of coastal and blue-water marine vessels, mini-submarines, ROVs and AUVs. Please refer to the web site for details <http://www.soest.hawaii.edu/UMC/index.html>. Most of the analytical equipment necessary for the program is currently available in shared-use facilities operated by SOEST, CNS, and PBRC on the UH Mānoa campus. Periodic upgrades to these facilities are funded by combined means of extramural and matching (UH) funds.

9.0 Five – Year Business Plan

In the initial phase of the program, the additional courses proposed here will be covered by the existing faculty with assistance from a Program Coordinator that will be requested from the supporting colleges/schools. We anticipate that once the program is established, the increased enrollment will require at least 3-5 new faculty positions. A competitive graduate program will also require resources that attract top student candidates (such as assistantships, grants and awards). We will work with

federal and private institutions to establish extramural resources for these needs. Any new faculty hires will be situated in existing departments/research units, and therefore, we are not budgeting for additional clerical staff for projected future hires.

a. Annual costs to implement the program

In the first year of the program, we will hire a Program Coordinator. The Program Coordinator will be an APT position.

b. Projected enrollment and estimated tuition revenue.

See below.

c. How will the program be funded?

Existing faculty will be funded as they are currently. A Program Coordinator will be requested to assist in the implementation of the program. Graduate research assistants will be funded via extramural funds.

d. Does the current or proposed budget (Department/College/Campus) include funds or a request for funds for the proposed program?

Costs for laboratory supplies, equipment usage and maintenance, and field trips will be borne by the laboratory fees. We will propose strategic hiring initiatives after completion of 4 years with growth and successful program review.

e. Given a "flat budget" situation, how will the proposed program be funded?

No new resources are requested at this time. However, after completion of 4 years with growth and successful program review, the program director and supporting deans will need to reassign or request new positions as appropriate.

	YEAR	FY2012 ^a	FY2013 ^b	FY2014 ^c	FY2015 ^d	FY2016 ^e
PROGRAM COSTS						
Faculty w/o fringe		\$0	\$0	\$0	\$0	\$0
Other personnel costs w/o fringe		\$65,000	\$65,000	\$70,000	\$70,000	\$75,000
Library						
Equipment/Supplies		\$0	\$0	\$0	\$0	\$0
Other						
TOTAL Expenses		\$65,000	\$65,000	\$70,000	\$70,000	\$75,000
REVENUES						
Projected Enrollment (2012 – 30 students)		30	35	40	45	50
No. of Courses ^f		2	4	6	6	6
No. of Credits		8	16	24	24	24
SSH		240	608	960	1,080	1,200
Tuition Rate – 5% increase/y						
*avg res & nonres		\$790	\$830	\$872	\$916	\$962
Total Revenue from Tuition ^g		\$12,640	\$26,560	\$41,856	\$43,968	\$46,176
Other Sources of Income						
*extramural/priv		\$200,000	\$300,000	\$400,000	\$500,000	\$600,000
TOTAL Revenues		\$212,640	\$326,560	\$441,856	\$543,968	\$646,176

^aIn 2012, we expect to hire one faculty member through a partnership with NOAA. In the grant awarded to HIMB, the faculty researcher has startup funds and two graduate research assistants. The salary listed here is for the Program Coordinator. Also, Biology will recruit a faculty member for the Chao Endowed Chair in Marine Biology. The College of Natural Sciences plans to hire faculty in Marine Biology and will continue to make investments in this program.

^bIn 2013, the Program Coordinator continues.

^cIn 2014, we expect to hire from reassigned position through retirements.

^dIn 2015, the table shows the continuing costs for the Program Coordinator.

^eIn 2016, we expect to hire from reassigned positions through retirements.

^fStudents currently enrolled in the program also will select courses from the following list of courses. Although five new courses have been designed for the Graduate program, we anticipate that the survey of course will be taught by existing faculty. We also anticipate that any newly hired faculty may wish to develop new courses in their particular sub-disciplines or that address new program needs.

- ANSC 450 Aquaculture Production (3)
- BOT 480 Algal Diversity and Evolution (4)
- BOT 680 Marine Macrophytes Seminar (2)
- OCN 450 Aquaculture Production (3) same as ANSC 450
- OCN 621 Biological Oceanography (3)
- OCN 626 Marine Microplankton Ecology (4)
- OCN 627 Ecology of Pelagic Marine Animals (4)
- OCN 628 Benthic Biological Oceanography (4)
- OCN 750 Topics in Biological Oceanography (V)
- ZOOL 466 Fisheries Science (3)
- ZOOL 467 Ecology of Fishes (3)
- ZOOL 475 Biology of Invertebrates (3)
- ZOOL 620 Marine Ecology (3)

^gSince graduate students will only be accepted into the program if research funding extramural resources for at least two years are available, the generation of tuition as a source of revenue will be limited. An estimated two students will not be supported on extramural funds and will pay full tuition.

10.0 Impact on current courses or programs.

The graduate degree program is expected to have a positive impact on programs at UHM because it will attract students who otherwise would not have selected the University of Hawai'i. Presently several academic units receive graduate applications for studies in marine biology but these programs cannot support the large number of highly qualified applicants. Thus, this program should reduce unmet need of these programs. The program is designed to directly support the graduate education goals as identified by the University of Hawai'i Strategic Plan. The home unit of each instructor that contributes to the program will receive the returned tuition as incentive for participation.

11.0 Proposed Graduate Faculty for Graduate Program in Marine Biology

Graduate Faculty	Department	College/School	Rank	email
Harry Ako	MMBE	CTAHR	Professor	hako@hawaii.edu
Marlin Atkinson	HIMB/Oceanog	SOEST	Professor	mja@hawaii.edu
Whitlow Au	HIMB/Oceanog	SOEST	Researcher	wau@hawaii.edu
Robert Bidigare	HIMB	SOEST	Professor	bidigare@hawaii.edu
Paul Bienfang	Oceanography	SOEST	Researcher	bienfang@hawaii.edu
Brian Bowen	HIMB	SOEST	Researcher	bbowen@hawaii.edu
Sean Callahan	Microbiology	CNS	Professor	scallaha@hawaii.edu
Rebecca Cann	Cell Mol Biol	CNS	Professor	rcann@hawaii.edu
David Carlon	Biology	CNS	Assoc Prof	carlon@hawaii.edu
Mathew Church	CMORE/Oceanog	SOEST	Asst Prof	mjchurch@hawaii.edu
Kathleen Cole	Biology	CNS	Assoc Prof	colek@hawaii.edu
H. Gert de Coet	Biology	CNS	Professor	couet@hawaii.edu
Megan Donahue	HIMB	SOEST	Asst. Researcher	donahuem@hawaii.edu
Stuart Donachie	Microbiology	CNS	Assoc. Prof	donachie@hawaii.edu
Jeffrey Drazen	Oceanography	SOEST	Assoc. Prof	jdrazen@hawaii.edu
Ruth Gates	HIMB	SOEST	Researcher	rgates@hawaii.edu
Erica Goetze	Oceanography	SOEST	Asst Prof	egoetze@hawaii.edu
Gordon Grau	HIMB/Biology	SOEST/CNS	Professor	grau@hawaii.edu
Michael Hadfield	Kewalo/Biology	PBRC	Professor	hadfield@hawaii.edu
Kim Holland	HIMB	SOEST	Researcher	kholland@hawaii.edu
Cynthia Hunter	Biology	CNS	Assoc. Prof	cindyh@hawaii.edu
David Karl	CMORE/Oceanog	SOEST	Professor	dkarl@hawaii.edu
Stephen Karl	HIMB	SOEST	Assoc. Researcher	skarl@hawaii.edu
Jo-Ann Leong	HIMB	SOEST	Professor	joannleo@hawaii.edu
Mark Martindale	Kewalo/Biology	PBRC	Researcher	mqmartin@hawaii.edu
Margaret McManus	Oceanography	SOEST	Assoc. Prof	mamc@hawaii.edu
Paul Nachtigall	HIMB	SOEST	Researcher	nachtiga@hawaii.edu
Brian Popp	Geology & Geophysics	SOEST	Professor	popp@hawaii.edu
Michael Rappe	HIMB	SOEST	Assoc. Researcher	rappe@hawaii.edu
Robert Richmond	Kewalo/Biology	PBRC	Researcher	richmond@hawaii.edu
Alison Rieser	Geography	CNS	Professor	rieser@hawaii.edu

Tetsuzan Benny Ron	Chancellor's Office		Aquaculture Prog	bennyron@hawaii.edu
Elaine Seaver	Kewalo/Biology	PBRC	Assoc. Researcher	seaver@hawaii.edu
Karen Selph	Oceanography	SOEST	Assoc. Specialist	selph@hawaii.edu
Alison Sherwood	Botany	CNS	Assoc. Prof.	asherwoo@hawaii.edu
Craig Smith	Oceanography	SOEST	Professor	craig.smith@hawaii.edu
Celia Smith	Botany	CNS	Professor	limuwahine@gmail.com
Grieg Steward	Oceanography	SOEST	Assoc. Prof.	grieg@hawaii.edu
Florence Thomas	HIMB	SOEST	Assoc. Researcher	fithomas@hawaii.edu
Robert Toonen	HIMB	SOEST	Assoc. Researcher	toonen@hawaii.edu
Timothy Tricas	Biology	CNS	Professor	tricas@hawaii.edu
Guangyi Wang	Oceanography	SOEST	Assoc. Prof.	guangyi@hawaii.edu
Les Watling	Biology	CNS	Professor	watling@hawaii.edu
Kevin Weng	Oceanography/JIMAR	SOEST	Prog. Mgr./PFRP	kevin.weng@hawaii.edu

Affiliate Graduate Faculty

Greta Aeby	HIMB	SOEST	Asst. Researcher	greta@hawaii.edu
Jonathan Brodziak	PIFSC	NOAA		Jon.Brodziak@noaa.gov
Gerard Dinardo	PIFSC	NOAA		Gerard.Dinardo@noaa.gov
Jeffrey Polovina	PIFSC	NOAA		Jeffrey.Polovina@noaa.gov
Robert Nishimoto	DLNR	HI State Gov		Robert.T.Nishimoto@hawaii.gov
Alan Friedlander	Hawaii Coop Fish Unit	CNS	Professor	alan.friedlander@hawaii.edu
Daniel Polhemus	Papahanaumokuakea	USFWS	Prog. Mgr., USFWS	Daniel_A_Polhemus@fws.gov
Randall Kosaki	Papahanaumokuakea	NOAA	Chief Scientist	Randall.Kosaki@noaa.gov
Jim Beets	Marine Sciences	UH Hilo	Professor	beets@hawaii.edu
Michael Seki	PIFSC	NOAA		Michael.Seki@noaa.gov
Thierry Work	USGS	USGS		Thierry_Work@usgs.gov
Charles Birkeland	Hawaii Coop Fish Unit	CNS	Retired Prof	charlesb@hawaii.edu
Samuel Pooley	PIFSC	NOAA	Director	Samuel.Pooley@noaa.gov

Abbreviations: PIFSC, Pacific Islands Fisheries Science Center; PFRPC, Pelagic Fisheries Research Program Center; DLNR, Department of Land and Natural Resources.

12.0 Program Quality and Evaluation

Benchmarks in Program Assessment - The evaluation of the Program Quality for Graduate Training in Marine Biology will be conducted on a routine basis, with a preliminary program assessment in Year 3 of the program and a comprehensive assessment in Year 4, and every 5 years thereafter. In the National Research Council Assessment of the Research Doctorate Programs in the United States (2010), the data required for assessment included 20 characteristics for quality evaluation:

1. Publications per allocated faculty member
2. Citations per publication
3. Percent faculty with grants
4. Awards per allocated faculty member
5. Percent interdisciplinary faculty
6. Percent non-Asian minority faculty
7. Percent female faculty
8. Average GRE scores
9. Percent 1st year students with full support
10. Percent 1st year students with external funding
11. Percent non-Asian minority students
12. Percent female students
13. Percent international students
14. Average Ph.D. candidates in 2012-16. (This criterion might be too soon for this new program)
15. Average completion percentage
16. Median time to degree
17. Percent students with academic plans
18. Student workspace
19. Student health insurance
20. Number of student activities offered (internships, work experience, field experience)

Providing this information for an assessment of the program should be relatively easy and listing the components of the assessment at this early stage will provide graduate faculty members and students the measures to track the program's development. However, the critical assessment of the program should consider the training of the graduate students that will include translation of their research findings into publications and professional presentations, and placement in postdoctoral programs and/or professional positions that include federal, state, and non-governmental research and regulatory agencies, academic education and research positions, and community organizations.

The program contains requirements that will ensure that the graduate students are adequately trained and prepared for professional employment opportunities (see 5.0 Program Description). The graduate program of study at the doctoral level will include:

- a. required research defense

- b. required seminar presentations
- c. required teaching assistant experience
- d. comprehensive exam.
- e. dissertation defense.

Student Assessment of Program – Graduates of the Marine Biology graduate program will be tracked and a survey instrument will be developed to monitor post-graduate professional activities and obtain feedback on satisfaction with the Ph. D. program.

APPENDIX A

APPENDIX A:

Current Marine Biology Courses Offered at the University of Hawai'i at Mānoa. Note that 100 and 200 level courses cannot be used for a graduate degree except to remedy deficiencies.

BIOLOGY UNDERGRAD		
Coastal systems	Ecological Processes, Evolution, Nat History	BIOL 301 Marine Ecology and Evolution (3) Functional, ecological, and evolutionary problems faced by life in the sea. Draws from major marine habitats and associated communities, from the deep sea to the plankton. Impacts of overfishing, marine pollution, and land development on the ecology and evolution of marine organisms. Emphasis on developing problem solving and quantitative skills. A-F only. Pre: 265,265L; 275,275L (or concurrent); and OCN 201; or consent. Co-requisite: 301L. DB
Coastal systems	Ecological Processes	BIOL 301L Marine Ecology and Evolution Lab (1) (1 3-hr Lab) Laboratory to accompany 301. A-F only. Pre: 265, 265L; 275, 275L (or concurrent); and OCN 201; or consent. Co-requisite: 301. DY
		BIOL 403 Field Problems in Marine Biology (4) Integrated program of intensive lectures, laboratory experiments, and field surveys that focus on the biological processes that shape the lives of marine organisms at HIMB. A-F only. Pre: 301/301L or consent. DB
		BIOL 404 Advanced Topics in Marine Biology (3) Current themes in marine biology and experience in scientific assessment. Repeatable two times. A-F only. Pre: 301/301L or consent. DB
BOTANY UNDERGRAD		
	Nat history, Systematics, Evolution	BOT 480 Algal Diversity and Evolution (4) (3 Lec, 1 3-hr Lab) Principles of algal diversity, structure, and evolution. Identification of common Ha2006-2007ian algae. Pre: one of 101, BIOL 172, MICR 351, ZOOL 101; or consent. DB, DY
BOTANY GRAD		

		BOT 602 Foundations of Current Botany II (2) Discussion of current research and classical papers important to modern concepts in ecology, plant interactions with other plants or animals, and ecosystem functioning. BOT majors only. Pre: graduate standing in BOT or consent. (Spring only).
MICROBIOLOGY UNDERGRAD		
Coastal systems, Ocean systems	Ecological processes, Nat. history/ Systematics/ Evolution	MICR 401 Marine Microbiology (3) Evolution, ecology, biochemistry, genetics and physiology of marine bacteria by examining defined systems and organisms. Pre: BIOL 265/265L and 275/275L and 301/301L, and OCN 201; or 351/351L; or consent. DB
Coastal systems, Ocean systems	Ecological processes, Nat. history/ Systematics/ Evolution	MICR 401L Marine Microbiology Laboratory (1) (1 3-hr Lab) Laboratory to accompany 401. Pre: BIOL 265/265L and BIOL 275/275L and BIOL 301/301L and OCN 201; or 351/351L; 401 or concurrent; or consent. DY
Coastal systems, Ocean systems	Ecological processes, Nat. history/ Systematics/ Evolution	MICR 485 Microbes and Their Environment (3) Distribution, diversity, and roles of microorganisms in terrestrial, freshwater, and marine ecosystems. Importance of bacteria in pesticide degradation, bioremediation of oil spills, sewage treatment, biocontrol, food fermentation. Pre: BIOL 172 and CHEM 272, or consent. DB
Coastal systems, Ocean systems	Ecological processes, Nat. history/ Systematics/ Evolution	MICR 485L Microbes and Their Environment Lab (2) (2 3-hr Lab) Techniques for study of interaction of microorganisms with and within their natural habitats; symbiosis between microorganisms and plants and animals; role of microorganisms in element cycling; food fermentation by bacteria. Pre: 485 (or concurrent) or consent. DY
MICROBIOLOGY GRAD		
Coastal systems, Ocean systems	Ecological processes, Nat. history/ Systematics/ Evolution	MICR 652 Advanced Marine Microbiology (3) Advanced studies of marine microorganisms in diverse habitats with consideration of applications of marine microbes, interactions with higher organisms, phylogeny and diversity, and past and current methods. A-F only. Pre: 351 and 401, or consent. (Alt. years)

Coastal systems, Ocean systems	Ecological processes, Nat. history/ Systematics/ Evolution	MICR 680 Advances in Microbial Ecology (3) Highlights in microbial ecology; interaction of microorganisms with abiotic and biotic components of their environments. Modern techniques for study of autecology and synecology of microorganisms. Pre: 485 or consent. (Alt. years: spring)
ZOOLOGY UNDERGRAD		
	Nat. Hist., Ecological processes	ZOOL 200 Marine Biology (2) Biology and ecology of marine plants and animals; coral reefs, the deep sea, rocky shores, marine mammals, fisheries, aquaculture, pollution, and conservation of marine resources. DB
		ZOOL 200L Marine Biology Lab (1) (1 3-hr Lab) Laboratory, field trips to accompany 200. Pre: 200 (or concurrent). DY
	Ecological processes, Nat. Hist.	ZOOL 410 Corals and Coral Reefs (3) A course in the biogeography, evolution, ecology, and physiology of corals and coral reefs, and the application of this information to the management of coral reefs. Emphasis will be placed on processes such as dispersal, the evolution and operation of mutualisms, calcification, reproduction, and the maintenance of diversity. Pre: BIOL 265. Spring only.
	Fisheries	ZOOL 465 General Ichthyology (3) Biology of fishes; reproduction, physiological processes, functional anatomy, behavior, ecology, distribution, and systematics. Pre: BIOL 265. Co-requisite: 465L. DB
	Fisheries	ZOOL 465L General Ichthyology Lab (1) (2 2-hr Lab) Overview of the major orders and families of fishes of the world; introduction to local Hawaiian fishes; coverage of basic fish anatomy; introduction to field and laboratory techniques in fish research. Pre: BIOL 265. Co-requisite: 465. DY
	Fisheries	ZOOL 466 Fisheries Science (3) General characteristics of fisheries; harvesting methods; principles and techniques to derive data and analyze fished populations. Field trips. Pre: one of the following: 410, 465, 470, 608, or 620; or consent. DB

	Fisheries	ZOOL 467 Ecology of Fishes (3) Reproduction, early life history, age and growth, feeding, niche specificity, competitive interactions, communities, and evolutionary mechanisms. Pre: 465 or consent. DB
	Ecological Processes	ZOOL 470 Limnology (2) Biology, physics, chemistry of lakes, streams, estuaries. Pre: BIOL 172 or consent. Co-requisite: 470L. DB
	Ecological Processes	ZOOL 470L Limnology Lab (1) (1 3-hr Lab) Experimental and descriptive field projects on the biology, chemistry, hydrology, and physics of lakes, streams, and estuaries. Pre: BIOL 172 or consent. Co-requisite: 470. (Alt. years) DY
	Nat Hist, Systematics, Evolution	ZOOL 475 Biology of the Invertebrates (3) Body plans, development, cellular construction, physiological integration, Nat. Hist., and ecology of invertebrate animals. Emphasis on marine species, especially local ones. Pre: BIOL 172 and CHEM 161, or consent. Co-requisite: 475L. DB
	Nat Hist, Systematics, Evolution	ZOOL 475L Biology of the Invertebrates Lab (2) (2 3-hr Lab) Pre: BIOL 172 and CHEM 161, or consent. Co-requisite: 475. DY
ZOOLOGY GRAD COURSES		
Fisheries	Fisheries, Evolution	ZOOL 608 Fish Behavior and Sensory Biology (2) Lectures, readings and presentations on sensory systems and behavior of fishes. A-F only. Pre: 306, 430, 465, or 606; or consent.
Fisheries	Fisheries, Evolution	ZOOL 608L Fish Behavior and Sensory Biology Laboratory (1) (1 3-hr Lab) Laboratory study of fish sensory systems and behavior. A-F only. Pre: 306, 430, 465, or 606; or consent. Co-requisite: 608.
	Ecological Processes	ZOOL 620 Marine Ecology (3) Principles of ecology of marine biota and environment. Pre: graduate standing in zoology, oceanography, or botany; or consent.
		ZOOL 631 Biometry (4) (3 Lec, 1 2-hr Discussion) Basic statistical methods: design of studies; data exploration; probability; distributions; parametric and nonparametric one-sample, two-sample, multi-sample, regression, and correlation analyses; frequency tables. Pre: MATH 241 or consent.

		ZOOL 632 Advanced Biometry (4) (3 Lec, 1 2-hr Discussion) Multivariate statistical methods: multiple regression and correlation; multiway anova; general linear models; repeated measures and multivariate anova; loglinear analysis and logistic regression. Pre: 631 and MATH 241, or consent.
Fisheries	Fisheries, Systematics	ZOOL 666 Systematic Ichthyology (3) Review of the higher classification of the fishes of the world. Pre: 465.
		ZOOL 690 Conservation Biology (3) Theories and concepts of ecology, evolution and genetics for conservation of biological diversity. Topics will include restoration ecology, management planning, laws and policies, biological invasions. Pre: 410, 439, 620 or 623; or BOT 453, 454, 456 or 482; and 480 or BOT 462 and BIOL 375; or consent. (Cross-listed as BOT 690)
Fisheries	Fisheries	ZOOL 716 Topics in Fish and Fisheries Biology (V) Lecture-discussion of various aspects.
OCEANOGRAPHY UNDERGRAD		
Fisheries/Aquaculture Coastal Systems Ocean Systems	Fisheries/Aquaculture Ecological Processes Nat. Hist./Systemat./Evolution	OCN 201 Science of the Sea (3) Structure, formation, and features of ocean basins: seawater properties, and distributions; currents; waves; tides; characteristics of marine organisms; marine ecological principles; man and the sea. Field trip required.
Fisheries/Aquaculture Coastal Systems Ocean Systems	Fisheries/Aquaculture Ecological Processes Nat. Hist./Systemat./Evolution	OCN 201L Experiments, computer exercises and field trips demonstrating the geological, physical, chemical and biological principles of earth and ocean sciences. A-F only. Co-requisite OCN 201.
Fisheries/Aquaculture	Fisheries/Aquaculture	OCN 331 Living Resources of the Sea (3) Marine fisheries, aquaculture, and law of the sea. Principles of management of renewable resources. Political and scientific constraints and limitations. Pre: OCN 201.

Coastal Systems Ocean Systems		OCN 401 Biogeochemical Systems (3) Relationship of biogeochemical cycles in the atmosphere, lithosphere, and biosphere to global chemical cycles and planetary climatic conditions. GES degree foundation course. A-F only. Pre: OCN 201, BIOL 171/171L, BIOL 172/172L, CHEM 161/161L, CHEM 162/162L, GG101/101L, MATH 205, MATH 206/206L, MATH 231 (or GG 312), MATH 323 (or ECON 321), MET 200, OEST 310/310L, PHYS 170/170L, and PHYS 272/272L; or consent.
Coastal Systems Ocean Systems	Nat. Hist./Systemat./Evolution	OCN 402 Solar Nebula to the Human Brain (3) Changes in the chemical composition from solar nebula to meteorites, bulk earth, earth's mantle and crust, sedimentary rocks, hydrosphere, biosphere and human body and underlying principles. Pre: CHEM 161 and 162; or consent.
	Nat. Hist./Systemat./Evolution	OCN 403 Marine Functional Genomics (3) Molecular techniques in genomics and their application in the marine environment
		GG 101 Dynamic Earth (3) The natural physical environment; the landscape; rocks and minerals, rivers and oceans; volcanism, earthquakes, and other processes inside the earth; effects of human use of the Earth and its resources. Field trip. DP
		GG 101L Dynamic Earth Lab (1) (1 3-hr Lab) Hands-on study of minerals, rocks, and topographic maps. Examine volcanism, hydrology, coastal processes and hazards, geologic time and earthquakes. Field trips to investigate landslides, beaches and O'ahu geology. A-F only. Pre: one of 101, 103, 108, or 168 (or concurrent). DY
		GG 104 Volcanoes in the Sea (4) Hawaiian geology and geologic processes: origin of Hawaiian islands, volcanism, rocks and minerals, landforms, stream and coastal processes, landslides, earthquakes and tsunamis, groundwater, geologic and environmental hazards. Frequent required field trips. Credit not given for both 103 and 104. DP

		GG 325 Fundamentals of Geochemistry (3) Lecture course on theory and applications of geochemistry and environmental chemistry to Earth and ocean sciences. Topics: Chemistry of Hydrosphere-Geosphere-Biosphere system, origin/differentiation of Earth/Solar System. Pre: 200, 250, MATH 241 or MATH 251A, CHEM 162 (or concurrent); or consent. Fall only. DP
		GG 423 Marine Geology (3) Sediments, structure, geophysics, geochemistry, history of ocean basins and margins. Pre: 302 and 308; or consent. (Cross-listed as OCN 423) DP
		GG 425 Environmental Geochemistry (3) Lecture course on theory and applications of geochemistry to contaminant/pollutant distribution in the Hydrosphere-Geosphere-Biosphere system. Topics include aqueous geochemistry, thermodynamics, kinetics, organic and isotope chemistry of environmental contaminants. Pre: 325 or consent. Fall only. DP
OCEANOGRAPHY GRADUATE		
Coastal Systems Ocean Systems		620 Physical Oceanography (4) Introduction to properties of sea water, oceanographic instruments and methods, heat budget, general ocean circulation, formation of water masses, dynamics of circulation, regional oceanography, waves, tides, sea level. Core course requirement. Pre: MATH 242 (or concurrent), or consent.
Coastal Systems Ocean Systems	Fisheries/Aquaculture Ecological Processes Nat. Hist./Systemat./Evolution	621 Biological Oceanography (3) Factors governing productivity, population dynamics, distribution of organisms in major ecosystems of the ocean, pelagic and benthic ecology. Core course requirement. Pre: OCN 620 or consent.
Coastal Systems Ocean Systems		622 Geological Oceanography (3) Marine geological processes; ocean basin structure and tectonics; sedimentation. Core course requirement. Pre: GG 101 or consent.

Coastal Systems Ocean Systems	Ecological Processes	623 Chemical Oceanography (3) Chemical processes occurring in marine waters; why they occur and how they affect the oceanic environment. Core course requirement. Pre: CHEM 171 or equivalent.
Coastal Systems Ocean Systems	Ecological Processes Nat. Hist./Systemat./Evolution	626 Marine Microplankton Ecology (4) (3L, 2-hr Dis) Distribution, abundance and ecology of marine microplankton, including bacteria, algae and protozoans, with an emphasis on metabolic rates and processes. Core course requirement for biological oceanography graduate students. Pre: consent. Spring only.
Coastal Systems Ocean Systems	Fisheries/Aquaculture Ecological Processes Nat. Hist./Systemat./Evolution	627 Ecology of Pelagic Marine Animals (4) (3L, 3-hr Lb) Ecology of pelagic animals including feeding, energetics, predation, and anti-predation tactics, life-history strategies, vertical flux of materials, population dynamics, fisheries. Core course requirement for biological oceanography graduate students. Spring only. Pre: consent.
Coastal Systems Ocean Systems	Ecological Processes Nat. Hist./Systemat./Evolution	628 Benthic Biological Oceanography (4) (3L, 3-hr Lb) Processes controlling the structure and function of benthic communities including organism-sediment-flow interactions, sediment geochemistry, feeding strategies, recruitment, succession and population interactions. Spring only. Pre: consent.
	Ecological Processes	635L Radiochemical Techniques (1) (3-hr Lb) Radiation detection and measurement, separation and manipulation of radionuclides, experimental design and use of tracers. Student project based on individual interest. Pre: OCN 635 (or concurrent) and consent.

Coastal Systems Ocean Systems		638 Ocean-Atmosphere Evolution and Biogeochemical Cycles (3) Global biogeochemical cycles and evolution of Earth's surface environment. Cycling versus evolution in relation to chemical history of ocean-atmosphere-sediment system. Pre: BS in environmentally related science or 1 year of chemistry, physics and calculus.
Coastal Systems Ocean Systems	Ecological Processes Nat. Hist./Systemat./Evolution	653L Methods in Microbiological Oceanography (3) (8-hr Lb). Modern methods for sampling microbial populations from sea and for quantifying biomass and in situ rates of metabolism. Integrated field projects, theme varies. Pre: OCN 621 or 623, or consent (Cross-listed as MICRO 653L).
Coastal Systems Ocean Systems		662 Marine Hydrodynamics (3) Introduction to classical hydrodynamics and continuum mechanics; techniques for solution of Navier-Stokes equations on various scales of oceanic motion; vorticity, potential theory, viscosity and boundary layers, laminar and turbulent flow, instability. Pre: MATH 403-404 or consent.
Coastal Systems Ocean Systems	Ecological Processes	663 Satellite Oceanography (3) Techniques of satellite observations of the ocean, including temperature, pigment concentration, currents and winds; analysis of a satellite data set as term project. Pre: 620 or consent.
Coastal Systems Ocean Systems		664 Oceanographic Instrumentation & Technology (3) Measurement techniques in physical oceanography, including pressure, temperature, salinity, oxygen, optical sensors, current meters, navigation systems, ocean acoustics and mooring structures. Includes a laboratory research project. Pre: 620 or consent.
Coastal Systems Ocean Systems	Ecological Processes Nat. Hist./Systemat./Evolution	674 Seminar in Stratigraphy and Paleooceanography (2) Topics in biostratigraphy, evolution, sedimentary facies, paleoecology and paleooceanography; Mesozoic and Cenozoic marine record. Repeatable. Pre: consent (Cross-listed as GG 674).

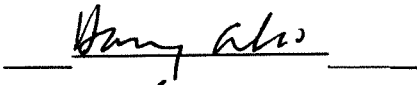
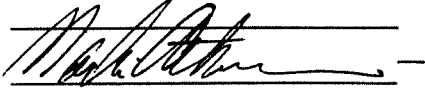
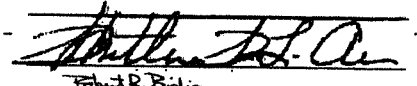



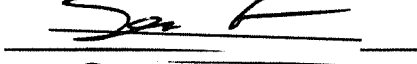

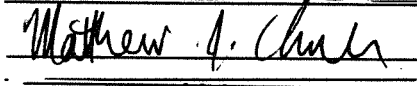
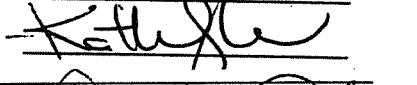
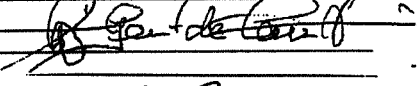
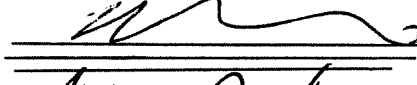

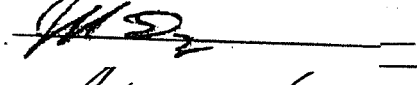
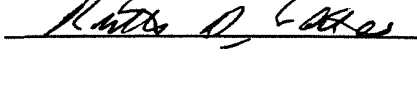

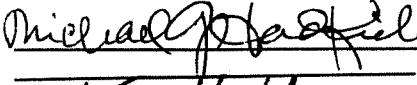
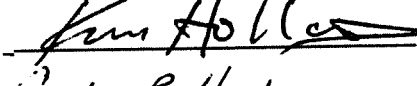
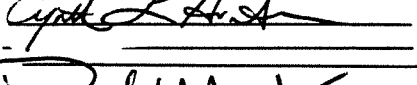
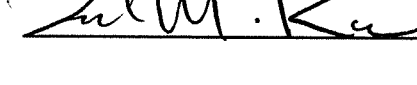
Fisheries/Aquaculture Coastal Systems Ocean Systems	Fisheries/Aquaculture Ecological Processes Nat. Hist./Systemat./Evolution	750 Topics in Biological Oceanography (V) Seminar. Literature and concepts in one of several active fields considered in detail. Pre: consent. Repeatable.
Fisheries/Aquaculture Coastal Systems Ocean Systems	Fisheries/Aquaculture Ecological Processes Nat. Hist./Systemat./Evolution	OCN 780 Seminar (1) Oceanographic topics of current interest.
	Nat. Hist./Systemat./Evolution	GG 615 Micropaleontology (3) (2 Lec, 1 3-hr Lab) Taxonomy and identification of microfossils and their recent representatives. Use in determining age, paleoecology, provenance of sedimentary rocks. Pre: 308 or consent.
	Nat. Hist./Systemat./Evolution	GG 637 Macroevolution and Earth History (3) Evolutionary biology in the context of Earth history; fossil record of life; fundamentals of microevolution; speciation, molecular evolution and phylogeny; geologic history of the Earth; evolution of genomes, development, and behavior; and case studies in evolution. A-F only Pre: BIOL 171 or equivalent. (Alt. years)
Coastal Systems Ocean Systems	Ecological Processes	GG 639 Stable Isotope Biogeochemistry (3) Stable isotope geochemistry applied to questions of biogeochemical cycling in the oceans, sediment diagenesis, paleoceanography, environmental geochemistry and ecology. Pre: 325 or consent. (Alt. years)
Coastal Systems Ocean Systems	Ecological Processes	OEST 735 Ocean Policy Seminar (2) Interdisciplinary approach to problems relating to humans and their interactions with the world's oceans and coasts. Theme changes each semester. Repeatable eight times. (Cross-listed as SOCS 735)
Coastal Systems Ocean Systems	Ecological Processes	OEST 740 Marine Biofilms: Ecology and Impact (3) Intensive description of biofilms, their growth and their impact upon engineered processes in the marine environment. Basic principles of bioadhesion, corrosion, attachment and metamorphosis of larvae (i.e. biofouling), antifouling techniques and modeling of biofilms reactors will be presented. Focus on how biofilms impact research thesis topics will also be emphasized. A-F only. Pre: good standing in any science or engineering graduate program or consent. Fall only
OTHER Relevant Courses		

Coastal Systems Ocean Systems	Ecological Processes Nat. Hist./Systemat./Evolution	ECON 358 Environmental Economics (3) Nature and causes of environmental degradation and economic solutions. Topics include air and water pollution, toxic waste, deforestation, soil erosion, biodiversity, global warming and sustainable economic growth. Pre: 120, 130, or 131; or consent
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APPENDIX B

SIGNATURES OF PROPOSED GRADUATE FACULTY

We apologize for the appearance of these pages since the 52 signatures have been put pasted together from several signature pages. To facilitate getting these signatures from 10 different units, separate signature pages were sent to each unit and then collated.

Graduate Faculty	Departmental	College/School	Signature
Harry Ako	MMBE	CTAHR	
Marlin Atkinson	HIMB/Oceanog	SOEST	
Whitlow Au	HIMB/Oceanog	SOEST	
Robert Bidigare	HIMB	SOEST	 <small>Robert R. Bidigare</small>
Paul Bienfang	Oceanography	SOEST	
Brian Bowen	HIMB	SOEST	
Sean Callahan	Microbiology	CNS	
David Carlon	Biology	CNS	
Mathew Church	CMORE/Oceanog	SOEST	
Kathleen Cole	Biology	CNS	
H. Gert de Coet	Biology	CNS	
Stuart Donachie	Microbiology	CNS	 <small>Donachie</small>
Megan Donahue	HIMB	SOEST	
Jeffrey Drazen	Oceangoraphy	SOEST	
Ruth Gates	HIMB	SOEST	
Eric Goetze	Oceanography	SOEST	
Michael Hadfield	Kewalo/Biology	PBRC	
Kim Holland	HIMB	SOEST	
Cynthia Hunter	Biology	CNS	
David Karl	CMORE/Oceanog	SOEST	

Stephen Karl	HIMB	SOEST
Judy Leums	HIMB	SOEST
Jo-Ann Leong	HIMB	SOEST
Mark Martindale	Kewalo/Biology	PBRC
Margaret McManus	Oceanography	SOEST
Paul Nachtigall	HIMB	SOEST
Brian Popp	Geology & Geophysics	SOEST
Michael Rappe	HIMB	SOEST
Robert Richmond	Kewalo/Biology	PBRC
Tetsuzan Benny Ron	Chancellor's Office	
Elaine Seaver	Kewalo/Biology	PBRC
Karen Selph	Oceanography	SOEST
Alison Sherwood	Botany	CNS
Craig Smith	Oceanography	SOEST
Celia Smith	Botany	CNS
Grieg Steward	Oceanography	SOEST
Florence Thomas	HIMB	SOEST
Robert Toonen	HIMB	SOEST
Timothy Tricas	Biology	CNS
Guangyi Wang	Oceanography	SOEST
Les Watling	Biology	CNS
Kevin Weng	Oceanography/JIMAR	SOEST

Stephen Karl

Judy Leums

Jo-Ann Leong

Mark A. Martindale

Margaret McManus

Paul Nachtigall

Brian Popp

Michael Rappe

Robert Richmond

Tetsuzan Benny Ron

Elaine Seaver

Karen Selph

Alison Sherwood

Craig Smith

Celia Smith

Grieg Steward

Florence Thomas

Robert Toonen

Timothy Co Tricas

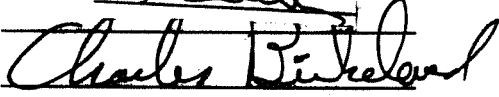
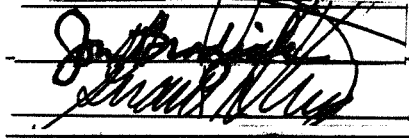

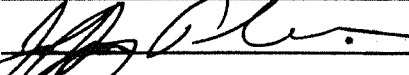

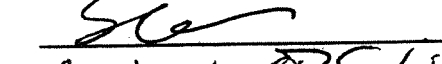

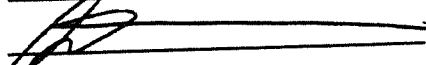

Guangyi Wang

Les Watling

Kevin Weng

Affiliate Graduate Faculty

Greta Aeby	HIMB	SOEST
Charles Birkeland	Hawaii Coop Fish Unit	CNS
Jon Brodziak	PIFSC	NOAA
Gerard DiNardo	PIFSC	NOAA
Alan Friedlander	Hawaii Coop Fish Unit	CNS
Jeffrey Polovina	PIFSC	NOAA
Daniel Polhemus	Papahanaumokuakea	USFWS
Samuel Pooley	PIFSC	NOAA
Michael Seki	PIFSC	NOAA
Thierry Work	USGS	USGS

~~9500~~










Faculty curricula vitae available upon request.

REVIEW OF LIBRARY RESOURCES



UNIVERSITY
of HAWAII
MĀNOA

October 26, 2011

MEMORANDUM

TO: Jo-Ann Leong
Professor and Director
Hawaii Institute of Marine Biology
Coconut Island

FROM: Paula Mochida
University Librarian

SUBJECT: Review of Library Marine Biology Resources

The Library has reviewed its subscriptions to, and acquisitions of, major resources in all formats that support graduate research in Marine Biology. I have enclosed a copy of that list with this memorandum. We think that these resources can adequately support Masters and PhD level research in Marine Biology and related disciplines.

The University of Hawaii at Manoa Library is a member of the Association of Research Libraries, a highly selective group of the top 126 leading research libraries in North America. The Library is also a member of several consortia which include institutions with institutes of marine biology and who participate in resource-sharing between the libraries. These resources can complement the holdings of the UH Manoa Library.

If you have questions, please contact me at: paula@hawaii.edu

Enclosed

University of Hawaii at Manoa Library Resources in Support of Graduate Education in Marine Biology

The library has long collected books, journals, and videos to support research related to marine sciences, both biological and physical sciences.

RESOURCES CATALOGED IN HAWAII VOYAGER

A search on Marine Biology as a Library of Congress subject heading retrieves 406 separate titles held in the UHM Library and in the other nine UH campus libraries.

A search on Oceanography as an LC subject heading retrieves 635 titles from our system holdings.

GUIDE TO THE RESOURCES

A Marine Sciences guide presents selected library resources, e.g. journals, databases, and encyclopedias for literature searches in marine biology. See [<guides.library.manoa.hawaii.edu/marine>](http://guides.library.manoa.hawaii.edu/marine)

DATABASES TO FIND ARTICLES

Aquatic Sciences & Fisheries Five indexes of aquatic biology, policy, and books. The indexing has an international scope and is a great source for articles and for harder to find materials (policy papers, book chapters)

Biological Abstracts A premier index of biological literature from 1926--the online version covers biological journal literature from 1969 to present. Make your search better by using the descriptors and selecting a field such as organism rather than using keyword anywhere.

BioOne1 and BioOne2

A collection of full-text online journals published by scientific societies, strong in conservation and environmental studies.

Geobase

Citations for journal articles, books, monographs, conference proceedings, and reports, many with abstracts, in environmental sciences and geology.

JSTOR Arts & Sciences

A collection of full-text online core ecology and science journals that can be searched for literature back to the first issues of key scientific journals such as Ecology, Science, Copeia.

Oceanic Abstracts

Citations and abstracts covering worldwide technical literature on the marine and brackish-water environments.

Web of Science

Three indexes/databases Science, Social Sciences, Arts & Humanities. Covers the core scholarly journal literature of all disciplines from 1980 to the present. The most up-to-date of the indexes. Select General Search to search on a topic. You can sort the retrieved papers by the number of citations; this is a good way to find older papers that have contributed to more current research. Select Cited Reference Search to search for papers that cite a particular author or reference

Zoological Record

An index that goes back to 1864--the online version covers zoological literature from 1978 to present. Some overlap with Biological Abstracts, but better coverage of international literature, and articles on insects and birds. Includes coverage of books and meetings that Biological Abstracts does not cover.

JOURNALS

From a search in Journal Citation Report to create a list of journals in Marine Biology with the highest impact factors I selected the top 28 journals in marine biology. The UHM Library holdings are indicated in the attached table.

COLLECTION POLICIES RELATED TO MARINE BIOLOGY

Biology

<http://library.manoa.hawaii.edu/about/collection/2008/natural2008/biology2008.html>

Botany

<http://library.manoa.hawaii.edu/about/collection/2008/natural2008/botany2008.html>

Oceanography

<http://library.manoa.hawaii.edu/about/collection/ocean/oceanography.html>

Zoology

<http://library.manoa.hawaii.edu/about/collection/natural/zoo.html>

JOURNAL CITATION REPORTS-TOP MARINE BIOLOGY JOURNALS 2010

Journal Title	ISSN	2010 Cites	Impact Factor	Print Volumes	Call Number of print	Electronic Access
ADV MAR BIOL	0065-2881	1027	4.25	v.1-current	<u>QH91.A1 A22</u>	NA
AQUACULTURE	0044-8486	21459	2.044	v.1-272	<u>SH1 .A626</u>	1995-current
AQUAT BOT	0304-3770	3827	2.087	v. 1-80	<u>OK916 .A65</u>	1995-current
AQUAT CONSERV	1052-7613	1717	1.968	NA	NA	1996-2009
AQUAT MICROB ECOL	0948-3055	3457	2.089	NA	NA	1995-current
AQUAT TOXICOL	0166-445X	7232	3.333	v.1-70	<u>QH541.5.W3 A66</u>	1995-current
BIOFOULING	0892-7014	1671	3.333	NA	NA	receive via ILL
BIOL BULL-US	0006-3185	4767	2.475	v22-213	<u>QH301 .B38</u>	1899-last year
CAN J FISH AQUAT SCI	0706-652X	15049	2.166	v.1-65	<u>QH1 .C143</u>	1996-current
CORAL REEFS	0722-4028	4126	3.78	v. 1-25	<u>QE565 .C68</u>	1997-current
ESTUAR COAST FISH SHELLFISH	1559-2723	931	1.921	v.1-current	<u>GC96 .E88</u>	1997-current
IMMUN	1050-4648	4285	3.044	NA	NA	1995-current
HARMFUL ALGAE	1568-9883	2051	4.28	NA	NA	2002-current
HYDROBIOLOGIA	0018-8158	17516	1.964	v.1-573	<u>QH90 .H9</u>	1997-current
J EXP MAR BIOL ECOL	0022-0981	11318	1.91	v.1-3131	<u>QH91.A1 J68</u>	1995-current
J MARINE SYST	0924-7963	3753	2.005	NA	NA	1995-current
J N AM BENTHOL SOC	0887-3593	4452	2.974	v.1-current	<u>QL141 .F73</u>	1986-current
J PHYCOL	0022-3646	7077	2.239	v.1-42	<u>OK564 .J68</u>	1997-current
J SEA RES	1385-1101	1696	2.444	v.1-33	<u>QH91.A1 N47</u>	1996-current
MAR BIOL	0025-3162	14720	2.011	v.1-149	<u>QH91.A1 M4</u>	1997-current
MAR BIOTECHNOL	1436-2228	2010	2.962	NA	NA	1999-current
MAR ECOL-PROG SER	0171-8630	28326	2.483	v. 1-421	<u>QH541.5.S3 M26</u>	1979-current
MAR ENVIRON RES	0141-1136	3058	1.953	v. 1-58	<u>GC1 .M355</u>	1995-current
MAR POLLUT BULL	0025-326X	10044	2.359	v.1-49	<u>GC1080 .M37</u>	1995-current
MICROB ECOL	0095-3628	5470	2.875	v.1-52	<u>QR100 .M53</u>	1997-current
OCEANOGR MAR BIOL	0078-3218	2082	8.571	v.1-current	<u>GC1 .O32</u>	NA
PHYCOLOGIA	0031-8884	2090	2.08	v.1-49	<u>OK564 .P49</u>	2005-current
REV FISH BIOL FISHER	0960-3166	1758	3.609	NA	NA	1997-current

SUPPORT LETTERS

To: Whom it may concern,

11/11/11

From: Brian Taylor, Dean of SOEST

Re: Graduate Degree in Marine Biology at UH Manoa

I write to express my strong support for the proposed graduate degree program (M.S. and Ph.D.) in Marine Biology at the University of Hawaii at Manoa (UHM).

UHM, through its College of Natural Sciences (CNS) and School of Ocean and Earth Science and Technology (SOEST), is well positioned and equipped to offer this graduate program through the faculty and facilities in the relevant units (Department of Oceanography and Hawaii Institute of Marine Biology, in the case of SOEST), and further supported by numerous affiliate graduate faculty in units other than CNS and SOEST.

There is considerable interest in this graduate degree, as witnessed by the existing graduate faculty and students in the Marine Biology graduate field of study. There is growing demand for graduates with a Marine Biology advanced degree from employers in industry, government as well as academe. A graduate degree in Marine Biology at UHM will support the aspirations and further training of graduates of the UH undergraduate programs (BS in Marine Sciences at UH Hilo, AS in Marine Sciences at Maui College, and BS in Marine Biology as well as Global Environmental Sciences at UHM).

The planned graduate program calls for representatives from DLNR, DBEDT and the contributing colleges to serve on an advisory council, and I hereby commit SOEST, through the office of the Associate Dean for Academic Affairs, to serve on said council.



UNIVERSITY
of HAWAII[®]
MĀNOA

Colleges of Arts and Sciences
College of Natural Sciences
Office of the Dean

MEMORANDUM

November 14, 2011

TO: To Whom it May Concern

FROM: William L. Ditto ^{in L.D.}
Dean

SUBJECT: Proposed Marine Biology Graduate Program

I am in enthusiastic support of the proposed graduate program in Marine Biology. I cannot imagine a better time than now to implement such a program. There is tremendous demand from students and enthusiastic support from the faculty for this program. A marine biology program is not only appropriate, but also badly needed by the state and the University of Hawaii. This program will involve formal collaboration of marine biology resources between the College of Natural Sciences and SOEST. It will build upon and expand existing natural resources and contributing federal/state/community programs in marine biology/conservation in Hawaii. It formally initiates graduate level training of Marine Fisheries scientists in the University of Hawaii System. There is a need for trained scientists in marine biology as the needs increase for conservation of marine resources in the world and particularly in the Pacific Ocean. CNS is acutely aware of the need to make this investment in a program that has the potential to grow and secure students from all parts of the globe as well as Hawaii. The program will create educational opportunities that train Hawaiian/Pacific Island students in marine biology. It will lead to increased representation in the biological sciences faculty across the University of Hawaii System. It will enhance research training of future marine employees of City and County, State of Hawaii, Federal, and International agencies. The program will provide expert resources for teachers at all levels of education. Thus with this great opportunity before us, the College of Natural Sciences is prepared to support all phases of the marine biological sciences and proposed graduate degrees with future strategic faculty hires (including the Hsiao endowed chair in Marine Biology), infrastructure improvements, curricula innovations, teaching facilities and equipment, laboratories and sufficient administrative and clerical support. CNS will participate in the initiation and facilitation of new collaborations with UH and non UH agencies to strengthen the program.

For far too long one of the most significant and relevant locations in the world for the study of marine biology – the Hawaiian Islands – has been bereft of such an educational program. It is my intention to vigorously support and nurture such a program and aid the faculty, students, and staff of the University of Hawaii and the people of the Hawaiian Islands to create the very best marine biology graduate program in the world. Frankly, it is not only our duty towards our Hawaiian community but the destiny of the University of Hawaii to take this leadership role on the world stage.

2545 McCarthy Mall, Bilger Hall 102
Honolulu, Hawai'i 96822
Telephone: (808) 956-6451
Fax: (808) 956-9111

<http://www.hawaii.edu/natsci/>

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NOAA PACIFIC ISLANDS FISHERIES SCIENCE CENTER

November 7, 2011

Professor Jo-Ann C. Leong, Ph. D.
Director
Hawai'i Institute of Marine Biology,
School of Ocean & Earth Sciences Technology, University of Hawaii
PO Box 1346, Kaneohe, Hawaii 96744

Re: Proposed MARINE BIOLOGY GRADUATE PROGRAM

Dear Dr. Leong:

NOAA's Pacific Islands Fisheries Science Center strongly supports the development of an advanced degree program in Marine Biology at the University of Hawaii at Manoa. Such a program would build on the excellent work of the Hawaii Institute of Marine Biology (as well as parallel work at UH Hilo) by extending it to a formal graduate degree granting program. We have been continually surprised at the absence of such a program at the University of Hawaii which has made recruiting high level scientists to our center, particularly those with quantitative skills in ecological assessments and population dynamics related to fisheries, cetaceans, and coral reef ecosystems, difficult.

In 2000 NOAA requested the National Research Council to convene a workshop to discuss avenues the agency could take to ensure an adequate supply of experts in fisheries stock assessment (and social sciences).¹ Subsequently NMFS and the U.S. Department of Education conducted an analysis of the supply and demand for such scientists and found a considerable gap². As one step to assist, we have recently made a commitment to such education by funding, through the NOAA grants process, a graduate level faculty position at SOEST/HIMB with an emphasis on quantitative ecological assessment and population dynamics. We expect this to be an on-going commitment and hopefully one that will lead to further opportunities for collaboration between our science center and the university.

¹ Recruiting Fishery Scientists: Workshop on Stock Assessment and Social Science Careers (2000). Ocean Studies Board, National Research Council, National Academy Press. Washington, D.C.

² The Shortage in the Number of Individuals with Post-Baccalaureate Degrees in Subjects Related to Fishery Science: Report to Congress (2008). National Marine Fisheries Service and the U.S. Department of Education. NOAA Tech. Memo. NMFS-F/SPO-91, 84 p.

NOAA PACIFIC ISLANDS FISHERIES SCIENCE CENTER

Development of a formal graduate level degree program would enhance this commitment substantially and we would be happy and enthusiastic about having our scientific staff participate.

Please feel free to call me if you have any questions (808-983-5301).

Sincerely,



Samuel G. Pooley, PhD.

Director



UNIVERSITY
of HAWAII*
HILO

14 November 2011

Jo-Ann Leong, Director, Chair MB Graduate Degree Program Committee
Hawaii Institute of Marine Biology
P.O. Box 1346
Kaneohe, HI 96744

Re: Proposed Marine Biology Graduate Program at UH-Manoa

Dear Dr. Leong:

I am pleased to have this opportunity to support the proposed Marine Biology Graduate Program at UH-Manoa. Further, I formally express our desire to actively participate in cross-campus collaborations between the proposed graduate MB program and UH-Hilo's undergraduate and graduate programs including a planned Aquaculture and Fisheries program (to replace and expand upon the existing Aquaculture specialization in Agriculture). This collaboration would maximize efficiencies and student opportunities through distance education, joint faculty, and access to facilities on both Oahu and the Big Island.

An obvious structure for this cross-campus collaboration is for UH-Hilo to offer the undergraduate degrees, both UH-Hilo and UH-Manoa to offer the Masters degrees; and for the foreseeable future, UH-Manoa would offer the Ph.D. The "home" institution of each master's degree student would depend upon the home of his/her graduate committee chairman. Faculty joint appointments (at both institutions) and active administrator support will be essential.

Establishment of the Marine Biology Graduate Program is a critical step in this cross-campus collaboration. Although the "devil is in the details", I hope we will show that the University of Hawaii can truly act as an integrated system to the benefit of our students and communities.

Sincerely,

A handwritten signature in black ink, appearing to read "Kevin Hopkins".

Kevin Hopkins
Professor of Aquaculture and Director

1079 Kalaniana'ole Avenue
Hilo, Hawai'i 96720
Telephone: (808) 933-3289
Fax: (808) 933-0499
hilo.hawaii.edu

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UNIVERSITY
OF HAWAII
HILO

To: Prof. Jo-Ann C. Leong
Chair, UH-Mānoa Marine Biology Graduate Degree Proposal Committee
Director, Hawai'i Institute of Marine Biology
P.O. Box 1346
Kāne'ohe, Hawaii 96744

From: Dr. Misaki Takabayashi
Associate Professor and Chair of Marine Science Department
University of Hawaii at Hilo
200 West Kawili Street
Hilo, HI 96720

November 14th, 2011

Aloha Jo-Ann,

Thank you very much for including UH-Hilo Marine Science Department in consideration as you move forward with the Marine Biology graduate degree planning at UH-Mānoa. All of the eight faculty in our department are very active in research on marine biology, fisheries science, and chemical, geological and biological oceanography. We currently work with undergraduate students from the department, Master's students from UH-Hilo Tropical Conservation Biology and Environmental Science (TCBES) Program, as well as collaborators from UH System and other institutions. We look forward to reviewing the UH-Mānoa Marine Biology Graduate Degree proposal as a department and to determining how we can contribute and participate through our continued dialogue.

Yours truly,

Misaki Takabayashi, Ph.D.
Chair, Marine Science Department

Marine Science

200 W. KĀWILI STREET
HILO, HAWAII 96720-4091
PHONE: (808) 974-7383
FAX: (808) 933-0423

www.mare.hawaii.edu



**DEPARTMENT OF BUSINESS,
ECONOMIC DEVELOPMENT & TOURISM**

GOVERNOR

RICHARD C. LIM
DIRECTOR

MARY ALICE EVANS
DEPUTY DIRECTOR

No. 1 Capitol District Building, 250 South Hotel Street, 5th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804
Web site: www.hawaii.gov/dbedt

Telephone: (808) 586-2355
Fax: (808) 586-2377

2011 1117 153212

Ref. No. P-13461

November 18, 2011

Jo-Ann Leong, Ph.D., Professor and Director
Hawaii Institute of Marine Biology
School of Ocean and Earth Science and Technology
University of Hawaii at Manoa
P.O. Box 1346
Kaneohe, Hawaii 96744

Dear Dr. Leong:

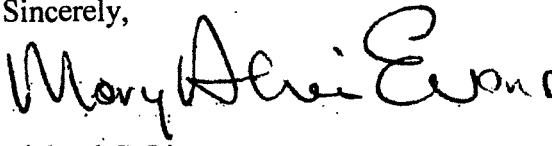
The State of Hawaii Department of Business, Economic Development and Tourism (DBEDT) supports your efforts to establish a graduate program in Marine Biology at the University of Hawaii.

The Office of Planning (OP) is an attached agency to DBEDT. OP is charged with coastal and ocean policy management, which includes developing and coordinating implementation of the Hawaii Ocean Resources Management Plan, and formulating ocean policies with respect to the exclusive economic zone, coral reefs, and national marine sanctuaries. OP's Coastal Zone Management (CZM) Program carries out much of this work through its network of federal, state, and county agencies. The use of scientific and social science data and analysis from various research projects performed by the University of Hawaii, including the School of Ocean and Earth Science and Technology, is an important factor for current and future initiatives of OP, the CZM Program, and CZM network agencies.

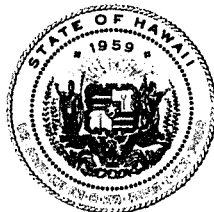
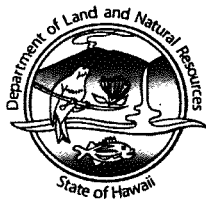
We understand the intent of your proposal to establish a graduate Marine Biology program that will train master and doctoral candidates in the marine biological sciences as they relate to the nearshore and ocean waters located in tropical and semi-tropical areas. It is important to provide decision-makers and government agencies with the best available science to ensure long-term, sustainable management of coastal and ocean resources that are essential for the economic, social, and environmental vitality of the State of Hawaii. We believe your proposal to establish a graduate Marine Biology program has the potential to positively impact our activities; therefore, we strongly support your effort.

For the above reasons, I designate Jesse K. Souki, the Director of OP, or his designee, to sit on your advisory council for DBEDT. If you have any questions, you may contact Mr. Souki at 587-2846.

Sincerely,


for Richard C. Lim
Director

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

December 5, 2011

WILLIAM J. AILA, JR.
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HISTORIC PRESERVATION
KAIHOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

Jo-Ann C. Leong
Chair, Marine Biology Graduate Specialization
University of Hawaii at Manoa

Re: Support of Graduate degrees in Marine Biology at the University of Hawaii at Manoa

Dear Jo-Ann,

The Department of Land and Natural Resources welcomes the opportunity to review the proposed Graduate degree program in Marine Biology at the University of Hawaii at Manoa and lends it support to this program. The DLNR supports the training of advanced students who will have a firm grounding in conservation research at the graduate level. In Hawaii, where the land and ocean are inextricably linked, we foresee the need for trained graduates with advanced degrees to begin to understand these linkages and to provide the scientific and cultural basis for some of the regulatory decisions that will be required in the future.

We will participate in the proposed Advisory Council for the program by providing a senior staff member to sit on the council. Please do call on us when the Marine Biology program and its Advisory Council is formed.

Aloha,

WILLIAM J. AILA, JR.,
Chairperson