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PI/PD Name: Jarrett Byrnes

Gender: ☐ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☒ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name): ☒

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PI/PD Name: Brenda H Konar

Gender: ☐ Male ☒ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☒ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

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PI/PD Name: Jonathan Grabowski

Gender: ☐ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☒ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

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PI/PD Name: Matthew S Edwards

Gender: ☒ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☒ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

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PI/PD Name: Fiorenza Micheli

Gender: ☐ Male ☒ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☐ Not Hispanic or Latino

Race: (Select one or more)
☐ American Indian or Alaska Native
☐ Asian
☐ Black or African American
☐ Native Hawaiian or Other Pacific Islander
☒ White

Disability Status: (Select one or more)
☐ Hearing Impairment
☐ Visual Impairment
☐ Mobility/Orthopedic Impairment
☐ Other
☒ None

Citizenship: (Choose one) ☐ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

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PI/PD Name: Jennifer Dijkstra

Gender: ☐ Male ☒ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☒ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
- ☐ Other
- ☒ None

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PI/PD Name: Scott Hamilton

Gender: ☒ Male ☐ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
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- ☐ Asian
- ☐ Black or African American
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- ☒ White

Disability Status: (Select one or more)
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- ☐ Visual Impairment
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PI/PD Name: Michael H Graham

Gender: ☒ Male ☐ Female

Ethnicity: (Choose one response) ☒ Hispanic or Latino ☐ Not Hispanic or Latino

Race: (Select one or more)
- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White

Disability Status: (Select one or more)
- ☐ Hearing Impairment
- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
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- ☒ None

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Collection of this information is authorized by the NSF Act of 1950, as amended, 42 U.S.C. 1861, et seq. Demographic data allows NSF to gauge whether our programs and other opportunities in science and technology are fairly reaching and benefiting everyone regardless of demographic category; to ensure that those in under-represented groups have the same knowledge of and access to programs and other research and educational oppurtunities; and to assess involvement of international investigators in work supported by NSF. The information may be disclosed to government contractors, experts, volunteers and researchers to complete assigned work; and to other government agencies in order to coordinate and assess programs. The information may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records", 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records", 63 Federal Register 268 (January 5, 1998).

02 INFORMATION ABOUT PRINCIPAL INVESTIGATORS/PROJECT DIRECTORS(PI/PD) and co-PRINCIPAL INVESTIGATORS/co-PROJECT DIRECTORS

Submit only ONE copy of this form **for each PI/PD and co-PI/PD** identified on the proposal. The form(s) should be attached to the original proposal as specified in GPG Section II.C.a. Submission of this information is voluntary and is not a precondition of award. This information will not be disclosed to external peer reviewers. ***DO NOT INCLUDE THIS FORM WITH ANY OF THE OTHER COPIES OF YOUR PROPOSAL AS THIS MAY COMPROMISE THE CONFIDENTIALITY OF THE INFORMATION.***

PI/PD Name: Diana L Steller

Gender: ☐ Male ☒ Female

Ethnicity: (Choose one response) ☐ Hispanic or Latino ☒ Not Hispanic or Latino

Race: (Select one or more)
☐ American Indian or Alaska Native
☐ Asian
☐ Black or African American
☐ Native Hawaiian or Other Pacific Islander
☒ White

Disability Status: (Select one or more)
☐ Hearing Impairment
☐ Visual Impairment
☐ Mobility/Orthopedic Impairment
☐ Other
☒ None

Citizenship: (Choose one) ☒ U.S. Citizen ☐ Permanent Resident ☐ Other non-U.S. Citizen

Check here if you do not wish to provide any or all of the above information (excluding PI/PD name): ☐

REQUIRED: Check here if you are currently serving (or have previously served) as a PI, co-PI or PD on any federally funded project ☒

Ethnicity Definition:
Hispanic or Latino. A person of Mexican, Puerto Rican, Cuban, South or Central American, or other Spanish culture or origin, regardless of race.
Race Definitions:
American Indian or Alaska Native. A person having origins in any of the original peoples of North and South America (including Central America), and who maintains tribal affiliation or community attachment.
Asian. A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.
Black or African American. A person having origins in any of the black racial groups of Africa.
Native Hawaiian or Other Pacific Islander. A person having origins in any of the original peoples of Hawaii, Guam, Samoa, or other Pacific Islands.
White. A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

WHY THIS INFORMATION IS BEING REQUESTED:

The Federal Government has a continuing commitment to monitor the operation of its review and award processes to identify and address any inequities based on gender, race, ethnicity, or disability of its proposed PIs/PDs. To gather information needed for this important task, the proposer should submit a single copy of this form for each identified PI/PD with each proposal. Submission of the requested information is voluntary and will not affect the organization's eligibility for an award. However, information not submitted will seriously undermine the statistical validity, and therefore the usefulness, of information recieved from others. Any individual not wishing to submit some or all the information should check the box provided for this purpose. (The exceptions are the PI/PD name and the information about prior Federal support, the last question above.)

Collection of this information is authorized by the NSF Act of 1950, as amended, 42 U.S.C. 1861, et seq. Demographic data allows NSF to gauge whether our programs and other opportunities in science and technology are fairly reaching and benefiting everyone regardless of demographic category; to ensure that those in under-represented groups have the same knowledge of and access to programs and other research and educational oppurtunities; and to assess involvement of international investigators in work supported by NSF. The information may be disclosed to government contractors, experts, volunteers and researchers to complete assigned work; and to other government agencies in order to coordinate and assess programs. The information may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records", 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records", 63 Federal Register 268 (January 5, 1998).

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

List of Suggested Reviewers or Reviewers Not To Include (optional)

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 13-1

PD 98-1650 **08/15/13**

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

OCE - BIOLOGICAL OCEANOGRAPHY

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
				808008122	

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)

043167352

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

University of Massachusetts Boston

AWARDEE ORGANIZATION CODE (IF KNOWN)

0022228000

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

University of Massachusetts Boston
100 Morrissey Boulevard
Dorchester, MA. 021253300

NAME OF PRIMARY PLACE OF PERF

University of Massachusetts Boston

ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE

University of Massachusetts Boston
100 Morrissey Blvd
Boston ,MA ,021253393 ,US.

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS ☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **870,667**	**48** months	**08/01/14**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☒ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ EAGER* (GPG II.D.2) ☐ RAPID** (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____
PHS Animal Welfare Assurance Number _____

☐ HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____

PI/PD DEPARTMENT
Biology Department

PI/PD POSTAL ADDRESS
100 Morrissey Blvd.

Boston, MA 02125
United States

PI/PD FAX NUMBER
805-892-2501

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Email Address
PI/PD NAME **Jarrett Byrnes**	**PhD**	**2008**	**401-529-4104**	**jarrett.byrnes@umb.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

CERTIFICATION PAGE

Certification for Authorized Organizational Representative (or Equivalent) or Individual Applicant

By electronically signing and submitting this proposal, the Authorized Organizational Representative (AOR) or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding conflict of interest (when applicable), drug-free workplace, debarment and suspension, lobbying activities (see below), nondiscrimination, flood hazard insurance (when applicable), responsible conduct of research, organizational support, Federal tax obligations, unpaid Federal tax liability, and criminal convictions as set forth in the NSF Proposal & Award Policies & Procedures Guide,Part I: the Grant Proposal Guide (GPG). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U.S. Code, Title 18, Section 1001).

Conflict of Interest Certification

When the proposing organization employs more than fifty persons, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Conflict of Interest:
By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the organization has implemented a written and enforced conflict of interest policy that is consistent with the provisions of the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Section IV.A; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the organization's expenditure of any funds under the award, in accordance with the organization's conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be disclosed to NSF.

Drug Free Work Place Certification

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent), is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency? Yes ☐ No ☒

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

Certification Regarding Lobbying

This certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding $150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:
(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.
(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Certification Regarding Nondiscrimination

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:
(1) community in which that area is located participates in the national flood insurance program; and
(2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:
(1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
(2) for other NSF grants when more than $25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

Certification Regarding Responsible Conduct of Research (RCR)
(This certification is not applicable to proposals for conferences, symposia, and workshops.)

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research.
The AOR shall require that the language of this certification be included in any award documents for all subawards at all tiers.

CERTIFICATION PAGE - CONTINUED

Certification Regarding Organizational Support

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that there is organizational support for the proposal as required by Section 526 of the America COMPETES Reauthorization Act of 2010. This support extends to the portion of the proposal developed to satisfy the Broader Impacts Review Criterion as well as the Intellectual Merit Review Criterion, and any additional review criteria specified in the solicitation. Organizational support will be made available, as described in the proposal, in order to address the broader impacts and intellectual merit activities to be undertaken.

Certification Regarding Federal Tax Obligations

When the proposal exceeds $5,000,000, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal tax obligations. By electronically signing the Certification pages, the Authorized Organizational Representative is certifying that, to the best of their knowledge and belief, the proposing organization:
(1) has filed all Federal tax returns required during the three years preceding this certification;
(2) has not been convicted of a criminal offense under the Internal Revenue Code of 1986; and
(3) has not, more than 90 days prior to this certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

Certification Regarding Unpaid Federal Tax Liability

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal Tax Liability:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has no unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

Certification Regarding Criminal Convictions

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Criminal Convictions:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has not been convicted of a felony criminal violation under any Federal law within the 24 months preceding the date on which the certification is signed.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME		

TELEPHONE NUMBER	EMAIL ADDRESS	FAX NUMBER

* EAGER - EArly-concept Grants for Exploratory Research
** RAPID - Grants for Rapid Response Research

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 13-1

PD 98-1650 **08/15/13**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

OCE - BIOLOGICAL OCEANOGRAPHY

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

1357370

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
08/15/2013	**2**	**06040000 OCE**	**1650**	**615245164**	**08/15/2013 4:04pm**

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)

926000147

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

University of Alaska Fairbanks Campus

AWARDEE ORGANIZATION CODE (IF KNOWN)

0010637000

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

University of Alaska Fairbanks Campus
West Ridge Research Bldg 008
Fairbanks, AK. 997757880

NAME OF PRIMARY PLACE OF PERF

University of Alaska Fairbanks Campus

ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE

University of Alaska Fairbanks Campus

Fairbanks ,AK ,997757880 ,US.

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS ☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **315,568**	**48** months	**08/01/14**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ EAGER* (GPG II.D.2) ☐ RAPID** (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____
PHS Animal Welfare Assurance Number _____

☐ HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____

PI/PD DEPARTMENT
School of Fisheries and Ocean Sciences

PI/PD POSTAL ADDRESS
P.O. Box 757220

Fairbanks, AK 997750900
United States

PI/PD FAX NUMBER
907-474-5804

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Email Address
PI/PD NAME **Brenda H Konar**	**PhD**	**1998**	**907-474-5028**	**bhkonar@alaska.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

CERTIFICATION PAGE

Certification for Authorized Organizational Representative (or Equivalent) or Individual Applicant

By electronically signing and submitting this proposal, the Authorized Organizational Representative (AOR) or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding conflict of interest (when applicable), drug-free workplace, debarment and suspension, lobbying activities (see below), nondiscrimination, flood hazard insurance (when applicable), responsible conduct of research, organizational support, Federal tax obligations, unpaid Federal tax liability, and criminal convictions as set forth in the NSF Proposal & Award Policies & Procedures Guide,Part I: the Grant Proposal Guide (GPG). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U.S. Code, Title 18, Section 1001).

Conflict of Interest Certification

When the proposing organization employs more than fifty persons, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Conflict of Interest:
By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the organization has implemented a written and enforced conflict of interest policy that is consistent with the provisions of the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Section IV.A; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the organization's expenditure of any funds under the award, in accordance with the organization's conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be disclosed to NSF.

Drug Free Work Place Certification

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent), is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency? Yes ☐ No ☒

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

Certification Regarding Lobbying

This certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding $150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:
(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.
(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

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(1) community in which that area is located participates in the national flood insurance program; and
(2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:
(1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
(2) for other NSF grants when more than $25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

Certification Regarding Responsible Conduct of Research (RCR)
(This certification is not applicable to proposals for conferences, symposia, and workshops.)

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research.
The AOR shall require that the language of this certification be included in any award documents for all subawards at all tiers.

CERTIFICATION PAGE - CONTINUED

Certification Regarding Organizational Support

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that there is organizational support for the proposal as required by Section 526 of the America COMPETES Reauthorization Act of 2010. This support extends to the portion of the proposal developed to satisfy the Broader Impacts Review Criterion as well as the Intellectual Merit Review Criterion, and any additional review criteria specified in the solicitation. Organizational support will be made available, as described in the proposal, in order to address the broader impacts and intellectual merit activities to be undertaken.

Certification Regarding Federal Tax Obligations

When the proposal exceeds $5,000,000, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal tax obligations. By electronically signing the Certification pages, the Authorized Organizational Representative is certifying that, to the best of their knowledge and belief, the proposing organization:
(1) has filed all Federal tax returns required during the three years preceding this certification;
(2) has not been convicted of a criminal offense under the Internal Revenue Code of 1986; and
(3) has not, more than 90 days prior to this certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

Certification Regarding Unpaid Federal Tax Liability

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal Tax Liability:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has no unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

Certification Regarding Criminal Convictions

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Criminal Convictions:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has not been convicted of a felony criminal violation under any Federal law within the 24 months preceding the date on which the certification is signed.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Andrew M Gray**	**Electronic Signature**	**Aug 15 2013 3:14PM**

TELEPHONE NUMBER	EMAIL ADDRESS	FAX NUMBER
907-474-1851	**UAF-OSP@alaska.edu**	**907-474-5444**

* EAGER - EArly-concept Grants for Exploratory Research
** RAPID - Grants for Rapid Response Research

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 13-1

PD 98-1650 **08/15/13**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

OCE - BIOLOGICAL OCEANOGRAPHY

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

1356864

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
08/14/2013	**2**	**06040000 OCE**	**1650**	**001423631**	**08/15/2013 4:04pm**

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)

041679980

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

Northeastern University

AWARDEE ORGANIZATION CODE (IF KNOWN)

0021998000

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

Northeastern University
360 Huntington Ave
Boston, MA. 021155005

NAME OF PRIMARY PLACE OF PERF

Northeastern University, Marine Science Center

ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE

Northeastern University, Marine Science Center
430 Nahant Rd
Nahant ,MA ,019081638 ,US.

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS ☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **136,813**	**48** months	**08/01/14**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ EAGER* (GPG II.D.2) ☐ RAPID** (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____
PHS Animal Welfare Assurance Number _____

☐ HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____

PI/PD DEPARTMENT

Marine and Environmental Sciences

PI/PD FAX NUMBER

PI/PD POSTAL ADDRESS

Marine Science Center
430 Nahant Rd
Nahant, MA 01908
United States

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Email Address
PI/PD NAME **Jonathan Grabowski**	**DSc**	**2002**	**781-581-7370**	**j.grabowski@neu.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

CERTIFICATION PAGE

Certification for Authorized Organizational Representative (or Equivalent) or Individual Applicant

By electronically signing and submitting this proposal, the Authorized Organizational Representative (AOR) or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding conflict of interest (when applicable), drug-free workplace, debarment and suspension, lobbying activities (see below), nondiscrimination, flood hazard insurance (when applicable), responsible conduct of research, organizational support, Federal tax obligations, unpaid Federal tax liability, and criminal convictions as set forth in the NSF Proposal & Award Policies & Procedures Guide,Part I: the Grant Proposal Guide (GPG). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U.S. Code, Title 18, Section 1001).

Conflict of Interest Certification

When the proposing organization employs more than fifty persons, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Conflict of Interest:
By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the organization has implemented a written and enforced conflict of interest policy that is consistent with the provisions of the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Section IV.A; that to the best of his/her knowledge, all financial disclosures required by that conflict of interest policy have been made; and that all identified conflicts of interest will have been satisfactorily managed, reduced or eliminated prior to the organization's expenditure of any funds under the award, in accordance with the organization's conflict of interest policy. Conflicts which cannot be satisfactorily managed, reduced or eliminated must be disclosed to NSF.

Drug Free Work Place Certification

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent), is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency? Yes ☐ No ☒

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

Certification Regarding Lobbying

This certification is required for an award of a Federal contract, grant, or cooperative agreement exceeding $100,000 and for an award of a Federal loan or a commitment providing for the United States to insure or guarantee a loan exceeding $150,000.

Certification for Contracts, Grants, Loans and Cooperative Agreements

The undersigned certifies, to the best of his or her knowledge and belief, that:
(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.
(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

Certification Regarding Nondiscrimination

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is providing the Certification Regarding Nondiscrimination contained in Exhibit II-6 of the Grant Proposal Guide.

Certification Regarding Flood Hazard Insurance

Two sections of the National Flood Insurance Act of 1968 (42 USC §4012a and §4106) bar Federal agencies from giving financial assistance for acquisition or construction purposes in any area identified by the Federal Emergency Management Agency (FEMA) as having special flood hazards unless the:
(1) community in which that area is located participates in the national flood insurance program; and
(2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:
(1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
(2) for other NSF grants when more than $25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

Certification Regarding Responsible Conduct of Research (RCR)
(This certification is not applicable to proposals for conferences, symposia, and workshops.)

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research.
The AOR shall require that the language of this certification be included in any award documents for all subawards at all tiers.

CERTIFICATION PAGE - CONTINUED

Certification Regarding Organizational Support

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that there is organizational support for the proposal as required by Section 526 of the America COMPETES Reauthorization Act of 2010. This support extends to the portion of the proposal developed to satisfy the Broader Impacts Review Criterion as well as the Intellectual Merit Review Criterion, and any additional review criteria specified in the solicitation. Organizational support will be made available, as described in the proposal, in order to address the broader impacts and intellectual merit activities to be undertaken.

Certification Regarding Federal Tax Obligations

When the proposal exceeds $5,000,000, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal tax obligations. By electronically signing the Certification pages, the Authorized Organizational Representative is certifying that, to the best of their knowledge and belief, the proposing organization:
(1) has filed all Federal tax returns required during the three years preceding this certification;
(2) has not been convicted of a criminal offense under the Internal Revenue Code of 1986; and
(3) has not, more than 90 days prior to this certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

Certification Regarding Unpaid Federal Tax Liability

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal Tax Liability:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has no unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

Certification Regarding Criminal Convictions

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Criminal Convictions:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has not been convicted of a felony criminal violation under any Federal law within the 24 months preceding the date on which the certification is signed.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Lawrence W Barnett**	**Electronic Signature**	**Aug 14 2013 11:28AM**

TELEPHONE NUMBER	EMAIL ADDRESS	FAX NUMBER
617-373-5600	**ORAF@neu.edu**	**617-373-4595**

* EAGER - EArly-concept Grants for Exploratory Research
** RAPID - Grants for Rapid Response Research

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 13-1

PD 98-1650 **08/15/13**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

OCE - BIOLOGICAL OCEANOGRAPHY

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

1357022

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
08/14/2013	**2**	**06040000 OCE**	**1650**	**073371346**	**08/15/2013 4:05pm**

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)

956042721

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

San Diego State University Foundation

AWARDEE ORGANIZATION CODE (IF KNOWN)

0011510001

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

San Diego State University Foundation
5250 Campanile Drive
San Diego, CA. 921822190

NAME OF PRIMARY PLACE OF PERF

San Diego State University

ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE

San Diego State University
5500 Campanile Ave
San Diego ,CA ,921822190 ,US.

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS
☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Responses to Changing Climate & Local Disturbances**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **166,704**	**48** months	**08/01/14**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ EAGER* (GPG II.D.2) ☐ RAPID** (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____
PHS Animal Welfare Assurance Number _____

☐ HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____

PI/PD DEPARTMENT
Biology

PI/PD POSTAL ADDRESS
5250 Campanile Drive
San Diego, CA 921151338
United States

PI/PD FAX NUMBER
619-594-5676

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Email Address
PI/PD NAME **Matthew S Edwards**	**PhD**	**2001**	**619-594-7049**	**Edwards@sciences.sdsu.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

CERTIFICATION PAGE

Certification for Authorized Organizational Representative (or Equivalent) or Individual Applicant

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(If answer "yes", please provide explanation.)

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The undersigned certifies, to the best of his or her knowledge and belief, that:
(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.
(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.
(3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

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(2) building (and any related equipment) is covered by adequate flood insurance.

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant located in FEMA-designated special flood hazard areas is certifying that adequate flood insurance has been or will be obtained in the following situations:
(1) for NSF grants for the construction of a building or facility, regardless of the dollar amount of the grant; and
(2) for other NSF grants when more than $25,000 has been budgeted in the proposal for repair, alteration or improvement (construction) of a building or facility.

Certification Regarding Responsible Conduct of Research (RCR)
(This certification is not applicable to proposals for conferences, symposia, and workshops.)

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The AOR shall require that the language of this certification be included in any award documents for all subawards at all tiers.

CERTIFICATION PAGE - CONTINUED

Certification Regarding Organizational Support

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(1) has filed all Federal tax returns required during the three years preceding this certification;
(2) has not been convicted of a criminal offense under the Internal Revenue Code of 1986; and
(3) has not, more than 90 days prior to this certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

Certification Regarding Unpaid Federal Tax Liability

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal Tax Liability:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has no unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

Certification Regarding Criminal Convictions

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Criminal Convictions:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has not been convicted of a felony criminal violation under any Federal law within the 24 months preceding the date on which the certification is signed.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Dena K Plemmons**	**Electronic Signature**	**Aug 14 2013 5:14PM**

TELEPHONE NUMBER	EMAIL ADDRESS	FAX NUMBER
619-594-5938	**awards@foundation.sdsu.edu**	**619-594-4109**

* EAGER - EArly-concept Grants for Exploratory Research
** RAPID - Grants for Rapid Response Research

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 13-1

PD 98-1650 **08/15/13**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

OCE - BIOLOGICAL OCEANOGRAPHY

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

1357008

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
08/14/2013	**2**	**06040000 OCE**	**1650**	**009214214**	**08/15/2013 4:05pm**

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)

941156365

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

Stanford University

AWARDEE ORGANIZATION CODE (IF KNOWN)

0013052000

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

3160 Porter Drive
Suite 100
Palo Alto, CA 94304-1212

NAME OF PRIMARY PLACE OF PERF

Hopkins Marine Station of Stanford University

ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE

Hopkins Marine Station of Stanford University
120 Oceanview Blvd
Pacific Grove ,CA ,939503924 ,US.

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS
☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate and Local Disturbances**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **96,657**	**48** months	**08/01/14**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)
☐ HISTORIC PLACES (GPG II.C.2.j)
☐ EAGER* (GPG II.D.2) ☐ RAPID** (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____
PHS Animal Welfare Assurance Number _____

☐ HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____

PI/PD DEPARTMENT
Hopkins Marine Station

PI/PD FAX NUMBER
831-375-0793

PI/PD POSTAL ADDRESS
Oceanview Boulevard

Pacific Grove, CA 93950
United States

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Email Address
PI/PD NAME **Fiorenza Micheli**	**PhD**	**1995**	**831-655-6250**	**micheli@stanford.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

CERTIFICATION PAGE

Certification for Authorized Organizational Representative (or Equivalent) or Individual Applicant

By electronically signing and submitting this proposal, the Authorized Organizational Representative (AOR) or Individual Applicant is: (1) certifying that statements made herein are true and complete to the best of his/her knowledge; and (2) agreeing to accept the obligation to comply with NSF award terms and conditions if an award is made as a result of this application. Further, the applicant is hereby providing certifications regarding conflict of interest (when applicable), drug-free workplace, debarment and suspension, lobbying activities (see below), nondiscrimination, flood hazard insurance (when applicable), responsible conduct of research, organizational support, Federal tax obligations, unpaid Federal tax liability, and criminal convictions as set forth in the NSF Proposal & Award Policies & Procedures Guide,Part I: the Grant Proposal Guide (GPG). Willful provision of false information in this application and its supporting documents or in reports required under an ensuing award is a criminal offense (U.S. Code, Title 18, Section 1001).

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Drug Free Work Place Certification

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent), is providing the Drug Free Work Place Certification contained in Exhibit II-3 of the Grant Proposal Guide.

Debarment and Suspension Certification

(If answer "yes", please provide explanation.)

Is the organization or its principals presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency? Yes ☐ No ☒

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) or Individual Applicant is providing the Debarment and Suspension Certification contained in Exhibit II-4 of the Grant Proposal Guide.

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CERTIFICATION PAGE - CONTINUED

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(1) has filed all Federal tax returns required during the three years preceding this certification;
(2) has not been convicted of a criminal offense under the Internal Revenue Code of 1986; and
(3) has not, more than 90 days prior to this certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

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AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Nicole Pobuta**	**Electronic Signature**	**Aug 14 2013 4:50PM**

TELEPHONE NUMBER	EMAIL ADDRESS	FAX NUMBER
650-723-6267	**npobuta@stanford.edu**	**650-725-0093**

* EAGER - EArly-concept Grants for Exploratory Research
** RAPID - Grants for Rapid Response Research

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 13-1

PD 98-1650 **08/15/13**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

OCE - BIOLOGICAL OCEANOGRAPHY

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

1356833

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
08/14/2013	**2**	**06040000 OCE**	**1650**	**111089470**	**08/15/2013 4:05pm**

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)

026000937

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

University of New Hampshire

AWARDEE ORGANIZATION CODE (IF KNOWN)

0025890000

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

51 COLLEGE RD SERVICE BLDG 107
Durham, NH 03824-3585

NAME OF PRIMARY PLACE OF PERF

University of New Hampshire

ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE

University of New Hampshire

NH ,038243515 ,US.

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS ☐ IF THIS IS A PRELIMINARY PROPOSAL
☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **223,444**	**48** months	**08/01/14**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☒ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)
☐ PROPRIETARY & PRIVILEGED INFORMATION (GPG I.D, II.C.1.d)
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☐ EAGER* (GPG II.D.2) ☐ RAPID** (GPG II.D.1)
☐ VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____
PHS Animal Welfare Assurance Number _____

☐ HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____
Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____

PI/PD DEPARTMENT
Center for Coastal and Ocean Mapping

PI/PD POSTAL ADDRESS
24 Colovos Roaad

Durham, NH 038243585
United States

PI/PD FAX NUMBER
603-862-0838

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Email Address
PI/PD NAME **Jennifer Dijkstra**	**PhD**	**2007**	**603-862-1775**	**dijkstra@cisunix.unh.edu**
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				
CO-PI/PD				

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(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.
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AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Cheryl A Moore**	**Electronic Signature**	**Aug 14 2013 10:03AM**

TELEPHONE NUMBER	EMAIL ADDRESS	FAX NUMBER
603-862-1992	**cheryl.moore@unh.edu**	**603-862-3564**

* EAGER - EArly-concept Grants for Exploratory Research
** RAPID - Grants for Rapid Response Research

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./CLOSING DATE/if not in response to a program announcement/solicitation enter NSF 13-1

PD 98-1650 **08/15/13**

FOR CONSIDERATION BY NSF ORGANIZATION UNIT(S) (Indicate the most specific unit known, i.e. program, division, etc.)

OCE - BIOLOGICAL OCEANOGRAPHY

FOR NSF USE ONLY

NSF PROPOSAL NUMBER

1357300

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
08/15/2013	**2**	**06040000 OCE**	**1650**	**056820715**	**08/15/2013 4:05pm**

EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)

946017638

SHOW PREVIOUS AWARD NO. IF THIS IS
☐ A RENEWAL
☐ AN ACCOMPLISHMENT-BASED RENEWAL

IS THIS PROPOSAL BEING SUBMITTED TO ANOTHER FEDERAL AGENCY? YES ☐ NO ☒ IF YES, LIST ACRONYM(S)

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE

San Jose State University Foundation

AWARDEE ORGANIZATION CODE (IF KNOWN)

0011551001

ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE

210 North Fourth Street
San Jose, CA 95112-5569

NAME OF PRIMARY PLACE OF PERF

Moss Landing Marine Laboratories

ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE

Moss Landing Marine Laboratories
8272 Moss Landing Road
Moss Landing ,CA ,950399647 ,US.

IS AWARDEE ORGANIZATION (Check All That Apply) (See GPG II.C For Definitions)
☐ SMALL BUSINESS ☐ MINORITY BUSINESS ☐ FOR-PROFIT ORGANIZATION ☐ WOMAN-OWNED BUSINESS

☐ IF THIS IS A PRELIMINARY PROPOSAL THEN CHECK HERE

TITLE OF PROPOSED PROJECT **Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **190,732**	**48** months	**08/01/14**	

CHECK APPROPRIATE BOX(ES) IF THIS PROPOSAL INCLUDES ANY OF THE ITEMS LISTED BELOW

☐ BEGINNING INVESTIGATOR (GPG I.G.2)
☐ DISCLOSURE OF LOBBYING ACTIVITIES (GPG II.C.1.e)
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☐ VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____
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Exemption Subsection _____ or IRB App. Date _____
☐ INTERNATIONAL COOPERATIVE ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)
_____

PI/PD DEPARTMENT
Moss Landing Marine Laboratories

PI/PD FAX NUMBER
408-924-1496

PI/PD POSTAL ADDRESS
210 N. Fourth Street, 4th floor

San Jose, CA 95122
United States

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Email Address
PI/PD NAME **Scott Hamilton**	**PhD**	**2007**	**408-924-1434**	**shamilton@mlml.calstate.edu**
CO-PI/PD **Michael H Graham**	**PhD**	**2000**	**831-771-4481**	**mgraham@mlml.calstate.edu**
CO-PI/PD **Diana L Steller**	**PhD**	**2003**	**831-771-4440**	**dsteller@mlml.calstate.edu**
CO-PI/PD				
CO-PI/PD				

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(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, ''Disclosure of Lobbying Activities,'' in accordance with its instructions.
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Certification Regarding Responsible Conduct of Research (RCR)
(This certification is not applicable to proposals for conferences, symposia, and workshops.)

By electronically signing the Certification Pages, the Authorized Organizational Representative is certifying that, in accordance with the NSF Proposal & Award Policies & Procedures Guide, Part II, Award & Administration Guide (AAG) Chapter IV.B., the institution has a plan in place to provide appropriate training and oversight in the responsible and ethical conduct of research to undergraduates, graduate students and postdoctoral researchers who will be supported by NSF to conduct research.
The AOR shall require that the language of this certification be included in any award documents for all subawards at all tiers.

CERTIFICATION PAGE - CONTINUED

Certification Regarding Organizational Support

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that there is organizational support for the proposal as required by Section 526 of the America COMPETES Reauthorization Act of 2010. This support extends to the portion of the proposal developed to satisfy the Broader Impacts Review Criterion as well as the Intellectual Merit Review Criterion, and any additional review criteria specified in the solicitation. Organizational support will be made available, as described in the proposal, in order to address the broader impacts and intellectual merit activities to be undertaken.

Certification Regarding Federal Tax Obligations

When the proposal exceeds $5,000,000, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal tax obligations. By electronically signing the Certification pages, the Authorized Organizational Representative is certifying that, to the best of their knowledge and belief, the proposing organization:
(1) has filed all Federal tax returns required during the three years preceding this certification;
(2) has not been convicted of a criminal offense under the Internal Revenue Code of 1986; and
(3) has not, more than 90 days prior to this certification, been notified of any unpaid Federal tax assessment for which the liability remains unsatisfied, unless the assessment is the subject of an installment agreement or offer in compromise that has been approved by the Internal Revenue Service and is not in default, or the assessment is the subject of a non-frivolous administrative or judicial proceeding.

Certification Regarding Unpaid Federal Tax Liability

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Federal Tax Liability:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has no unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

Certification Regarding Criminal Convictions

When the proposing organization is a corporation, the Authorized Organizational Representative (or equivalent) is required to complete the following certification regarding Criminal Convictions:

By electronically signing the Certification Pages, the Authorized Organizational Representative (or equivalent) is certifying that the corporation has not been convicted of a felony criminal violation under any Federal law within the 24 months preceding the date on which the certification is signed.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME **Michele Vaccaro**	**Electronic Signature**	**Aug 15 2013 2:15PM**

TELEPHONE NUMBER	EMAIL ADDRESS	FAX NUMBER
408-924-1430	**michele.vaccaro@sjsu.edu**	**408-924-1496**

* EAGER - EArly-concept Grants for Exploratory Research
** RAPID - Grants for Rapid Response Research

PROJECT SUMMARY

Overview:

As oceans continue to slowly warm, we are confronted with the problem of assessing when and where climate change will cause ecosystems to rapidly shift states. These state shifts can be particularly pronounced when they affect species that serve as foundations for the entire ecosystem. This proposal will establish globally-replicated experiments to determine how slow changes in temperature - a press perturbation of climate change ? are likely to interact with the anticipated increased severity of pulsed disturbances to push kelp forest ecosystem past tipping points, engendering potential community state shifts. The proposed research asks the following questions:

1) How will global increases in water temperature affect the ability of kelp forest communities to recover from disturbance?

2) How does temperature interact with a common disturbance (storm waves) to affect kelps and their associated communities across the globe?

To answer these questions, our global network of kelp forest ecologists will conduct identical manipulative and observational experiments using standardized protocols in the kelp forests of four biogeographic regions spanning 54 sites across the globe. Results will be analyzed using nonlinear mixed models and Structural Equation Modeling (SEM) to quantify the interactions among temperature, disturbance, and kelp forest persistence.

Intellectual Merit :

Intellectual Merit: Kelp loss is being documented around the world. Loss often correlates with areas exhibiting ocean warming that show water temperatures exceeding kelps? thermal limits. However, the size and type of disturbance that actually causes loss varies from location to location; whether temperature is actually implicated in the subsequent lack of recovery is unclear. This research will take a global-scale approach to ask whether kelp forests and their associate communities will change due to interactions between the long-term press of climate change and the short-term agents of more local disturbance.

Broader Impacts :

Broader Impacts: This proposal forms the backbone of the new collaborative Kelp Ecosystem Ecology Network (KEEN). The research we propose takes the nascent international collaborations started in an ongoing synthetic working group at the National Center for Ecological Analysis and Synthesis and expands them into ongoing field work and data collection. KEEN leverages enormous amounts of international expertise in kelp forest ecology, enabling collaboration and co-operation that is heretofore unknown in the field. It will facilitate the integration of multiple research programs, allowing any student, postdoc, or researcher that is part of the network to have access to a data stream. The data we generate will put their work into an extremely broad context, and create international collaborative opportunities for members. These collaborative efforts promise to open up additional funding streams that will use this grant as a point of departure. We will reach outside of the group, opening our data to other kelp forest researchers and NGOs. Members of the network will be actively involved in bringing this work to a broader audience. Students and researchers will participate in public discussions of kelp forest ecology online in a variety of interactive platforms. We are collaborating with the Zooniverse citizen science team at the Adler Planetarium to build a platform that allows the public to assist us in understanding how canopy-forming kelps have changed since the 1980s.

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Special Information/Supplementary Documents (Data Management Plan, Mentoring Plan and Other Supplementary Documents)	3	
Appendix (List below.) **(Include only if allowed by a specific program announcement/ solicitation or if approved in advance by the appropriate NSF Assistant Director or designee)**		
Appendix Items:		

*Proposers may select any numbering mechanism for the proposal. The entire proposal however, must be paginated. Complete both columns only if the proposal is numbered consecutively.

Results from Previous NSF Support

Micheli: OCE-0410439 ($1,600,000 10/04-09/10) "Linking human and biophysical processes in coastal marine ecosystems of Baja California." *Intellectual Merit*: This project has provided novel insights on the human and natural processes underlying the varying success of small-scale fisheries. In particular, we found that interaction between variation in the natural capital and social context of fishing cooperatives of Baja California, Mexico, lead to high variation in outcomes among communities even in systems that have adopted a common management approach. Our studies also highlighted vastly different ecological, social and economic performances and important feedbacks, within a single cooperative, between fisheries for which cooperatives hold exclusive access rights and those that are instead open access. Genetic and ecological studies revealed high intra-regional spatial variation in connectivity and productivity of key harvested species, suggesting that setting fisheries regulation at finer scales than current ones would more closely match the species population dynamics. Finally, our research highlighted significant past and current climatic impacts on the coastal fisheries and human communities of Baja California, and revealed that the establishment of marine reserves may increase the resilience of exploited species to adverse oceanographic conditions.

Broader Impacts: Results have informed and supported the establishment of marine reserves by four coastal communities. The project has involved, at Stanford, 3 PhD students (2 women), 2 MS students (1 woman, 1 underrepresented), and 9 undergraduates (4 women, 3 underrepresented). Results have been presented in numerous publications, national and international conferences, departmental seminars, and in undergrad and graduate courses.

Grabowski: OCE-0709527 ($872,023, 7/07-6/12). "Collaborative Research: Direct and Indirect Coupling of Fisheries through Economic, Regulatory, Environmental and Ecological Linkages. Coupled Natural and Human Systems." *Intellectual Merit*: This project examines linkages among key fisheries (herring, lobster, groundfish) in the Gulf of Maine through field efforts, experiments and development of a model coupling economic, oceanographic, and ecological dynamics. To date, this award has supported over 10 publications, including the following five by Grabowski: Grabowski et al. 2009, 2010; Sherwood and Grabowski 2010; Runge et al. 2010; and McMahan et al. 2012. Grabowski has used a variety of field and lab approaches in this study to examine the importance of top-down and bottom-up forcing on lobster population dynamics, and has trained 1 graduate student (McMahan 2011, MSc.) as part of this project.

Grabowski: OCE-0961741 & OCE-1203859, ($131,305). "**Collaborative Research: the influence of predators on community structure and resultant ecosystem functioning at a biogeographic scale.**" *Intellectual Merit:* We are investigating how predators structure oyster reef communities by both consuming and altering the traits of prey, and if they vary biogeographic scales because factors (e.g., predator diversity, resource supplies, and physical conditions) known to affect local predator mechanisms also vary with latitude. Furthermore, we are assessing if these effects are linked to local variation in ecosystem functions such as primary production and nutrient cycling.

Broader Impacts: This study has already resulted in 4 published manuscripts (Piehler and Smyth 2011, Grabowski et al. 2012, Orrock et al. 2013, Smyth et al. 2013); three additional manuscripts stemming from this study are in review. Three graduate (1 MSc. & 2 PhD) students and one post-doctorate are currently working on this study.

Graham: OCE-0752523 ($571,027, 5/15/2008-4/30/2013). "Effects of ocean climate change on recruitment of kelp populations." *Intellectual Merit* This project supported a series of lab and field experiments to establish whether the response of kelp recruitment to climate stressors (increased ocean temperature and decreased nutrients) was affected by either (1) phylogenetic constraints or (2) local acclimation. The primary research objective for the project was to conduct a series of laboratory culture

experiments under controlled temperature and nutrient conditions and assess the successful propagation of the kelp microscopic life history under such conditions. We conducted 31 laboratory culture experiments on 19 different kelp taxa, from four regions: central California, southern California, British Columbia and Chile. We sampled kelp taxa in each of the four kelp families. In every case, temperature was the overwhelming factor driving reproductive success, rather than nutrients as previously suggested; all kelps responded to temperature with little among-taxa variability. Contrary to current paradigms, nutrients had minimal impact on kelp recruitment. After completing all phylogenetic and geographic sampling, we concluded that, although temperature has a ubiquitously negative effect on kelp recruitment, the Macrocystae and Costariaceae clades have the ability to geographically acclimate to high temperature, and that the Lessoniaceae can tolerate the warmest temperatures of all clades; the Alariaceae is intolerant of rising temperatures and therefore may be the most vulnerable to climate change. The graduate and undergraduate students conducted 21 additional experiments related to their thesis research to further explore the mechanisms of kelp reproductive success. In addition to meeting all project objectives, we exceeded the number of proposed experiments by 50%. The British Columbia team also conducted field experiments to test temperature stress on the boundaries of competing kelp foundation species.

Broader Impacts: This grant supported the thesis research of 6 MLML M.S. students (2 M, 4 F), 1 MLML B.S. student (F), and 2 UBC PHD students (1 M, 1 F) and research experience for 5 additional M.S. student (2 M, 3 F) field/laboratory assistants and has resulted in scientific presentations at the annual meetings of Benthic Ecology, Ecological Society of America, Phycological Society of America, Western Society of Naturalists and the Northwest Algal Symposium. We published 8 papers from this project and have 5 additional papers in review or in preparation for publication.

Konar & Edwards: OCE-0647844 with J. Estes ($626,678, 4/07-5/10): "Collaborative Research: Kelp forest interaction webs in the Aleutian Archipelago: Patterns and mechanism of change following the collapse of an apex predator." This research examined temporal changes in kelp forest ecosystems throughout the Aleutian Archipelago. We resurveyed 20 islands where we had historic data on kelp, urchin and otter abundances and found that the declines in otter abundances have continued, and that this has resulted in further declines in kelp beds. Further, our results show that while the kelp beds have largely been lost, remnant beds remain and are stable for several years, being maintained by physical abrasion of the seafloor by the algae. Also, our results show that the kelp beds that do remain are important in sequestering carbon from the seawater and thus produce different chemical environments within their boundaries than areas without kelp.

Intellectual Merit: This work has thus far resulted in the three peer-reviewed publication (Wilmers et al. 2012, Edwards and Konar 2012, Stewart and Konar 2012). Three additional manuscripts are currently in revision (Konar et al., Schuster and Konar, Stewart et al.). Four additional papers are being prepared for submission. In addition to publications, the PIs and graduate students have presented results at an array of scientific meetings.

Broader Impacts: This project has supported several graduate and undergraduate students from UAF and SDSU who used this opportunity to conduct thesis research and gain valuable field experience. The graduate students and PIs have done radio news interviews, used these data for public seminars, and shared findings with college and public high school classes. One of the graduate students produced short movies that were narrated by a traveling puppet and shown on Chilean children's television. We have collected kelp samples throughout the archipelago for analysis of nutritional quality, identified the possible new occurrence of urchin bald spot disease, and determined that changes this ecosystem may have larger impacts to global carbon cycles. As a result, the PIs have done radio news interviews, used these data for public seminars, and detailed our findings to college and public high school classes

Witman: OCE 1061475 ($628,896, 3/15/11 – 2/28/14) "Effects of predator diversity on the strength of trophic cascades in an oceanic benthic ecosystem." *Intellectual Merit:* Exploiting the high diversity of consumer species in Galapagos subtidal food webs to test theory about the influence of consumer diversity on ecosystem functioning, J. Witman and post-doc F. Smith have conducted trophic cascade experiments to examine the influence of predator (fish feeding on sea urchins) and herbivore (fish, urchin) richness on the consumption of benthic algae since summer 2012. The novel experimental design took a year to set up and was "open" to most behavioral and consumptive interactions, which were documented by time-lapse photography ~11 hrs. / day for 7-8 days per experiment. Initial results provide 1) the first experimental evidence that consumptive cascades occur in the Galapagos Marine Reserve with 2 species of triggerfish consuming *Eucidaris* urchins in <24 hrs., releasing algae from urchin grazing, 2) that consumer prey preferences are key as the most voracious urchin, *Lytechinus,* was apparently avoided by predators, and 3) that species identity effects at two trophic levels (herbivores, predators) appear more important than consumer diversity per se in regulating trophic cascade strength.

Broader impacts: The grant has provided training in subtidal ecology for 4 undergraduate students (senior thesis) which has influenced their career choices (marine ecology). Five publications are in preparation, and four presentations have been given - Charles Darwin Foundation, Galapagos (8/12), Northeastern University (10/12), Benthic Ecology Meetings (3/13), Galapagos Nacional Parque (8/13).

Project Introduction

As humans continue to alter the environment around us, we have witnessed multiple examples of rapid changes in the state of ecosystems (Hughes et al. 2013), many of which are triggered by the interaction of long-term press perturbations with a sudden pulsed disturbance event. Climate change in particular presents an opportunity to study the interaction between these multiple types of disturbance in ocean ecosystems (Harley et al. 2006). Classically, researchers have tried to understand the effect of long-term press perturbations, such as climate change's slow rise in temperature (Gleckler et al 2012, Roemmich et al. 2012) or short-term pulse disturbances, such as a heat-wave (Wernberg et al 2012) or storm (Byrnes et al. 2011), in isolation. We propose that we can understand many of these state shifts as an interaction between press and pulse perturbations (Bender et al. 1984, Scheffer et al. 2001). Furthermore, the effects of this interaction between press and pulsed perturbations may exert exceedingly strong effects rippling through entire food webs in systems dominated by vulnerable foundation species.

Climate change presents a wide variety of examples of the dramatic consequences of the interaction between the long-term press of temperature increases and a short-term additional disturbance. Consider, for example, coral die offs in already warming areas subjected to heat waves (McWilliams et al. 2015) or the denuding of forests when climate driven decreased tree health coincides with likewise range and phenology shifts in pest outbreaks (Williams and Liebold 2002, Bentz et al. 2010). Is this interaction between temperature change and locally pulsed disturbances general? In what types of ecosystems will this press-pulse interaction have its strongest effect? How can we better understand the interaction between press and pulse disturbance for communities and ecosystems using climate change as a backdrop?

The loss of a dominant habitat forming foundation species (*sensu* Dayton 1971) can set off a cascade of indirect changes within an ecosystem (Dunne et al. 2004, Novak et al. 2011). Climate change could thus have its strongest effects where temperature alters recovery of foundation species from local pulsed disturbances. Moreover, ecosystems that are common globally and defined by foundation species that are taxonomically closely related provide a unique opportunity to understand the generality of the effects of climate change. Temperate marine ecosystems dominated by large structure forming brown macroalgae –

kelp forests - present a unique opportunity to understand the effects of climate change via shifts in the ecology of foundation species.

Here we propose to establish a global experimental network to examine the ubiquity and generality of the interaction between long-term changes in ocean temperature and short-term disturbances for kelp forests ecosystems.

Roughly 25% of the world's coastlines are dominated by kelps (Steneck et al 2002, Cavanaugh Unpublished Data). Kelps provide numerous ecosystem functions and services. They provide food for a wide variety of herbivores, detritivores, and filter feeders (Duggins et al 1989, Krumhansl & Scheibling 2012), alter water flow around shorelines (Gaylord et al. 2007), give habitat to both adult and juveniles of a wide variety of species many of which are commercially harvested (Carr and Syms 2006), influence marine nutrient cycling (Krumhansl & Scheibling 2012), and much more (see Dayton 1985 for a thorough review). Even modest shifts in their abundance and distribution would mean a major change to coastal ocean ecosystems and to the human communities that rely on them.

Kelps are particularly susceptible to changes in ocean temperature due to their physiological and ecological dependence on cold water. Kelps equatorward range limits are set by a combination of physiological tolerance of adults (Lüning 1984, Hatcher et al. 1987), limits to reproduction (Bartsch et al. In Press), tolerance of gametophytes (tom Dieck 1983), failure of recruits (Ladah et al. 1999), and nutrient availability (Dayton 1985) which often correlates with temperature (Deysher and Dean 1986). Changes in temperature threaten to act on any and all of these. In particular, temperature induced decreases in growth and reproduction in kelps suggest that increases in temperature may inhibit kelps ability to recover from strong but local short-term disturbances (Wernberg et al. 2010). If kelps are not able to recover from a strong short-term disturbance, then the ecosystem may shift into one of several alternate states dominated by sea urchin barrens (Harrold and Reed 1985), algal turfs (Connell et al. 2008), foliose understory algae (Arkema et al. 2009), sessile suspension feeders (Rassweiler et al. 2010) and more. Each of these alternate community states has radical implications for all species in the kelp forest food web. Indeed, changes in the food web may help to force and maintain these new alternate states (Estes and Palmisano 1978).

We have already witnessed climate change related impacts on kelp forests in nearly every region of the globe. In Australia, climate change has hindered kelp recovery from heat waves (Wernberg et al 2010), caused range shifts in giant kelp (Johnson et al. 2011), facilitated range shifts of urchin herbivores (Ling et al. 2009), and has been implicated to interact with urbanization to alter the relative competitive superiority of kelps and algal turfs (Connell et al. 2008). In Norway, warming waters have facilitated epibiont growth, a dominance of ephemeral algae and large-scale kelp die-offs (Moy and Christie 2012). Similarly, in the eastern North America, warmer waters have been linked to the success of epibionts (Krumhansl & Scheibling 2011a) and increases in herbivore grazing rates (Krumhansl & Scheibling 2011b), which cause kelp canopy defoliation. Open space on the substratum may then be rapidly colonized by invasive algal species that prevent the recruitment of kelps (Levin et al. 2002, Scheibling & Gagnon 2006). We are also beginning to see range shifts in southern Europe as climate drives shifts in kelp biomass (Pehlke and Bartsch 2008, Fernandez 2011, Tuya et al. 2012) and reproduction (Bartsch et al. In Press). Last, in the exception that proves the rule, climate change has led to shifts in oceanography that have caused waters around South Africa to become colder, and thus actually has led to kelps marching towards the equator (Bolton et al. 2012).

In systems where climate change has not yet been documented to impact kelp forests, we have witnessed climatic events, such as El Niños, that give us a window into how climate change may alter these systems. For example, while giant kelp (*Macrocystis sp.*) forests have not had any documented climate-change related shifts, we know that increased temperatures after strong storms from ENSO events can suppress their recovery due to shifts in nutrient availability (Ladah et al. 1999, Hernández-Carmona et al. 2001,

Edwards 2004, Edwards and Estes 2006). Furthermore, even though no impacts have as yet been demonstrated in kelp systems of the NE pacific, there is a signal of climate change in temperature (Hansen et al. 2006) and maximum wave heights in the region (Bromirski et al. 2002, Ruggiero et al. 2010) that are expected to have strong impacts on food web structure (Byrnes et al. 2011). Incorporating temperature with disturbance may be a key to understanding why the giant kelp systems of North and South America have, as of yet, not witnessed any large-scale changes shifts. Current information on changes in other systems, such as the Northwest Atlantic, are not possible due to inadequately standardized data (Merzouk and Johnson 2011).

Given this background, we seek to answer the overarching question: *How do temperature and disturbance interact to affect kelp bed persistence?* This general question will be addressed by investigating *a) How temperature affects the ability of kelp forests to recover from disturbance and 2) How temperature interacts with local scale wave disturbance to affect kelp forest community structure?* To address these questions, we will utilize a combination of manipulative and observational experimental approaches. We have begun to create a global network of researchers studying the effects of climate change on kelp forests – the Kelp Ecosystem Ecology Network (KEEN). With funding, we will establish a global research program that examines the consequences of controlled and natural disturbance on kelp forests across thermal gradients within different biogeographic regions. This will enable us to build models to tease apart the role of temperature change *per se* versus local species-specific effects on the response of kelps and their communities to disturbance.

Question 1) How will global increases in water temperature affect the ability of kelp forest communities to recover from disturbance?

Hypotheses

- H_0: Temperature and biogeography will have no effect on kelp recovery and resulting community structure.
- H_1: Recovery of kelp forest community structure will depend on the species pool of the biogeographic region alone.
- H_2: The closer kelps come to their thermal limit, the poorer their recovery from disturbance (i.e., a linear relationship between temperature relative to kelp thermal limit and kelp recovery) and the greater the shift in the related community. This relationship is general across the globe, but may vary in strength regionally.

Figure 1: The locations of our proposed study sites for the experimental manipulation.

- H_3: Kelps and the associated community will recover from disturbance, unless a critical threshold (e.g., some temperature relative to kelps' thermal limits) is crossed. At this point, kelps fail or slowly recover and the associated community shifts. This relationship is general across the globe, but may vary in failure point regionally.

Research Methods

Biogeographic Area	Team	Location	Manipulation Sites	Observational Sites
Arctic	Dunton & Konar	Beaufort Sea, AK		1
Northeast Atlantic	Smale, O'Connor, Moore, Griffin, Burrows	UK & Ireland	4	4
Northeast Atlantic	Sousa Pinto	Portugal		1
Northeast Pacific	Caselle	Channel Islands, CA	2	2
Northeast Pacific	Edwards & Parnell	San Diego, CA	2	2
Northeast Pacific	Edwards, Graham, Steller, Hamilton	Stillwater Cove, CA	1	1
Northeast Pacific	Jane Watson	Vancouver Island, British Columbia		2
Northeast Pacific	Konar	Kachemak Bay, AK	1	1
Northeast Pacific	Micheli	Isla Natividad, Baja California	1	1
Northeast Pacific	Micheli	Hopkins Marine Station, CA	1	1
Northeast Pacific	Novak	Depoe Bay, OR		1
Northeast Pacific	Salomon	Haida Gwai & Central British Columbia	1	2
Northeast Pacific	SBC LTER	Santa Barbara, CA		5
Northwest Atlantic	Byrnes	Long Island, NY	1	2
Northwest Atlantic	Byrnes	Narraganset Bay, RI	1	2
Northwest Atlantic	Byrnes & Grabowski	Northern Massachusetts	2	5
Northwest Atlantic	Byrnes, Djikstra, Grabowski, Witman	Isles of Shoals, NH	2	4
Northwest Atlantic	Djikstra	York, Maine	1	2
Northwest Atlantic	Steneck	Pemaquid Point, ME		1
Northwest Atlantic	Witman	Murray Rock, Maine		1
Northwest Pacific	Nakaoka	Akkeshi, Japan		1
Southeast Pacific	Perez-Matus	Central Chile	4	4
Southwest Pacific	Connell	South & East Australia	3	2
Southwest Pacific	Hepburn	Southern New Zealand	2	2
Southwest Pacific	Johnson & Ling	Tasmania		2
Southwest Pacific	Shears	Northern New Zealand	4	3
Southwest Pacific	Wernberg	Perth, Western Australia	1	3

Table 1: Locations and teams performing manipulative and observational experiment.

To quantify the effect of temperature on the response of kelp communities to disturbance, we will conduct a standardized disturbance experiment. Our experiment will be repeated in five kelp-dominated regions (Northeast Atlantic, Northwest Atlantic, Northeast Pacific, Southwest Pacific, Southeast Pacific, Fig. 1). In each region, we will conduct the experiment at sites that span kelp's thermal gradients, removing all kelp plants within a plot of 8m radius (=200m^2). This plot and a nearby control plot will be sampled for kelp and associated species before, 1 month after, and 1 year after kelp removal. We will then use nonlinear models to examine the relationship effect of temperature on the response of kelps and other sessile species to manipulation.

Site selection: Each of our region's research groups have selected multiple sites within their region that span a gradient of temperature from the equatorward edge of local kelps' distributions to colder areas that support kelp communities in abundance. Sites have been selected in areas that are characterized by low wave activity to avoid the confounding effects of excessive wave disturbance. Within each site, groups will randomly select two points along the 7-12m isobath where kelps are abundant. One point will be designated the center of a control and the other of a

removal plot. A total of n=52 sites will be used, including new locations at some sites during different years in order to increase temperature variation (35 unique sites).

Preliminary analyses indicate that alternative study designs with equivalent field effort (e.g., 3 replicate plots per site with fewer sites) would have less power to distinguish between H_2 and H_3 (linear v. non-linear effects). While higher within-site replication would provide better estimate of within site variation, this is not the target of our investigation, Moreover, as long as within site variation does not overwhelm variation due to temperature (i.e., H_0 is not true), having more sites rather than more replicates per site provides the optimal design to address our hypotheses.

Sampling and Experimental Manipulation: Initial sampling and kelp removal will occur during the time of year when large-scale kelp losses are most likely to occur: early fall in the Northwest Atlantic when hurricanes can drive large swell (Bromirski and Kossin 2008, Filbee-Dexter and Scheibling 2013), January in the Northwest Pacific matching the timing of the largest winter swell disturbances (Bromirski et al. 2002), August in Alaska matching when the annual kelps naturally senesce and storms easily take the weakened individuals away (Hamilton and Konar 2007), September-November in the Northeast Atlantic matching the periods of maximum wave height in fall and early winter (Woolf et al. 2002), May-June in the Southwest Pacific matching the frequency of swells in late fall and early winter (Graham et al. 2007), and April in the Southeast Pacific matching kelp erosion (Hepburn et al. 2007) and after potential Austral summer induced die-backs (Wernberg et al. 2012). We will sample twelve $1m^2$ quadrats in the center of each plot. In each plot, we will count the abundance of kelps and estimate the cover (point-contact-method) of other large algae, and sessile invertebrates. We will also measure densities of mobile invertebrates. In experimental plots we will then remove the major structure-forming kelps in a circle 8m in radius (roughly $200m^2$) by clipping them just above their holdfast, as kelps meristems are located just beneath their blades. This method will simulate kelp die back without leading to disturbance of other sessile species. A temperature logger will be placed in the middle of the control plot.

Team Participation in Manipulation: Removal of $200m^2$ of kelp in many of these systems will require significant effort. To accomplish this, the graduate students funded by this proposal will travel to New England, Baja, Southern California, and Chile to conduct manipulations working with project PIs. These efforts will be organized by the project's co-ordinating postdoc. Students will be housed and field support will be provided by the participating institutions. Students will meet virtually in between trips to organize additional side research projects to carry out during these trips. In Australia, New Zealand, and Europe, stringent regulations and prohibitive cost will not allow for students to participate. International PIs are using current and future funds to conduct the experiment independently (see letters of support), but will work with the co-ordinating postdoc who will travel to each location. Similarly, in Alaska manipulations will be carried out by PI Konar's lab in conjunction with her subtidal ecology course, and remote Haida Gwaii manipulations will be carried as part of pre-existing research in Salomon's group. PIs from the following regions will be participating in the removal:

Northwest Atlantic: PI Jarrett Byrnes and PI Jonathan Grabowski of UMass Boston and Northeastern University, respectively, will collaborate to perform manipulations in Massachusetts and the Southern Gulf of Maine using Cat Cove Marine Lab, Northeastern's Marine Science Center and the Shoals Marine Lab. Both have extensive time in kelp systems of the Pacific (Byrnes et al. 2011) and Atlantic (McGonigle et al. 2011). Byrnes will also conduct manipulations in the Narraganset Bay and at kelps' southern range limit (Egan and Yarrish 1988) in Long Island. PI Dijtkstra (Dijkstra et al. 2011) of UNH will collaborate with PI Byrnes and Grabowski on sites at the Shoals Marine Laboratory and conduct additional manipulations in Maine.

Northeast Atlantic: The European manipulations will be lead by a team of Dan Smale, Nessa O'Connor, Pippa Moore, John Griffin and Mike Burrows. Smale (Smale 2010, Smale & Wernberg 2013) at the Marine Biological Association of the United Kingdom is currently undertaking research on the effects of

climate change on the structure and functioning of subtidal kelp beds in southwest England. O'Connor at Queen's University Belfast is currently researching the effects of multiple stressors on the functioning of coastal ecosystems(O'Connor et al. 2013, O'Connor & Donohue 2013. Moore's research has at Aberystwyth University has documented changes in the distribution, abundance and phenology of temperate subtidal reef organisms (Poloczanska et al. 2013, Moore et al. 2011). Griffin at Swansea University focuses on the consequences of change in predator diversity (Griffin et al 2008) and macroalgal functional diversity (Griffin et al. 2009). Burrows at the Scottish Marine Institute Oban is working on identifying the main controls on kelp distributions (Burrows 2012) and comparing changes in distributions with predictions modeled climate conditions (Burrows et al. 2011)

Southeast Pacific: Manipulations in the Southeast Pacific will be lead by Alejandro Pérez-Matus of the Estacion Costera de Investigaciones Marinas (ECIM), Pontificia Universidad Católica de Chile. Perez-Matus has been leading the Chilean kelp forest research network under the FONDECYT grant (Pérez-Matus et al., 2007). Under FONDECYT, kelp and kelp communities have been surveyed at 10 different locations spanning 700 km of coast since 2011. In southern Chile, Perez-Matus will jointly work with Alejandro Buschmann of Imar-Universidad de los Lagos (Vásquez and Buschman 1997, Buschman et al. 2006) to conduct research at different sites along 2000 km of coastline.

Northeast Pacific & Alaska: The team performing manipulations in the Northeast pacific includes a wide variety of scientists who have been working in these systems for years. In Central California, PIs Scott Hamilton Mike Graham, and Diana Stellar of Moss Landing Marine Lab (Steller and Edwards 2004, Graham et al. 2007, Hamilton et al. 2010) will collaborate with PI Fiorenza Micheli (Micheli and Halpern 2005, Micheli et al. 2012) of Stanford's Hopkins Marine and PI Matt Edwards (Edwards 2004) of San Diego State to perform manipulations around Monterey Bay. The student team and PI Edwards will work with Jennifer Caselle of UC Santa Barbara in the Santa Barbara channel (Caselle et al. 2010) and in San Diego, PI Edwards will conduct additional manipulations with the student team. In Baja, PIs Micheli and Edwards we will work with Guillermo Torres-Moye (Torres and Edwards *In Press*) and Gabriela Montaño-Moctezuma (Montaño-Moctezuma et al. 2007) to conduct manipulations at the southern range limit of giant kelp. PI Mark Novak (Novak et al. in prep.) at Oregon State University will lead the Oregon team. PI Brenda Konar (Konar 2000, 2007) of University of Alaska Fairbanks will lead the northern team where students in her subtidal ecology course led by a graduate student will conduct monitoring and manipulation activities.

Southwest Pacific: A number of groups from the Southwest Pacific have agreed to collaborate. Nick Shears of the University of Auckland (Shears and Babcock 2009) will be heading the experiments in Northern New Zealand. Chris Hepburn at the University of Otago will conduct experiments New Zealand's South Island (Hepburn et al. 2011) and Stewart Island (Hepburn et al. 2007). In Tasmania, Craig Johnson and Scott Ling (Ling et al. 2008, Johnson et al 2011) will run experiments in two sites. Sean Connell and Bayden Russell (Connell et al. 2008) of the University of Adelaide will run the experiment both in Adelaide as well as in sites in Eastern Australia. Last, Thomas Wernberg at the University of Western Australia will run the experiment in sites that have seen significant effects of temperature increases in the last few years (Wernberg et al 2012).

Analysis to Address Hypotheses: For our analyses, we will examine the relationship between temperature relative to kelp thermal limit of the kelp species removed and three variables: 1) response of kelp abundance to manipulation relative to control, 2) response of non-kelp algal percent cover, and 3) response of sessile invertebrate cover (see metric below). We will also examine change in mobile invertebrate abundance, but acknowledge that the noise due to high mobility of species may outweigh the signal of our removals. To calculate temperature relative to kelp thermal limit, we will use published estimates for manipulated species. We repeat the analyses below for relative temperature calculated using a) average temperature from date of removal to date of sampling, b) maximum temperature between date

of removal and date of sampling, While we are most interested in the effect of change in the average, we are also interested in how change in maximum – stress – can alter recovery.

To quantify response of a group of organisms to kelp removal at site *i* we define the quantity

$$R_{it} = (E_{it}/E_{i0})/(C_{it}/C_{i0})$$

Where R_{it} is our measure of the response after removal with E_{it}, E_{i0}, C_{it}, and C_{i0} referring to the measurement of a quantity (e.g., kelp abundance) in the Experimental (E) and Control (C) plots before the removal (0) and at some time (t) after the removal. This metric has the advantage of being 1 if the plot recovers to the same level as the control, 0 if there is a complete failure of a species, and greater than 1 if the change in the plot is positive and outstrips that in the control plot (e.g., if recovery allows a plot to overshoot the otherwise expected state). It can also be used for both the one-month and one year sample, and it can be used for all four of the aforementioned response variables.

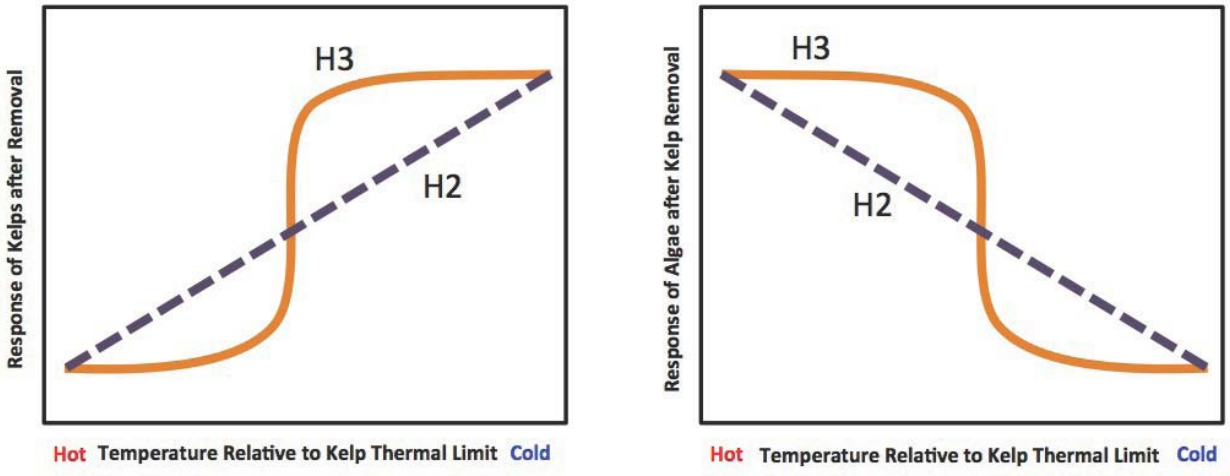

Figure 2: Conceptual models of the relationships between temperature and response of kelps and algae to removal. The linear and nonlinear responses of H2 (dashed) and H3 (solid) are highlighted.

To evaluate our five hypotheses listed above, we will fit and compare six separate linear and broken stick mixed models using an information theoretic approach (Burnham and Anderson 2002), all following the general form

$$R_{it} = \alpha_1 T_i + \alpha_2 + \Sigma\alpha_{3..j} C_{3..j} + \varepsilon$$

where T_i is the temperature relative to manipulated kelps' thermal limit, α_1 is a coefficient, α_2 is the intercept of the relationship, and $\Sigma\alpha_{3..j}C_{3..j}$ is the sum of additional covariates – percent cover of rocky substrate, urchin abundance, and maximum significant wave height from WaveWatch III (see Q2). Covariates will be included in all analyses for H1-H4. For H0, α_1 and $\alpha_2 = 0$. For H1, $\alpha_1 = 0$ and α_3 varies randomly by biogeographic region (random intercept). For H2 α_1 is non-zero, with α_3 varying. In H3, α_1 is 0, but α_3 is either 0 when D is greater than some threshold, β, or non-zero when d is less than that threshold. Similarly, β and α_2 will vary randomly by biogeographic region. In all models ε is a modeled error term. As our values are bounded at zero, we will model the error using a normal distribution, but allow the variance to scale with the mean. Examples of potential fit models for H2 and H3 can be seen in Fig. 2.

With our information theoretic analyses, we will evaluate the balance of evidence for each hypothesis, and how temperature influences kelp forest community response to disturbance.

Evaluation of Disturbance Intensity: A possible outcome of the above large-scale manipulation is that the sheer scale of the disturbance will hinder recovery in all systems, masking a temperature signal. Disturbance effects in kelp forests can range from thinning to a complete removal of kelps (Eibling et al. 1985, Seymour et al. 1989, Reed et al. 2008, Filbee-Dexter & Scheibling 2012). The nature and magnitude of community response to kelp loss, as well as the ability of the community to recover from such disturbance may vary with the extent of kelp thinning (O'Connor & Anderson 2010). To evaluate the effect of thinning on recovery, at all sites in the NW Atlantic, the network postdoc will add additional plots with 33%, 66% of original kelp density. We will evaluate the response as above using a mixed model with thinning percentage as a predictor of response and a random effect for location.

Question 2) How does temperature interact with a common disturbance (storm waves) to affect kelps and their associated communities across the globe?

Hypotheses:

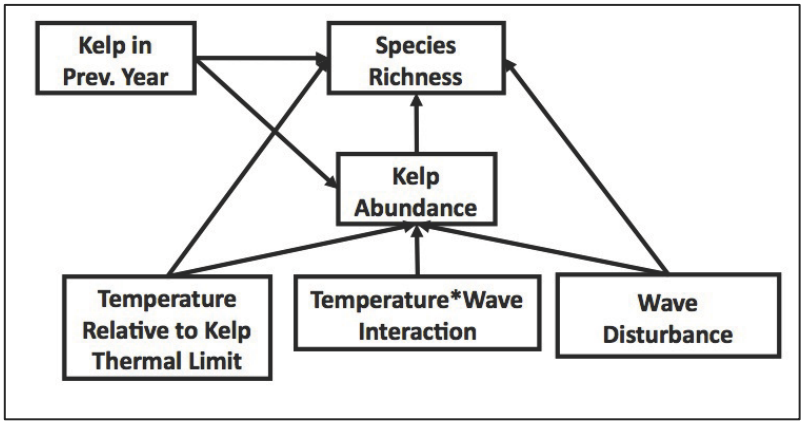

Figure 2: Model for the interaction of temperature and wave disturbance to affect kelp abundance and species richness.

- H_0: Temperature, wave disturbance, and biogeography will have no direct effect on kelp forest community structure, nor any indirect effect mediated by kelp abundance.
- H_1: Temperature, wave disturbance, and biogeography will indirectly determine kelp forest community structure via changing kelp abundance.
- H_2: Temperature, wave disturbance, their interaction, and biogeography will indirectly alter kelp forest community structure via changing kelp abundance.
- H_3: Temperature, wave disturbance, their interaction, and biogeography will indirectly alter kelp forest community structure via changing kelp abundance. Biogeography will have additional direct effects on community structure.
- H_4: Temperature, wave disturbance, their interaction, and biogeography will indirectly alter kelp forest community structure via changing kelp abundance. Temperature, disturbance, and biogeography will have additional direct effects on community structure.

Research Methods: Manipulative experiments are, by their nature, limited in scope and scale. In order to evaluate whether temperature and disturbance interact to affect whole communities, we will conduct an observational experiment as well. This experiment will be used to build a model of how temperature modifies the effects of a class of disturbance common to all kelp systems – wave disturbance (Dayton 1985, Graham et al. 2007, Reed et al. 2011). In some cases, higher temperatures have been shown to depress the recovery of kelps after wave disturbance (Edwards and Hernandez-Carmona 2005). However, it is unclear a) to what extent the effects of decreased recovery affect the entire community and b) whether temperature, wave disturbance, and their interaction all affect community structure independent of their effect on kelp. Indeed, the direct effects have the potential to outweigh the indirect effects.

Figure 4: Sites used for observational experiment.

To both answer the question of how temperature and wave disturbance interact to shape community structure both directly and indirectly via their impact on kelp, and evaluate whether these effects are entirely system specific or general across the globe, we will use Structural Equation Modeling (Bollen 1989, Grace 2006). SEM is a multivariate framework that will allow us to fit models with several interacting factors, as illustrated in Figure 3. It has proven to be an ideal method to model direct and indirect effects of disturbance on kelp forest ecology at single sites in the past (Arkema et al. 2008, Byrnes et al 2011). This approach has never been applied at a global scale, however, to address the question of how increasing temperature will modify the effect of wave disturbance on the distribution and community composition of kelp forests across different bioregions.

Site Selection: To collect data appropriate for SEM, research groups around the globe (Table 1) will sample temperate rocky reefs annually during the summer using a modified version of the Santa Barbara Coastal LTER's rocky reef sampling protocol (Arkema et al. 2008, Byrnes et al. 2012). Researchers will sample four 40m transects at 59 sites between 7-12m around the globe that vary in temperature, wave exposure, and community structure (Fig. 3). Sites are defined as areas within half a kilometer that share similar abiotic conditions. The regional distribution of sites has been selected to maximize variation in explanatory variables to increase the power of our analyses. Sites will be sampled in the middle of their hemisphere's summer. As the time-frame (see schedule) for the grant allows for one more year of sampling in the Southern Hemisphere, we have increased the number of Northern Hemisphere sites to compensate.

Data Collection: To assess abiotic variables at the site scale, we will use both *in situ* and modeled measurements. For temperature, we will deploy two HOBO pendant loggers at each site sampling temperature every half hour. Loggers will be replaced annually. As wave sensors are too costly to deploy at the large number of sites we will be sampling, we will assess swell heights using modeled wave height predictions. To assess significant swell heights, we will use results from the NOAA Wavewatch III model (Tolman et al. 2002). We will assess transect depth by averaging together the depth at the beginning, middle, and end of each transect.

To evaluate community structure along each 40m transect, we will take the following measurements: Divers will count and visually estimate the length of all fish visible along a 40m transect. The width of the fish transect will vary by biogeographic region, as differences in dominant algal type (e.g., canopy forming giant kelp versus benthic *Ecklonia radiata*) and regional variation in fish behavior have historically led to different optimal transect widths (e.g., 2m wide versus 5m wide for the aforementioned habitats). In the first summer of the project, each research team will conduct one set of four fish transects. On each transect, they will sample at 2 -5m widths. We will plot the width by average fish count estimate in order to ensure that the selected width for fish transects is correct within a biogeographic region, and that results are directly comparable between regions. In order to more accurately assess the richness of

highly mobile fish, we will also place an underwater camera at one end of transects for two hours and record the identity of all species. We will combine this with transect data for total fish richness.

Along the same 40m transect, we will sample common solitary sessile invertebrates (e.g., anemones, solitary tunicates), mobile invertebrates (e.g., urchins), and large algae using six evenly spaced 1m quadrats positioned on alternating sides along the transect. For species that are rare and/or have excessively clumped distributions (e.g., sea stars, crabs and lobsters) we will sample four 20x1m band transects. For the multistiped giant kelp (*Macrocystis sp.*) we will also record the number of stipes per plant, which is a good predictor of biomass (Reed et al. 2009). We will sample small cryptic fish in those same band transects. For each of the above methods, researchers within a biogeographic region will create closed species lists for these methods. Last, we will sample 80 evenly-spaced points (40 per side, each 1m apart) and record the identity of all sessile species (i.e., open list) and substrate type (e.g., sand or rock) at each point.

Network Participation: PIs will work either as lab groups or with other nearby PI and collaborator groups to conduct the observational experiment (Table 1). Efforts will be led by network graduate students. In addition to the groups participating in the manipulative experiment discussed in Q1, this project will obtain data from additional areas where manipulations are not possible for logistical or legal reasons:

Santa Barbara: UC Santa Barbara's Santa Barbara Coastal LTER headed by Dan Reed is a world-leading group in producing new insights and solid long-term data in kelp forest ecology (e.g., Gaylord et al. 2007, Arkema et al. 2009, Reed et al 2009). The protocol we have devised for sampling is based off of the SBC LTER protocol. Their continuing data stream can easily be incorporated into our analysis. They have generously agreed to add the additional video fish sampling to their own protocol to make their data compatible with our own.

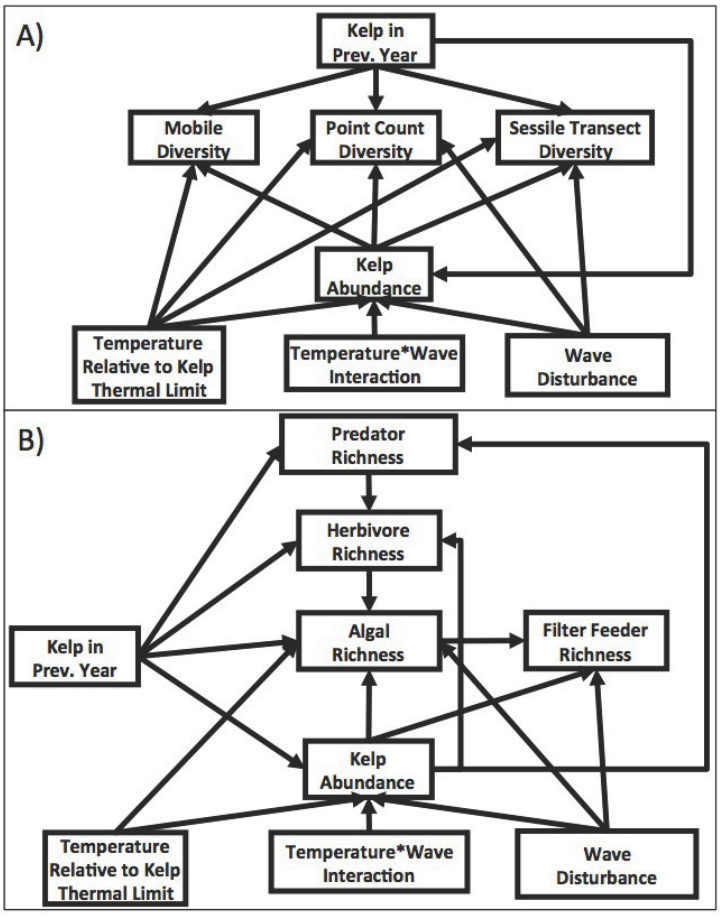

Figure 5: Models for the effect of temperature and wave disturbance on Shannon diversity (A) and richness of different functional groups (B).

Gulf of Maine: To provide further offshore and northern samples in the Northeast Atlantic, Jon Witman (Witman 1985, 1987, 1988), and Robert Steneck (Steneck et al. 2002, 2004) will subcontract to add additional sites in New Hampshire Maine. They have been sampling these sites since the 1970s providing essential points of comparison for our results. Steneck will also incorporate one site of sampling as part of the Darling Marine Center's scientific diver training program.

Arctic: Along with Brenda Konar, Ken Dunton (Dunton et al. 2006) will maintain two additional Arctic sampling sites in the Beaufort Sea.

Eastern Japan: While we cannot manipulate kelps at a large scale in Japan, Masahiro Nakaoka (Nakaoka 2005) will sample one site at eastern Hokkaido. We are now trying to increase the number of Japanese sites as the network gains momentum.

Portugal and Northern Spain: Isabel Sousa-Pinto of the University of Porto will lead sampling in continental Europe. Sousa-Pinto has been integral to the network's NCEAS working group, and will also provide co-ordination with the UN Group on Earth Observations/Biodiversity Network (GEOBON).

Additionally, as the network moves forward, we will publish our protocols for each region, and invite any other research group that is interested to contribute data. These groups will have access to all network data products before publication with the proviso that they involve the network in any publications that might result.

Analysis to Address Hypotheses: To analyze these data, we will build a number of SEMs to test four alternate hypotheses and quantify the effects of waves, temperature, and their interaction on community structure. Community structure will be characterized by several metrics: 1) species richness, 2) Shannon diversity (splitting point count versus non-point count species as the abundances for this metric come from two different sampling methods), 3) effective species richness (Jost 2006), and 4) functional group effective richness. For temperature, we will calculate the difference between the both the mean and maximum annual temperature versus the thermal maximum of the dominant kelps. We will run a set of models for each type of temperature, for reasons discussed in Q1. For wave disturbance, we will use average of the ten largest swell heights between sampling events multiplied by the kelp abundance in the previous year. We will use this metric as previous kelp forest SEM work by PI Byrnes (Byrnes et al. 2011) has shown that disturbance scales with kelp abundance.

We will test each hypothesis for each of the above four metrics using SEM (Figures 3 and 5). In this model, percent rocky substrate is incorporated as a covariate for all endogenous variables. While biogeographic region is not shown in the path model, all paths are allowed to vary randomly by region. The model will be fit using a Generalized Linear Mixed Model approach (Shipley 2009, Grace *et al*. 2012), and the fit of the whole model will be evaluated using an omnibus test of the implied conditional independence relationships (Fisher's C test *sensu* Shipley 2009). If the model does not fit the data, then we cannot reject H0. We will attempt to falsify each other hypothesis by evaluating the support for sets of paths and the effects of biogeographic region being different from zero using p-values from the fit models. Further models may be conceived and tested in the virtual course in SEM PI Byrnes will teach during year 2 to network students.

Personnel and Project Management Plan

Leadership & Coordination: PI Byrnes and UMass Boston will act as the main coordinating entity for the program. PI Byrnes's lab will coordinate procurement and mailing of temperature sensors, housing, GoPro cameras, and quadrapods to all member nodes. Additionally, UMB will house a coordinating post-doc, Kira Krumhansl currently a postdoc in Robert Scheibling's kelp forest ecology lab at Dalhousie. Kira will plan and lead all graduate student travel as a part of her research duties and conduct her own kelp-thinning project. As diving regulations differ at many labs, UMB will also house an American Academy of Underwater Scientists dive instructor, Theodore Lyman, to handle the co-ordination of diving regulations between member sites in addition to his duties coordinating the procurement and shipping of materials and managing data resources during year one and two. Last, UMass Boston will serve as the central contact point for data co-ordination and management. We will provide sites not only with the materials they need to collect and record data, but we will create the infrastructure to manage the data for use both within and outside of the network (see Data Management Plan).

Collaborating Partners: This project relies on the expertise and experience of multiple U.S. and international collaborators. All are highly experienced marine ecologists many of whom bring years of experience in kelp forest ecosystems. They also bring a broad variety of experiences working within similar networks – PI Konar and M. Nakaoka both participated in the Zostera Experimental Network and N. O'Connor and J. Griffin both participated in the MarBEF network in Europe. Each group, working alone or in concert with other regional groups, will be responsible for sampling for Q2. Those participating in Q1 will host the postdoc and any attendant graduate students. All data entry and first stage quality control will be carried out by each lab group (see *data management plan*).

Team Coordination: After the International Temperate Reefs Symposium in Perth in January 2014, all PIs are going to meet for three days to finalize protocols and co-ordination. Once the network is funded, we will have quarterly virtual meetings to check in on network progress and discuss any questions or concerns. Before these meetings, regional co-ordinators (Byrnes, Edwards, Wernberg, Pérez-Matus, and O'Connor) and the co-ordinating postdoc will meet virtually to set an agenda and deal with any larger organizational meetings. Groups in the NE Pacific will meet in Monterey Bay during the manipulation. The NW Atlantic group will also work together at the Shoals Marine laboratory to sample those sites rapidly. In addition to presentations and papers by network members during the duration of the grant, we will present the final results from our work at the following ITRS meeting in 2018.

	Year 1 (S2014-P2015)	**Year 2 (S2015-P2016)**	**Year 3 (S2016-P2017)**	**Year 4 (S2017-P2018)**
N. Hemisphere Surveys		S	S	S
S. Hemisphere Surveys	W	W	W	W
NE Atlantic Removals	***F***		***F***	
NW Atlantic Removals		F		
NE Pacific Removals		***W***	***W***	
SW Pacific Removals	***P***			
Alaska Removals		S		
SE Pacific Removals		P (AUS)	P (NZ)	
Analyze Removal Data			P	
Write Removal Manuscript				S
Begin Observational Analysis			P	
Write Observational Manuscript				P
Analyze Differences in Fish Protocols		F		
Write Protocol Manuscripts			W	

Table 2: Schedule of tasks. S=Summer, F=Fall, W=Winter, P=Spring. Seasons are normalized to the Northern Hemisphere. Bold = Removal schedule for grad student kelp removal team. Additional removals may be maintained by PI groups in off years if logistically possible.

Broader Impacts and Synergies with Other Projects

Building a Network of Kelp Forest Researchers: One of the primary reasons for launching this project is the collaborations that will be built from the network. Already with our NCEAS working group (http://www.nceas.ucsb.edu/projects/12660) and the discussions that have gone in to the writing of this proposal, we have built a community of collaborators, many of whom had not worked together previously. In that spirit, we want the activities funded here to form the backbone of collaboration between the researchers involved. We see this proposal and the network it will enable as a starting point for the next decade of kelp forest ecology.

Providing Data to the Community: The data we collect as part of this network will have a variety of uses beyond members of the network. Following the example of our collaborators at the Santa Barbara Long-Term Ecological Research Site, we plan to make all data we collect public. Data from the network's NCEAS working group will be made available within the next year. For new work, we will adopt the policy that all data is made public within two years of collection, or, after being used in a published manuscript – whichever comes first. This means that by year three, we will be providing the community

at large with data on subtidal rocky reef community structure and abiotic conditions. We hope that these data will be useful to the newly formed Smithsonian Marine Biodiversity Observation Network, the UN Group on Earth Observations/Biodiversity Observation Network, of which network member Isabel Sousa-Pinto is an organizer, and any scientist or NGO involved in the study of temperate rocky reefs.

Stimulating New Research: The work conducted within this proposal is a starting point. There are a wide number of research questions any collaborator could ask by adding a small additional manipulation or piece of data collected. The postdoctoral kelp thinning project is one such piece, and provides a template for how additional new research can grow out of the work done here. Other ideas include different removal types, imposition of shading treatments, repeating experiments across an exposure gradient, PAR sensors, and more. We will encourage others to push forward with these questions using this core dataset as a backbone, as well as providing tools and lessons we develop for coordination and data management.

Graduate Student Training and Opportunities: The seven graduate students funded by this program (one at each PI institution) will be integral to the function of the network and annual data collection. In addition to funding them during the course of the project, the scope of the manipulation requires their travel and interaction with all PIs in the network. This will give them a wide variety of exposure to systems that vary widely in their natural history. This exposure will facilitate the creation and completion of their own research projects, forcing them to think beyond just a single system. They will interact with PIs and colleagues who have a vast array of expertise and approaches to marine ecology. These intellectual exchanges will enable them to think about their own work in a much broader context, and will lead to additional collaborations for them in the future. Furthermore, PI Byrnes will adapt his one week intensive course in Structural Equation Modeling in order to teach it online for all network graduate students during year two of the grant.

Public Outreach: As part of this network, we believe outreach to the public is fundamental. The network, lead by network associate Kyle Cavanaugh, PI Byrnes, and collaborator Pérez-Matus from Chile have already engaged with the citizen science team Zooniverse (http://zooniverse.org) at the Adler planetarium to create an online citizen science project to quantify changes in canopy forming kelp cover from the 1980s to the present using Landsat imagery. This extends previous work in Southern California (Cavanaugh et al. 2011) to a global scale. We plan to use these data to quantify changes in equatorward range limits and a variety of abiotic drivers of canopy forming kelp abundances. Zooniverse projects regularly involve thousands of people interested in citizen science with their projects, with anywhere between getting one thousand to over one million page views per day depending on the phase of the project. When the Kelp Zooniverse site launches in November in both English and Spanish, we will concurrently launch a blog about kelp forest ecology and a series of monthly Google Hangouts – online discussions open to the public archived at YouTube – between project scientists about kelp forests in their system for the duration of the project. These regular hangout sessions have proven hugely successful for groups such as the astronomers at the Galaxy Zoo project (150 viewers on average). With funding for our network's experiments, we will keep these conversations and blog going. We will rotate responsibilities for keeping the blog updated between labs, maintaining a regular schedule of at least two posts about kelp forest ecology and ongoing work per week to ensure a that we build a consistent audience. During the kelp removal project, students will post notes, stories, and photos from the field. We will continue the regular Google hangouts, incorporating question and answer sessions with different lead PIs along with discussions of kelp forest ecology. We predict a broad audience for this work, as we will already have built an audience via our project at Zooniverse and the help of their outreach team. Regardless, we will quantify its impact via user statistics at both our blog and hangouts; we will make changes to the content and frequency of both based on monitoring the content that generates the greatest viewership.

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Jarrett E. K. Byrnes

Department of Biology; University of Massachusetts Boston
100 Morrissey Blvd; Boston, MA 02125-3393
Phone: 401.529.4104 Email: jarrett.byrnes@umb.edu
URL: http://jarrettbyrnes.info Twitter: @jebyrnes

Professional Preparation & Appointments

2012 – Present Assistant Professor, University of Masachusetts Boston
2010 - 2012 Postdoctoral Fellow, National Center for Ecological Analysis and Synthesis
2008 - 2010 Postdoctoral Fellow, Santa Barbara Long Term Ecological Research Project
2002-2008, UC Davis, Population Biology, M.S. 2003, Ph.D. 2008
1997-2001 Brown University, Bachelor of Science in Biology.

List of Five Relevant Products

1. Byrnes, J.E.K., Cardinale, B.J., and Reed, D.R. 2013. Sea urchin grazing increases with prey diversity on temperate rocky reefs. *Ecology*. 94:1636-1646. [doi]

2. Byrnes, J.E., Reed, D.C., Cardinale, B.J., Cavanaugh, K.C., Holbrook, S.J., and Schmitt, R.J. 2011. Climate driven increases in storm frequency simplify kelp forest food webs. *Global Change Biology*. 17: 2513-2524. [doi]

3. Byrnes, J.E. and Stachowicz, J.J. 2009. The consequences of consumer diversity loss: different answers from different designs. *Ecology*. 90: 2879-2888. [doi]

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List of Five Other Products

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2. O'Connor, M.I. and **Byrnes, J. E.K.** Biodiversity and Ecosystem Function in Marine Ecosystems. In Press. In Marine Community Ecology and Conservation, M. Bertness, J. Stachowicz, and B. Silliman, eds.

3. Hooper, D.U., Adair, E.C., Cardinale, B.J., **Byrnes, J.E.K.**, Hungate, B.A., Matulich, K.L., Gonzalez, A., Duffy, J.E., Gamfeldt, L., O'Connor, M.I. 2012. Biodiversity loss ranks as a major driver of ecosystem change. *Nature*. 286: 105-108. [doi]

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Synergistic Activities

1. Global Impacts of Climate Change on Kelp Forests. Leader, National Center for Ecological Analysis and Synthesis working group.

2. The future of publishing in ecology, evolution, and environmental sciences. Leader, National Center for Ecological Analysis and Synthesis working group.

3. Author of I'm a chordata! Urochordata! http://www.imachordata.com/. A science blog discussing ecology, marine biology, and the culture of science in the modern age.

4. Contributing Developer for Lavaan - Analysis of latent variable Structural Equation Models in R. http://lavaan.org

5. Co-Creator of The #SciFund Challenge. A large-scale effort for scientists to teach outreach to scientists by getting them to crowdfund their research. $252K raised to date http://scifundchallenge.org

6. Participant in Biodiversity and the functioning of ecosystems: translating results from model experiments to functional reality. National Center for Ecological Analysis and Synthesis working group.

7. Participant in Dissertation Initiative for the advancement of Climate Change ReSearch (DISCCRS) participant. Interdisciplinary workshop in climate change communication.

Collaborators and Co-Authors: Balvanera, Patricia, UNAM; Cavanaugh, Kyle, Smithsonian Environmental Research Center; Duffy, J. Emmett, Virginia Institute of Marine Sciences; Edwards, Kyle, University of Michigan; Gamfeldt, Lars, University of Gothenburg, Sweden; Gonzalez, Andrew, McGill University; Holbrook, Sally, University of California Santa Barbara; Hooper, David, Western Washington University; Isbell, Forest, University of Minnesota; O'Connor, Mary, University of British Columbia; Reynolds, Pamela, Virginia Institute of Marine Sciences; Schmitt, Russ, University of California Santa BarbaraHughes, A. Randall, Northeastern University; Kimbro, David, Northeastern University

Graduate Advisors and Postdoctoral Sponsors: Bradley J. Cardinale, University of Michigan. Daniel C. Reed, UC Santa Barara.

Thesis Advisor: John J. Stachowicz, UC Davis.

BIOGRAPHICAL SKETCH

Jennifer E. Caselle
Marine Science Institute
University of California, Santa Barbara, CA 93106
Phone: (805) 893-5144 Fax: (805) 893-8062 email: caselle@msi.ucsb.edu

Education

Ph.D. MARINE ECOLOGY. University of California, Santa Barbara. 1997.
Advisor: Dr. Robert Warner
B.S. ZOOLOGY. University of California, Berkeley. 1987.

Academic Positions

Associate Project Scientist and lecturer, University of California, Santa Barbara 2006-present
Assistant Research Biologist, University of California, Santa Barbara 1999-2006
Resident Postdoctoral Associate, Wrigley Institute of Environmental Studies (Catalina Island), University of Southern California 1998. Postdoctoral Researcher, University of California, Santa Barbara 1997, 1999
Lecturer, University of California, Santa Barbara 1995-2000, 2006-2008

Main area of interest:

Fish ecology

Other areas of interest

Marine conservation. Community ecology and biogeography of kelp forests and coral reefs. Larval dispersal and recruitment, especially of reef fishes. Movement patterns of commercially and ecologically important marine organisms using telemetry. Design and analysis of large scale monitoring programs. Design and monitoring of marine protected areas.

Professional presentations

42 presentations at scientific meetings since 1995 (*36 Invited or Keynote*).

Product summary

10 technical reports
45 peer reviewed papers and book chapters

5 most relevant peer-reviewed products

White, J.W. and J.E. Caselle. 2008. Scale-dependent changes in the importance of larval supply and habitat to abundance of a temperate reef fish. Ecology 89:1323-1333.

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Caselle, J.E., B.P. Kinlan, and R.R. Warner. 2010. Temporal and spatial scales of influence on near-shore fish recruitment in the Southern California Bight. *Bulletin of Marine Science*. 86:355-385

Watson, J.R., S. Mitarai, D.A. Siegel, J.E. Caselle, C. Dong, and J. C. McWilliams. 2010. Realized and potential larval connectivity in the Southern California Bight. *Marine Ecology Progress Series*. 401:31-48.

Hamilton, S.L. J.E. Caselle, C. Lantz, T. Egloff, E. Kondo, S.D. Newsome, D. Pondella, K. Loke-Smith, K. A. Kelly, and C. G. Lowe. 2011. Extensive geographic and ontogenetic variation characterizes the trophic ecology of a temperate reef fish in southern California kelp forests. *Marine Ecology Progress Series*. 429:227-244

Hamilton, S.L, J.R. Wilson, T. Ben-Horin, and J.E. Caselle. 2011. Utilizing spatial demographic and life history variation to optimize sustainable yield of a temperate sex-changing fish. *PLoS ONE* 6(9): e24580. doi:10.1371/journal.pone.0024580

SYNERGISTIC ACTIVITIES:

On camera host and curricula development for the JASON Project 2003-outreach to middle school students throughout the U.S. Mentorship of 35 undergraduates since 2000 including women and minorities. Guest lecturer for high school advanced placement biology and high school career days for S.B. high schools 2000-present. - Participated in the development, writing and publication of Coastal Connections, an outreach publication for PISCO (Partnership for Interdisciplinary Studies of Coastal Oceans). - Secretariat of the Western Society of Naturalists 2000-2003. - Science Executive Committee member for PARC (Palmyra Atoll Research Consortium) 2004-present. - Chair: UCSB Diving Control Board 2003-present, Research Activities Panel (RAP) for the Channel Islands National Marine Sanctuary 2005-present.

Collaborators (and institutions) within the past 48 months. Includes past students and advisors, excludes individuals at UCSB. No Co-Editors.

Friedlander, A. (NOS-NOAA), Lowe, C. (CSU Long Beach), Young, K. (CSU Long Beach), Papastamatiou, Y. (Univ. Florida), Goncalves, E. (Instituto Superior de Psicologia Aplicada, Portugal), Carr, M. (UCSC), S. Gosnell (FSU), S. Hamilton (MLML),

Graduate Students/Postdoctoral Students Supervised

Svedlund, C. (UCSB), Topping, D. (CSU Long Beach), Belquist, L. (CSU Long Beach), Graves M. (CSU San Francisco), Wilson, J. (Cal Poly San Luis Obispo and UCSB), Fontes, J. (University of Azores, Portugal), Horta e Costa, B. (Instituto Superior de Psicologia Aplicada, Portugal).

Postdoctoral Students Supervised

Readdie, M. (UCSB and UCSC), Vilas, C. (UCSB), Shears, N. (UCSB). S. Hamilton (UCSB).

Graduate Advisors and Postdoctoral Sponsors

Robert Warner (PhD advisor), Peter Sale (PhD comm.), Steve Gaines (PhD Comm), Roger Nisbet (PhD Comm), Milton Love (Post doc sponsor).

BIOGRAPHICAL SKETCH

Jon D. Witman July 2013

Professor of Biology
Department of Ecology and Evolutionary Biology
Brown University
Providence, RI 02912 USA
Phone: (401) 863-3936 Email: Jon_Witman@brown.edu

Education:
1970-1972 Franklin and Marshall College, Lancaster, PA
1973-1974 University of Otago, New Zealand (Independent study, Geology)
1977 B.A., University of New Hampshire, Durham (Zoology)
1982 M.S. University of New Hampshire, Durham (Zoology)
1984 Ph.D, University of New Hampshire, Durham (Zoology)

Professional Appointments:
1985 Instructor, Semester Program in Tropical Ecology, School for Field Studies
1986 - 1992 Assistant Professor of Marine Biology, Northeastern University
1992 - 1993 Visiting Scientist, Department of Marine Science, University of Otago, New Zealand
1992 - 1994 Associate Professor of Biology, Northeastern University
1994 - 2007 Associate Professor of Biology, Department of Ecology and Evolutionary Biology, Brown University
1998 - 2002 Editorial Board, Ecology and Ecological Monographs
2004 – present - Associate Scientist, Marine Biological Laboratory, Woods Hole
2007 – present- Professor of Biology, Department of Ecology and Evolutionary Biology, Brown University
2008- present - Collaborating Scientist, Charles Darwin Foundation, Galapagos Islands

Five Products Relevant to This Proposal
Witman, J. D. 1985. Refuges, biological disturbance, and rocky subtidal community structure in New England. Ecological Monographs 55: 421-445.

Witman, J. D. 1987. Subtidal coexistence: storms, grazing, mutualism, and the zonation of kelps and mussels. Ecological Monographs 57: 167-187.

Witman, J.D., S.J. Genovese, J. F. Bruno, J. W. McLaughlin and B. I. Pavlin. 2003. Massive prey recruitment and the control of rocky subtidal communities on large spatial scales. Ecological Monographs 73: 441-462

Siddon, C.E and J.D.Witman 2004. Behavioral indirect interactions: multiple predator effects and prey switching in the shallow rocky subtidal. Ecology 85: 2398-2945.

Witman, J. D. and K. R. Roy 2009. Experimental marine macroecology. Chapter 13 in *Marine Macroecology*. University of Chicago Press. Pp. 341-356 J.D. Witman and K. Roy editors (book chapter)

Five Additional Products
Witman, J. D. and K. P. Sebens. 1992. Regional variation in fish predation intensity: a historical perspective in the Gulf of Maine. Oecologia 90: 305 - 315.

Witman, J.D and P.K. Dayton. 2001 Rocky subtidal communities. Pp 339-366 in Bertness, M.D., S.D. Gaines and M. Hay Eds. *Marine Community Ecology*. Sinauer Press (book chapter)

Witman, J.D, R.J. Etter and F. Smith. 2004. The relationship between regional and local species diversity in marine benthic communities: a global perspective. Proceedings of the National Academy of Sciences USA 101: 156644 – 15669.

Palardy, J. and J.D. Witman 2011. Water flow drives biodiversity by mediating rarity in marine benthic communities. Ecology Letters 14:63-68

Witman, J. D. 2013 Are regional effects on local diversity more important in marine than in terrestrial communities ? Oikos. 122: 301-305

Current NSF grants
National Science Foundation (Biological Oceanography) *Effects of predator diversity on the strength of trophic cascades in an oceanic benthic ecosystem*. (National Science Foundation ,Biological Oceanography), J. Witman PI, March 15, 2011 – Feb. 28, 2014,
$ 628,000

Students Trained
Undergraduate: 28 independent study students (Senior Thesis) in subtidal community ecology
Masters:
Jeanette Dumas 1990, Carolyn Shield 1990, Timothy Loher 1992, James Leichter 1993, John Fiorentino 1994, Gregory Shellenbarger, 1994, Nina Andres, 1994
PhD:
Salvatore Genovese 1996, Christopher Siddon 2004, Julie Ellis 2005, Andrew Altieri 2006, James Palardy 2009, Margarita Brandt 2011, Robert Lamb 2013-

Post Doctoral Fellows
Salvatore Genovese 1996 – 1997, Douglas McNaught, 1999 – 2001, Franz Smith 2002 – 2004, 2012 -2013**,** Jose Miguel Farina 2001- 2003, Margarita Brandt 2012

Collaborators
Ken Sebens, Mark Patterson, Ron Etter, Hal Caswell, Tony Fan, Mark Bertness

Synergistic Activities
Early emphasis on role of oceanography and overfishing in shaping benthic community structure, Advanced a macroecological perspective in marine ecology, Led symposia on benthic pelagic coupling, marine macroecology and ENSO as a model system for ocean climate change, Leader, Working Group on Marine Productivity and Species Diversity, CORONA, Lead Scientist for designation of Cashes Ledge, Gulf of Maine as a Marine Reserve (a unique offshore kelp forest)

Brenda Konar

Professor
School of Fisheries and Ocean Sciences**,** University of Alaska Fairbanks
P.O. Box 757220, Fairbanks, Alaska 99775
e-mail: bhkonar@alaska.edu, phone: 907-474-5028 / fax: 907-474-5804

Academic Preparation

San Jose State University, San Jose, CA	Zoology	B.A. 1986
Moss Landing Marine Laboratories, CA	Marine Sciences	M.S. 1991
University of California, Santa Cruz	Biology	Ph.D. 1998

Appointments

2009- PRESENT: Professor, School of Fisheries and Ocean Sciences, University of Alaska Fairbanks (UAF).
2004-2009: Associate Professor, School of Fisheries and Ocean Sciences, UAF.
2006-PRESENT: Science Director, Kasitsna Bay Laboratory, UAF.
2004-2006: Interim Lab Director, Kasitsna Bay Laboratory, UAF.
2000 to 2004: Assistant Professor, School of Fisheries and Ocean Sciences, UAF.
1999 to 2000: Research Assistant Professor, School of Fisheries and Ocean Sciences, UAF.
1999 to 2013: Staff Scientist for the West Coast and Polar Regions National Undersea Research Center.

5 Most Relevant Publications

Konar B (2013) Lack of recovery from disturbance in high-arctic boulder communities. Polar Biology 36: 1205-1214

Stewart N, B Konar. (2012**)** Kelp forests versus urchin barrens: alternate stable states and their effect on sea otter prey quality in the Aleutian islands. Journal of Marine Biology Volume 2012, Article ID 492308, 12 pages, doi:10.1155/2012/492308

Deiman M, Iken K, Konar B (2012) Susceptibility of *Nereocystis luetkeana* (Laminariales, Ochrophyta) and *Eualaria fistulosa* (Laminariales, Ochrophyta) spores to sedimentation. Algae 27: 115-123

Edwards MS, Konar B (2012) A comparison of dragon kelp, *Eualaria fistulosa* (Phaeophyceae) fecundity in urchin barrens and nearby kelp beds throughout the Aleutian Archipelago. J Phycol 47: 897-901

Konar B (2007) Recolonization of a high-latitude hard-bottom nearshore community. Polar Biol 30: 663-667

5 Other Significant Publications

Wilmers CC, Estes JA, Laidre KL, Edwards M, Konar B (2012) Do trophic cascades affect the storage and flux of atmospheric carbon? An analysis of sea otters and kelp forests. Frontiers in Ecology and the Environment doi:10.1890/110176

Daly B, Konar B (2008) Effects of macroalgal structural complexity on nearshore larval and post-larval crab composition. Marine Biology 153: 1055-1064.

Konar B and 15 other authors. (2010) Current patterns of macroalgal diversity and biomass in northern hemisphere rocky shores. PLoSONE 5:e13195

Konar B, Iken K, and 9 other authors (2010) Surveying Nearshore Biodiversity. In: AD McIntyre (ed) Life in the World's Oceans: Diversity, Distribution, and Abundance Blackwell Publishing Ltd. (Oxford). pp 27-41

Konar, B, Iken K, Edwards M (2009) Depth-stratified community zonation patterns on Gulf of Alaska rocky shores. Marine Ecology 30:63-73

Synergistic Activities

Development of Curricular Materials (courses not previously taught at UAF):

Field Topics in Marine Biology, Kelp Forest Ecology, Scientific Diving, and several seminars including Macroalgae, Controversies in Science, and Professional Development

Committee examples:

International: Natural Geography Inshore Areas (NaGISA) Steering Committee (past co-PI)

National: National Research Council Study Committee for the North Pacific Research Board (past)

State: Kachemak Bay National Research Reserve Advisory Council (current)

University-wide: Faculty Senate (past), Diving Control Board (current chair)

Department-wide: Marine Biology Tenure & Promotion committee (past chair, current member)

Examples of Outreach:

K-12 presentations at 16 different schools, Alaska native community presentations at 10 different communities in Alaska, multiple media interactions.

Worked with PolarTREK teachers in the Arctic and Antarctic.

Collaborators in the last 48 months

Dr. Brenda Ballachey (USGS), James Bodkin (USGS), Dr. Lisandro Benedetti-Cecchi (University of Pisa, Italy), Dr. Lee Cooper (University of Tennessee), Dr. Juan J. Cruz (Simon Bolivar University, Venezuela), Dr. Ken Dunton (University of Texas), Dr. Matt Edwards (San Diego State University), Dr. James Estes (University of California Santa Cruz), Dr. Jackie Grebmeier (University of Tennessee), Dr. Kris Holderied, (NOAA), Dr. Katrin Iken (University of Alaska Fairbanks), Dr. Ann Knowlton (University of Alaska Fairbanks), Dr. Patricia Miloslavich (Simon Bolivar University, Venezuela), Dr. Brenda Norcross (UAF), Dr. Gerhard Pohle (The Huntsman Marine Science Centre, Canada), Dr. Tim Tinker (University of California Santa Cruz), Dr. John Trefry (Florida Institute of Technology), Dr. Yoshihisa Shirayama (Seto Marine Biological Lab, Kyoto University, Japan)

Graduate Advisors

PhD at the University of California, Santa Cruz:

Drs. James Estes (major), Dan Doak, John Pearse, Peter Raimondi

M.S. at the Moss Landing Marine Labs, California:

Drs. Michael Foster (major), James Barry, James Harvey

Thesis Sponsor

Present Chair: Alexandra Ravelo (PhD), Kimberly Powell (MS), Terril Efird (MS), Sarah Traiger (MS)

Past Chair: Amy Tippery (MS), Martin Schuster (MS), Nathan Stewart (PhD), Melissa Deiman (MS), Brooke McFarland (MS), Tracie Merrill (MS), Joel Markis (MS), Benjamin Daly (MS), Casey Debenham (MS), Heather Patterson (MS), Judith Hamilton (MS), Heloise Chenelot (MS), Catherine Hegwer (MS), Reid Brewer (MS)

Other student committee member: Tania Spurkland (PhD), Benjamin Daly (PhD), Seanbob Kelly (MS), Arny L Blanchard (PhD), Angela Dubois (MS), Christine Frazier (MS). Eloise Brown (MS), Ann L Knowlton (PhD).

BIOGRAPHICAL SKETCH

JONATHAN H. GRABOWSKI
Associate Professor, Department of Marine and Environmental Sciences
Marine Science Center, Northeastern University, 430 Nahant Road, Nahant, MA 01908
j.grabowski@neu.edu , 781.581.7370 (ext. 337)

PROFESSIONAL PREPARATION

PhD	2002	University of North Carolina at Chapel Hill	Ecology
BS	1994	Duke University	Biology & Economics

APPOINTMENTS

2011-present	Associate Professor, Northeastern University
2005-2011	Adjunct Scientist, University of Maine (UMaine), University of Southern Maine (USM)
2004-2011	Research Scientist, Gulf of Maine Research Institute (GMRI)
2002-2004	Post-Doctorate, UMaine and GMRI

PRODUCTS

5 publications related to the proposed research (out of 50 total); † post doc; ‡graduate student

‡McGonigle, C., **J. H. Grabowski**, C. J. Brown, T. Weber, and R. Quinn. 2011. Detection of deep water benthic macroalgae using image-based classification techniques on multibeam backscatter at Cashes Ledge, Gulf of Maine, USA. *Estuarine, Coastal and Shelf Science* 91: 87-101.

Priesser, E. L., D. I. Bolnick, and **J. H. Grabowski**. 2009. Resource dynamics influence the strength of non-consumptive predator effects on prey. *Ecology Letters* 12:315–323.

Grabowski, J. H., A. R. Hughes, and D. L. Kimbro. 2008. Habitat complexity influences cascading effects of multiple predators. *Ecology* 89:3413-3422.

Grabowski, J. H., and D. L. Kimbro. 2005. Predator-avoidance behavior extends trophic cascades to refuge habitats. *Ecology* 86:1312-1319.

Grabowski, J. H. 2004. Habitat complexity disrupts predator-prey interactions yet preserves the trophic cascade in oyster-reef communities. *Ecology* 85:995-1004.

Five Other Publications

Grabowski, J. H., R. D. Brumbaugh, R. Conrad, A. G. Keeler, J. Opaluch, C. H. Peterson, M. F. Piehler, S. P. Powers, and A. R. Smyth‡. 2012. Economic valuation of ecosystem services provided by oyster reefs. *BioScience* 632:900-909.

Zu Ermgassen†, P. S. E., M. D. Spalding, B. Blake, L. D. Coen, B. Dumbauld, S. Geiger, **J. H. Grabowski**, R. Grizzle, M. W. Luckenbach, K. McGraw, W. Rodney, J. Ruesink, S. P. Powers, and R. D. Brumbaugh. 2012. Historical ecology with real numbers: Past and present extent and biomass of an imperilled estuarine habitat. *Proceedings of the Royal Society B*: 279, 3393-3400.

O'Conner†, N. E., **J. H. Grabowski**, L. M. Ladwig, and J. F. Bruno. 2008. Simulated predator extinctions: species identity affects the survival and settlement of a foundation species. *Ecology* 89:428-438.

Schmitz, O., **J. H. Grabowski**, B. L. Peckarsky, E. L. Preisser, G. C. Trussell, J. Vonesh. 2008. From individuals to ecosystem function: Toward an integration of evolutionary and ecosystem ecology. *Ecology* 89:2436-2445.

Lenihan, H. S., C. H. Peterson, J. E. Byers, **J. H. Grabowski**, and G. W. Thayer. 2001. Cascading of habitat degradation: oyster reefs invaded by refugee fishes escaping stress. *Ecological Applications* 11: 764-782.

SYNERGISTIC ACTIVITIES

(1) Developed quantitative methods to assess secondary and tertiary biomass associated with estuarine habitats to evaluate ecosystem services and scale restoration efforts more effectively. This body of work has been utilized extensively by NOAA-Assessment & Restoration Division for environmental damage assessment and habitat equivalency analysis (HEA).
(2) Member of the New England Fisheries Management Council (NEFMC) – Habitat Plan Development Team since 2007– Charged with informing the council on all matters related to essential fish habitat, including fisheries closure design and assessment, essential fish habitat and habitat vulnerability in the northwest Atlantic.
(3) Have collaborated with recreational anglers and commercial (shellfish harvesters, trap fishers, gillnetters, aquaculture growers, trawlers) fishers in NC, ME, NH, AL and eastern Canada over the past 2 decades, resulting in broad dissemination of results within these fishing communities. Have attended, presented research findings, and organized sessions several times over the past decade at the Maine Fishermen's Forum in Rockland, Maine and other meetings convening fishermen, scientists, and regulators.
(4) I co-organized 2 workshops in 2009 to explore how to better involve habitat mapping and habitat information more generally in fisheries management in the Gulf of Maine. The workshops explored major ongoing habitat management efforts by the NEFMC (i.e., redesign of GOM and GB closures), and resulted in a publication (Grabowski and Hart 2012).
(5) I developed and orchestrated the Gulf of Maine Research Institute's research intern program from 2006-2010, which averaged between 5 and 10 interns per year during this time investigating estuarine, coastal, and marine ecology questions.

COLLABORATORS:

D. Bolnick (UT), J. E. Byers (UGA), C. Brown (U. Ulster), J. Byrnes (UMass Boston), Y. Chen (UMaine), E. J. Clesceri (USAID), B. Conrad (Duke), L. Dill (Simon Fraser U), F. J. Fodrie (UNC-CH) R. Grizzle (UNH), D. Holland (NOAA-NWFSC), G. Herrara (Bowdoin), A. R. Hughes (NU), H. Lenihan (UCSB), L. Incze (USM), D. L. Kimbro (NU), P. Lawton (DFO), B. Luttbeg (UC Davis), N. O'Conner (U. C. Cork), J. Orrock (Washington U St L)., S. Peacor (Michigan St U), B. Peckarsky (U Wisconsin), A. Pershing (UMaine), C. H. Peterson (UNC), M. J. Piehler (UNC-CH), S. Powers (USouth Alabama-DISL), E. Preisser (URI), J. Runge (UMaine), A. Richards (NOAA), A. Rodriguez (UNC-CH), O. Schmitz (Yale), S. Scyphers (NEU), G. Sherwood (GMRI), A. Sih (UC Davis), B. Steneck (UMaine), G. Trussell (NEU), T. Weber (UNH), E. Werner (U Michigan), J. Vonesh (VCU), T Willis (USM), K Wilson (USM).

Graduate and Postdoctoral Sponsor

PhD: Dr. Charles H. Peterson (UNC-Chapel Hill)
Postdoctoral Advisor: Dr. Phil O. Yund (University of Maine)

Thesis Advisor and Postdoctoral Sponsor

Dr. Steven Scyphers (PhD 2012, University of South Alabama), Postdoc from 2012-present.
Marissa McMahan (MSc, 2011, University of Maine; PhD, Northeastern University [NU]), Chris Baillie (PhD, NU), Chris Conroy (PhD, NU), Luke Dodd (PhD, UNC, co-advisor), Melissa Smith (MSc, University of New England [UNE], 2007, co-advisor), and Erin Wilkinson (MSc; UNE, 2012, co-advisor).

Matthew Sean Edwards

Department of Biology
San Diego State University
San Diego, CA 92182
Phone: (619)-594-7049; Fax (619)-594-5676; email: Edwards@sciences.sdsu.edu

A. Education

B.S.	University of California, Santa Barbara	Aquatic Biology	1990
M. S.	San Francisco State University	Marine Science	1996
Ph.D.	University of California, Santa Cruz	Biology	2001

B. Academic and Professional History

2013 – present Professor of Biology – San Diego State University
2008 – 2013 Associate Professor of Biology – San Diego State University
2002 – 2008 Assistant Professor of Biology – San Diego State University
2002 – 2008 Secretariat (along with T. Anderson, K. Hovel & B. Hentschel) the Western Society of Naturalists
2001 – 2002 University of California Faculty Fellow - Researcher & Lecturer in Biology
1999 – 2002 Scientific Advisor to the Monterey Bay National Marine Sanctuary on issues regarding Commercial kelp harvesting.
1994 -1996 Assistant Diving Safety Officer at Moss Landing Marine Laboratories

C. Products (* denotes publication with student)

Edwards, M.S. and B.K. Konar (2012). A comparison of dragon kelp, *Eualaria fistulosa*, (Phaeophyceae) fecundity in urchin barrens and nearby kelp beds throughout the Aleutian Archipelago. Journal of Phycology 48: 897-901

*Fejtek, S.M., **M.S. Edwards**, K.Y. Kim (2010). Elk kelp, *Pelagophycus porra*, distribution limited due to susceptibility of microscopic stages to high light. Journal of Experimental Marine Biology and Ecology 396: 194-201.

Edwards, M.S. and K.Y. Kim (2009). Diel variation in photosynthetic performance in giant kelp *Macrocystis pyrifera* (Phaeophyceae, Laminariales) at different depths. Aquatic Botany 92: 119-128..

*Cie, D.K. and **M.S. Edwards** (2008). The effects of high irradiance on the settlement competency and viability of kelp zoospores. Journal of Phycology 44:495-500.

*Matson, P.G. and **M.S. Edwards** (2007). Effects of ocean temperature on the southern range limits of two understory kelps, *Pterygophora californica* and *Eisenia arborea*, at multiple life-stages. Marine Biology 151: 1941-1949.

Foster, M.S., **M.S Edwards**, D.C Reed, D.R. Schiel and R.C. Zimmerman (2006). Top-down vs. bottom-up effects in kelp forests. Science 313: 1737-1738.

Edwards, M.S. and G. Hernández-Carmona (2005). Delayed recovery of giant kelp near its southern range limit in the North Pacific following El Niño. Marine Biology 147: 273-279.

Edwards, M.S. (2004). Estimating scale dependency in disturbance impacts: El Niños and giant kelp forests in the Northeast Pacific. Oecologia 138: 436-447.

Clark, R.P., **M.S. Edwards** and M.S. Foster. (2004). Effects of shade from multiple kelp canopies on an understory algal assemblage. Marine Ecology Progress Series 267: 107-119.

Edwards, M. S. (2000). The role of microscopic life-history stages in the persistence of marine macroalgae in seasonally variable environments. Ecology 81(9): 2404-2415.

D. Research Grants

US Army Corps of Engineers (w/ T. Anderson) - $78,232. Naval Base Point Loma ocean-side subtidal marine vertebrate and invertebrate inventory. 8/12 – 1/14

National Science Foundation - $108,768. Collaborative research: kelp forest interaction webs in the Aleutian Archipelago: patterns and mechanism of change following collapse of an apex predator. 3/01/07 – 2/28/10

NASA Grant - Monitoring of Global Change in Temperate Reef Communities Using Satellite Remote Sensing Technologies (w/Ocean Imaging Inc.) SDSU part of contract - $92,723. Academic years 04-07.

National Geographic Society Committee for Research and Exploration (CRE)– $19,050. "Distribution and abundance of kelp forests in the Northeast Pacific: implications for habitat and biodiversity". Academic year 03-04.

IAI International Collaboration grant (w/ E. Martínez, M. Foster and G. Hernández-Carmona) - $30,000. Inter-hemispheric comparative studies of ENSO effects in kelp populations: inhibition and facilitation mechanisms determining restoration after massive mortality events. Academic year 02-03.

UCMexus – Conacyt Collaborative Grant (w/ J. Estes and G. Hernández-Carmona) - $25,000. Grant written by M. Edwards to establish collaboration between University of California (UCSC) and Mexican (CICIMAR, La Paz) researchers in order to examine community dynamics in giant kelp forests along the coast of California, USA and Baja California, Mexico. Academic year 00.

National Science Foundation - Small Grants for Exploratory Research (SGER) OCE-9813562A (w/ J. Estes) - $45,796. Grant written to examine spatial patterns of community change in kelp forest communities along the west coast of California and Baja during and following El Niño. 07/98 – 06/99.

E. Collaborators & Other Affiliates

i. Collaborators. R. P. Clark, L. Deysher, J. A. Estes, M. S. Foster, M. H. Graham B. Konar, G. Hernández-Carmona, R. Riosmena, A. Caballo, E. Martíinez, J. Shurin

ii. Graduate Advisors. M. S. Foster (Masters), J. A. Estes (Ph.D.)

iii. Thesis Advisor. - Laura Carney (Ph.D.), Damien Cie (M.S.), Paul Matson (M.S.), S. Fetjek (M.S.), R. Mothokakobo (M. S.), C. Dodge (M. S.), G. Torres (Ph.D.), R. Borras (M.S), L. Evans (M.S.), D. Hondolero (M.S.), B. Bulach (M.S.), A. Pesce (M.S.), M. Brown (M.S.), B. McCollum (M.S.)

Fiorenza Micheli- Biographical Sketch

Present Position: Professor

Hopkins Marine Station
Stanford University
Oceanview Blvd., Pacific Grove, CA 93950, USA
http://micheli.stanford.edu, http://www-marine.stanford.edu/micheli.htm

(831) 655-6250
(831) 375-0793 fax
micheli@stanford.edu

Professional Preparation:

University of Florence, Italy	Natural Sciences	BS, 1988
University of North Carolina at Chapel Hill	Marine Sciences	PhD, 1995
NCEAS, Santa Barbara, CA	Ecology	Postdoc, 1996-1998

Research interests: Community ecology; coastal tropical and temperate marine ecosystems; marine conservation and management

Honors and Awards:
President, Western Society of Naturalists, 2011
Pew Fellow in Marine Conservation, 2009-2011
Fellow, California Academy of Sciences, 2008
Aldo Leopold Leadership Fellow, 2004
Commonwealth Postgraduate Award, AIMS, Townsville, Australia, 1989-1990
Fulbright scholarship for graduate studies, 1990-1991

Academic appointments:

2010-present	Stanford University, Professor
2008-2009	Stanford University, Associate Professor
2001-2007	Stanford University, Assistant Professor
1999-2000	University of Pisa, Visiting Researcher and Lecturer
1996-1998	National Center for Ecological Analysis and Synthesis, Postdoctoral Researcher

Products (5 most relevant to this proposal):

1. Kroeker, K., M.C. Gambi, and F. Micheli. 2013. Community dynamics and ecosystem simplification in a high-CO2 ocean. *PNAS* early edition www.pnas.org/cgi/doi/10.1073/pnas.1216464110.
2. Kroeker, K.J., Micheli, F. and M.C. Gambi. 2012. Ocean acidification causes ecosystem shifts via altered competitive interactions. *Nature Climate Change.* DOI: 10.1038/NCLIMATE1680
3. Micheli, F., A. Saenz-Arroyo, A. Greenley, L. Vazquez, A. Espinoza Montes, M. Rossetto, and G. De Leo. 2012. Evidence that marine reserves enhance resilience to climatic impacts. *PLoS ONE* 7(7): e40832. doi:10.1371/journal.pone.0040832.
4. Micheli, F., and B. S. Halpern. 2005. Low functional redundancy in coastal marine assemblages. *Ecology Letters* 8: 391-400.
5. Micheli, F., B. S. Halpern, L. W. Botsford, and R. R. Warner. 2004. Trajectories and correlates of community change in no-take marine reserves. *Ecological Applications* 14: 1709-1723.

Products (5 additional):

1. Micheli, F., A. O. Shelton, S. M. Bushinsky, A. L. Chiu, A. J. Haupt, K. W. Heiman, C. V. Kappel, M. C. Lynch, R. G. Martone, R. B. Dunbar and J Watanabe. 2008. Persistence of depleted abalones in marine reserves of central California. *Biological Conservation* 141: 1078-1090.

2. Halpern, B.S., S. Waldbridge, K.A. Selkoe, C. V. Kappel, F. Micheli and 14 others. 2008. A global map of human impact on marine ecosystems. *Science* 319: 948-952
3. Micheli, F., M. Bishop, C. H. Peterson and J. Rivera. 2008. Alteration of seagrass species composition and function over two decades. *Ecological Monographs* 78: 225-244.
4. Worm, B., E. B. Barbier, N. Beaumont, J. E. Duffy, C. Folke, B. S. Halpern, J.B.C. Jackson, H. K. Lotze, F. Micheli, S. Palumbi, E. Sala, K. A. Selkoe, J. J. Stachowicz, R. Watson. 2006. Impacts of biodiversity loss on ocean ecosystem services. *Science* 314: 787-790.
5. Micheli F. 1999. Eutrophication, fisheries, and consumer-resource dynamics in marine pelagic ecosystems. *Science* 285: 1396-1398.

Synergistic activities (5 examples):

Subject editor, Conservation Biology (2004-2009), Theoretical Ecology (2008-present).

Leader of working group on coastal hypoxia in the California Current region, Center for Ocean Solutions, Monterey, CA, May 2011-present.

Member of the Ecological Society of America committee for "Ecological Science, Education and Outreach in the First Decade of the 21st Century", 2002-2004, of the Science Advisory Board of NCEAS, Santa Barbara, CA, USA, September 2005-March 2008, of the Research Activity Panel for the Monterey Bay National Marine Sanctuary, 2001-present, and of the Science Advisory Committee for the WWF, Rome, Italy, September 2006-present.

Participant in training program of fishing cooperative members of Isla Natividad, Mexico to conduct marine reserves monitoring, in collaboration with the Mexican NGO Comunidad y Biodiversidad (COBI) and REEF CHECK. August 2006-present.

Organizer and speaker in symposia on “Conservation and management of the Mediterranean” (co-organized with G. Notarbartolo and T. Agardy), Pew marine conservation annual meetings, September 2010, Spain; “Biocomplexity, fisheries, and coupled natural human systems” (co-organized with R. Hilborn, University of Washington) at the annual meeting of the American Fisheries Society, September, 2007, San Francisco, CA, USA; “Coral Reef Ecosystems and People: Practical Applications of Biocomplexity Science” (co-organized with D. Brumbaugh, American Museum of Natural History, New York) at the annual meeting of the American Society for the Advancement of Science (AAAS), February 16-20, 2006, St Louis, MS, USA; and “Community-based and sustainable management of marine resources: incentives and institutions” (co-organized with J. Novy, WWF, and R. Sagarin, Stanford University) at the annual AAAS meeting, February 2002, Boston, MA, USA

Current Collaborators (not in the publications listed above or in this project): Barry, J., Chavez, F., MBARI; Bird D., Caldwell M., Crowder, L., Denny M., De Leo G., Durham W., Litvin S., Monismith S., Woodson B., Stanford U.; Cannicci S., U. of Florence, Italy; Caselle J., Warner R. UCSB, Ferraro P., Georgia State University; Fraschetti, S. & Guidetti, P., U. Salento, Italy; Lluch S., CIBNOR, Mexico; McCay, B. Rutgers U.; Niccolini F., University of Macerata, Italy; Bodini A., Rossetto M. U of Parma, Italy; Possingham, H., U. Queensland; Sutula M., Weisberg S., SCCWRP.

Graduate Advisors: Peterson, C.H., UNC-CH (PhD); Murdoch, W., NCEAS (Postdoc).

Graduate students (12 at Stanford): C.V. Kappel (PhD 2005); K. W. Heiman (PhD 2006); G.G. Shester (PhD 2008); R. G. Martone (PhD 2009); A.J. Haupt (PhD 2011); D.J. McCauley (PhD 2011); K.T. Honey (PhD 2012); K.J. Kroeker (PhD 2012); C.L. Wood (PhD 2013); D. Madigan (PhD 2013), P.R. Leary (PhD in progress), N. Low (PhD in progress).

Postdoctoral fellows (7 at Stanford): R. D. Sagarin (currently research scientist at the U. of Arizona); S.Y. Litvin (currently research associate at HMS); C. Dumont (currently faculty at U. Hong Kong); T. W. Kim (currently postdoctoral fellow at MBARI); S. Lee (currently assistant professor at Earlham College), F. Ferretti (current); J. O’Leary (current).

JENNIFER A. DIJKSTRA
Habitat Research Specialist
University of New Hampshire
Center for Coastal and Ocean Mapping NOAA/UNH Joint Hydrographic Center S122A
Jere A. Chase Engineering Laboratory
24 Colovos Road Durham, NH 03824

Tel: 603-862-1775
jdijkstra@ccom.unh.edu

PROFESSIONAL PREPARATION

University of New Hampshire (USA)	Zoology	Ph.D (2007)
University of Bremen (Germany)	Marine Biology	M.Sc. (2000)
University of New Brunswick (Canada)	Major: Biology	B.A. (1995)

APPOINTMENTS

Center for Coastal and Ocean Mapping, UNH	Habitat Research Specialist (2012-present)
Department of Biological Sciences, UNH	Affiliate Assistant Professor, (2010-present)
Wells National Estuarine Research Reserve	Research Scientist (2012-2013)
Wells National Estuarine Research Reserve	Post-Doctoral Research Fellow (2008-2012)
Department of Zoology, UNH	Post-Doctoral Research Associate (2007-2008)

PRODUCTS

1. **Dijkstra, J.A.,** W.J. Lambert, L.G. Harris (2013) Introduced species provide a novel temporal resource that facilitates native predator population growth. Biological Invasions 15:911-919.
2. **Dijkstra, J.A.,** J. Boudreau, M. Dionne (2012) Species-specific mediation of temperature and community interactions. Oikos 121(5): 646-654.
3. **Dijkstra, J.A.,** E.L. Westerman and L.G. Harris (2011). The effects of climate change on species composition, succession, and phenology. A case study. Global Change Biology. 17: 2360-2369
4. **Dijkstra, J.A.** and L. G. Harris (2009). Maintenance of diversity altered by a shift in dominant species: Implications for species coexistence. Marine Ecology Progress Series. 387: 71-80.
5. **Dijkstra, J.**, L. Harris and E. Westerman (2007). The long-term distribution and ecology of four invasive colonial ascidians in the Gulf of Maine. Journal of Experimental Marine Biology and Ecology. 342: 61-68.

OTHER PRODUCTS

1. **Dijkstra, J.A.**, K. Buckman, D. Ward, D.W. Evans, M. Dionne, C.Y. Chen. (2013) Experimental and natural warming increases mercury concentrations in estuarine fish. PLoS ONE 8(3): e58401. doi:10.1371/journal.pone.0058401
2. Westerman, E.L., R.B. Whitlatch, **J.A. Dijkstra**, L.G. Harris (2009). Variation in brooding period masks similarities in response to changing temperatures. Marine Ecology Progress Series. 391: 13-19.
3. **Dijkstra, J.**, A. Dutton*, E. Westerman and L. G. Harris (2008). Heart Rate reflects osmostic stress levels in two introduced colonial ascidians *Botryllus schlosseri* and *Botrylloides violaceus*. Marine Biology. Vol. 154 5: 805-811.
4. **Dijkstra, J.**, H. Sherman*, L. Harris (2007). The role of colonial ascidians in altering biodiversity in marine fouling communities. Journal of Experimental Marine Biology and Ecology. 342: 168-171.
5. Valentine, P. C., M. R. Carman, **J. Dijkstra**, D. Blackwood **(**2009). Larval recruitment of the colonial ascidian *Didemnum vexillum*, seasonal water temperatures in New England coastal and offshore waters, and implications for spread of the species. Aquatic Invasions 4(1): 153-168.

SYNERGISTIC ACTIVITIES

1. Guest Associate Editor: Estuaries and Coasts.
2. Train undergraduate and graduate students at the University of New Hampshire
3. Mentor to undergraduate and recently graduated students at the Wells National Estuarine Research Reserve
4. Instructor: University of New Hampshire

COLLABORATORS AND OTHER AFFILIATES

Walter Lambert	Framingham State University
Page Valentine	USGS
Robert Whitlatch	University of Connecticut
Celia Chen	Dartmouth College
Kate Buckman	Dartmouth College
David Evans	Habitat and Fisheries Research Center (NOAA)
Darren Ward	Humboldt State University
Rosana Rocha	Universidade Federal do Parana
Erica Westerman	University of Chicago
Marian Litvaitis	University of New Hampshire
Larry G. Harris	University of New Hampshire

Graduate and Postdoctoral Sponsors:

Dr. Michele Dionne	Postdoctoral Sponsor (deceased)
Dr. Larry Harris	PhD advisor
Dr. Julian Gutt	Masters of Marine Biology advisor

Curriculum Vitae

Scott L. Hamilton

A) Education

B.A. Princeton University, Princeton, NJ, 2000 (Ecology and Evolution)
Ph.D. University of California Santa Barbara, Santa Barbara, CA, 2007 (Marine Ecology)
Postdoc University of California Santa Barbara, Santa Barbara, CA, 2007-2008 (Marine Community Ecology)

B) Appointments

Assistant Professor, Moss Landing Marine Laboratories, 2011-*present*;
Associate Project Scientist, Marine Science Institute, UCSB, 2010-2011;
Assistant Project Scientist, Marine Science Institute, UCSB, 2008-2010;
Post-doctoral researcher, Marine Science Institute and Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), UCSB, 2007-2008;
Lecturer, EEMB 106 Biology of Fishes, UCSB, 2006-2010
Graduate student researcher, Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO), UCSB, 2006-2007;
Research Consultant & Project Manager, Aquarium of the Pacific, Long Beach, CA, 2005-2006;

C) Products

5 Relevant Publications (out of 22)

Hamilton, SL, Newsome SD, Caselle JE (*In press*) Dietary niche expansion of a kelp forest predator recovering from intense commercial exploitation. *Ecology*

Hamilton SL, Wilson J, Ben-horin T, Caselle JE (2011) Utilizing spatial demographic and life history variation to optimize sustainable yield of a temperate sex-changing fish. *PLoS ONE* 6(9): e24580. doi:10.1371/journal.pone.0024580

Hamilton SL, Caselle JE, Lantz CA, Egglof TL, Kondo E, Newsome SD, Loke-Smith K, Pondella DP, Young K, Lowe C (2011) Extensive geographic and ontogenetic variation characterizes the trophic ecology of a temperate reef fish on southern California rocky reefs. *Marine Ecology Progress Series* 429: 227-244

Hamilton SL, Caselle JE, Malone D, Carr MH (2010) Incorporating biogeography into evaluations of the Channel Islands marine reserve network. *Proceedings of the National Academy of Sciences* 107: 18272-18277

Hamilton SL, Caselle JE, Standish JD, Schroeder DM, Love MS, Rosales-Casian JA, Sosa-Nishizaki O (2007) Size-selective harvesting alters life histories of a temperate sex-changing fish. *Ecological Applications* 17: 2268-2280

5 Additional Publications

Max LM, **Hamilton SL**, Gaines SD, Warner RR (2013) Benthic processes and overlying fish assemblages drive the composition of benthic detritus on a central Pacific coral reef. *Marine Ecology Progress Series*. 482: 181-195

Price NN, **Hamilton SL**, Tootell JS, Smith JE. Species-specific consequences of ocean acidification for the calcareous tropical green algae *Halimeda* (2011) *Marine Ecology Progress Series* 440: 67-78

Caselle JE, **Hamilton SL**, Schroeder DM, Love MS, Standish JD, Rosales-Casian JA, Sosa-Nishizaki O (2011) Geographic variation in density, demography, and life history traits of a harvested temperate sex-changing reef fish. *Canadian Journal of Fisheries and Aquatic Science* 68: 288-303

Hamilton SL, Regetz J, Warner RR (2008) Post-settlement survival linked to larval-life in a marine fish. *Proceedings of the National Academy of Sciences USA* 105: 1561-1566

Hamilton SL (2008) Influence of larval growth and development on post-metamorphic condition in bluehead wrasse, *Thalassoma bifasciatum*. *Oecologia* 158: 449-461

D) Synergistic Activities

1. Development of curricula for a two semesters of a new Quantitative Marine Science course at MLML that teaches all incoming Master's students probability theory, biostatistics, programming, and applied calculus
2. Extensive mentoring of high school and undergraduate students from diverse backgrounds on independent scientific projects (50+ students mentored) (e.g. Undergraduate Research Opportunity Center)
3. Curator of UCSB fish museum collection (housing over 500 jars of specimens), including organization, cataloguing, and the generation of an electronic record keeping system. The museum collection was used to help develop of laboratory and lecture curricula for EEMB 106, Biology of Fishes
4. Western Society of Naturalists, Secretariat from 2012-2014; organizer of an annual international conference hosting 400-600 marine ecologists. Responsible for society website construction and maintenance, design of online registration system, talk and poster scheduling, correspondence with society members, and meeting logistics
5. Institutional Animal Care and Use Committee member at San Jose State University; Co-chair of MLML Diving Control Board

E) Collaborators and Other Affiliations

Collaborators and Co-editors (last 48 months)

Ben-Horin, T. (UCSB); Caselle, J. (UCSB); Carr, M. (UC Santa Cruz); Graham, M. (MLML); Kushner, D. (NPS); Lowe, C. (CSU Long Beach); Loke-Smith, K. (CDFG); Love M. (UCSB); Malone, D. (UCSC); Manriquez, P. (U. Austral de Chile); Newsome, S. (U. Wyoming); Pondella, D. (Occidental); Price, N. (Scripps); Ruttenberg, B. (NOAA); Samhouri, J. (NOAA); Sandin, S. (Scripps); Schroeder D (MMS); Smith J. (Scripps); Starr, R. (MLML); Stier, A. (U. Florida); Walsh, S. (TNC); White, C. (UCSB); White, J. (UNC Wilmington); Wilson, J. (UCSB)

Graduate Advisors and Postdoctoral Sponsors (UCSB)

Caselle, J. (postdoctoral sponsor); Gaines, S. (PhD committee); Hofmann, G. (PhD committee); Warner, R. (PhD advisor)

Thesis Advisor and Postgraduate-Scholar Sponsor

11 MS students advised at MLML

Andrews, K.; Chiu, J.; Clerkin, P.; Donham, E.; Fennie, W.; Fields, R.; Kramp, H.; Pien, C.; Tagini, A.; Walovich, K.; Yates, D.

BIOGRAPHICAL SKETCH

MICHAEL H. GRAHAM

A. PROFESSIONAL PREPARATION

1987-1992	University of California Santa Barbara Bachelor of Arts in Aquatic Biology and Geography
1992-1995	Moss Landing Marine Laboratories Masters of Science in Marine Science
1995-2000	Scripps Institution of Oceanography, University of California San Diego Doctor of Philosophy in Oceanography

B. APPOINTMENTS

2012-	Professor, Moss Landing Marine Laboratories, San Jose State University
2011-	Co-Editor/Managing Editor Journal of Phycology, Phycological Society of America
2007-2012	Associate Professor, Moss Landing Marine Laboratories, San Jose State University
2003-2007	Assistant Professor, Moss Landing Marine Laboratories, San Jose State University
2001-2002	University of California Faculty Fellow, Center for Population Biology, University of California, Davis
2001-2002	National Center for Ecological Analysis & Synthesis, Working Group: Long-Term Ecological Records of Marine Environments, Populations and Communities

C. (i) FIVE PRODUCTS MOST CLOSELY RELATED TO THIS PROPOSAL

Harley, CD, Anderson, KM, Demes, KW, Jorve, JP, Kordas, RL, Coyle, TA, and **MH Graham**. 2012. Effects of climate change on global seaweed communities. *Journal of Phycology* 48:1064-1078.

Graham, MH, BP Kinlan, and RK Grosberg. 2010. Post-glacial redistribution and shifts in productivity of giant kelp forests. *Proceedings of the Royal Society of London: Biological Sciences* 277:399-406.

Graham MH, BS Halpern, MH Carr. 2008. Diversity and dynamics of Californian subtidal kelp forests. Pp. 103-134 in McClanahan, TR and GR Branch(eds), Food Webs and the Dynamics of Marine Benthic Ecosystems, Oxford University Press.

Graham MH, JA Vasquez, AH Buschmann. 2007. Global ecology of the giant kelp *Macrocystis*: from ecotypes to ecosystems**.** *Oceanography and Marine Biology: An Annual Review* 45:39-88.

Graham, MH, BP Kinlan, LD Druehl, LE Garske and S Banks. 2007. Deep-water kelp refugia as potential hotspots of tropical marine diversity and productivity. *Proceedings of the National Academy of Sciences USA* 104:16576-16580

(ii) FIVE OTHER PRODUCTS

Stachowicz, JJ, **MH Graham**, MES Bracken, and AI Szoboszlai. 2008. Diversity enhances cover and stability of seaweed assemblages: the importance of environmental heterogeneity and experimental duration. *Ecology* 89:3008-3019.

Stachowicz, JJ, RJ Best, MES Bracken, and **MH Graham**. 2008. Complementarity in marine biodiversity manipulations: reconciling divergent evidence from field and mesocosm experiments. *Proceedings of the National Academy of Sciences USA* 105:18842-18847.

Graham, MH. 2004. Effects of local deforestation of the diversity and structure of southern California giant kelp forest food webs. *Ecosystems* 7:341-357.

Graham, MH, PK Dayton, and JM Erlandson. 2003. Ice-ages and ecological transitions on temperate coasts. *Trends in Ecology and Evolution* 18:33-40.

Graham, MH. 2003. Coupling propagule output to supply at the edge and interior of a giant kelp forest. *Ecology* 84:1250-1264.

BIOGRAPHICAL SKETCH

D. SYNERGISTIC ACTIVITIES

1) Founder and executive director of Marina Academy of Sustainable Science and Technology at Marina High School that provides high school biology students with curricula, internships, employment opportunities related to sustainable science applications (e.g. water use, integrated aquaculture, biofuel productions, sustainable farming, etc).
2) Developed Special Feature (2002) in the journal *Ecology* on "Paradigms in Ecology". The feature focused on how paradigms have contributed to the development and advancement of ecology, with the goal of provoking interested students to revisit central constructs from an historical perspective.
3) Received NSF awards (#0087359 in 1999, #0120789 in 2000) to support student-led symposia and workshops at WSN annual meetings. Provided WSN students with adequate funds to design, organize, and carry out scientific symposia developed around issues of interest to students of ecology, including: communicating science to non-scientists; integrative research; and social and academic tradeoffs between basic and applied research. Goal was to empower the WSN student membership by giving them the confidence to pursue non-research scientific activities that directly benefited their own education.
4) Convened 1998 symposium at the annual meeting of the Western Society of Naturalists (WSN) to discuss the significance of historical contributions to the evolution of modern ecology. The symposium was developed primarily for the benefit of WSN student members, with the theme ''How do ecological breakthroughs really happen? And, what can the past tell us about useful future directions in ecology?''

E. COLLABORATORS & OTHER AFFILIATIONS

(i) Collaborators

Mark Carr, University of California Santa Cruz; Matt Edwards, San Diego State University; Jon Erlandson, University of Oregon; Chris Harley, University of British Columbia; Jay Stachowicz, University of California Davis

(ii) Graduate & postdoctoral advisors

Michael Foster, Moss Landing Marine Laboratories (MS advisor); Paul Dayton, Scripps Institution of Oceanography (PhD advisor); Richard Grosberg, University of California Davis (Postdoctoral advisor)

(iii) Thesis advisor and postgraduate-scholar sponsor

Undergraduates (past): Christian Hansen, Brian Kinlan, Everett Yee, Greg Schroeder, Jasmine Ruvalcaba, Samuel Rivera, Sarah Jeffries, Gabriel Rodriguez
Undergraduates (present): Elizabeth Ramsey
MLML Masters (past): Tim Schaadt, Brent Hughes, Amber Szoboslai, Diana Kohtio, Jenn Jorve, Aurora Alifano, Max Overstrom Coleman, Selena McMillan, Thew Suskiewicz, Rosemary Romero, Catalina Reyes, Arley Muth, Kyle Demes, Megan Wehrenberg, Paul Tompkins, Brynn Hooton, Sonya Sankaran, Sara Hutto, Michael Fox
MLML Masters (present): Alexis Howard, Jasmine Ruvalcaba, Jarred Klosinski, Sarah Jeffries, Sara Worden, Maureen Wise, Lindsey Cooper, Susan Christensen, Heather Fulton-Bennett, Robert San Miguel
Post-doctoral fellows (present): Dr. Bernat Hereu (University of Barcelona), Dr. Gage Dayton (Texas A&M University).

DIANA STELLER
Research Faculty, Moss Landing Marine Laboratories (MLML), 8272 Moss Landing Rd., Moss Landing, CA 95039

(a) Professional Preparation

University of California, Santa Barbara, Aquatic Biology, B.A., 1988
San Jose State University/Moss Landing Marine Laboratories, Marine Science, MS, 1993
University of California Santa Cruz, Biology, Ph. D. 2003

(b) Appointments

2004 - 2013	Research Faculty / Diving Safety Officer – MLML
2001 - 2013	Lecturer in Biological Science (MLML/SJSU), Subtidal Ecology, Marine Botany, Marine Ecology of the Gulf of California
2002 – 2003	Lecturer in Biological Sciences (UC Santa Cruz), Marine Botany
1996 – 2003	Graduate Researcher, Ecology and Evolutionary Biology (UCSC) research on macroalgal ecology and population biology of coralline algal rhodoliths.
1995 – 1996	Biology Instructor (CSUMB, SFSU) – Watershed ecology, Island Biogeography
1993 – 1995	Research Biologist (Hopkins Marine Station/UCLA) Algal ecology/physiology

(c) Products:

(i)

Steller DL, Caceras-Martinez. 2009. Coralline algal rhodoliths enhance larval settlement and early growth of the Pacific calico scallop Argopecten ventricosus. Marine Ecology Progress Series 396:49-60

Steller DL, Hernandez-Ayon J, Riosmena-Rodriguez R, Cabello-Pasini A (2007) Effect of temperature on photosynthesis, growth and calcification rates of the free-living coralline alga *Lithophyllum margaritae*. Ciencias Marinas 33:441-456

Steller, D. L., R. Riosmena-Rodriguez, M. S. Foster, and C. A. Roberts. 2003. Rhodolith bed diversity in the Gulf of California: the importance of rhodolith structure and consequences of disturbance. Aquatic Conservation-Marine and Freshwater Ecosystems 13:S5-S20.

Zimmerman, R.C., **D.L. Steller**, D.G. Khors and R.S. Alberte. 2001. Top-down impact through bottom-up mechanism II: in situ effects of limpets grazing on growth, light requirements and survival of *Zostera marina* L. (eelgrass). *Marine Ecology Progress Series*. V218: 127-140.

Coyer, J.A., **D. L. Steller**, J. Witman. 1999. The underwater catalog: a guide to methods in underwater research. Shoals Marine Laboratory, Cornell University, Ithaca, NY. 151pp.

(ii)

Riosmena-Rodríguez, R., **D. L. Steller,** G. Hinojosa-Arango, M. S. Foster. 2010. Biology and Conservation of Rhodolith Beds in the Gulf of California. *in* R. Brusca, editor. Marine Biodiversity and Conservation in the Gulf of California. University of Arizona Press and Sonoran Desert Museum, Tuscon, AZ. Pp. 49-71.

Steller DL, Riosmena-Rodriguez R, Foster MS (2009) Living rhodolith bed ecosystems in the Gulf of California. In: Johnson ME, Ledesma-Vazquez J (eds) Atlas of Coastal Ecosystems in the Western Gulf of California: tracking limestone deposits on the margin of a young sea. University of Arizona Press, Tuscon, p 72-82

Steller, D. L., and M. S. Foster. 1995. Environmental factors influencing distribution and morphology of rhodoliths in Bahia Concepcion, B.C.S., Mexico. Journal of Experimental Marine Biology and Ecology 194:201-212.

Coyer, J.A., **D.L. Steller,** and R. S. Alberte. 1995. A field-compatible method for extraction of fingerprint-quality DNA from *Macrocystis pyrifera* (Phaeophyceae). *Journal of Phycology*. 31(1):177-180.

Zimmerman, R.C., D.G. Khors, **D.L. Steller,** R.S. Alberte. 1997. Impacts of CO2 enrichment on productivity and light requirements of eelgrass. Plant Physiology. 115(2):599-607.

(d) Synergistic Activities

1. *Advances in research in algal ecology*. A primary focus of my research has been on macroalgal, community ecology and physiology of kelp forests, seagrasses and carbonate reef systems in California and Gulf of California collaborating with US and Mexican researchers. Early work included research on the ecology of rhodolith beds, an important but relatively unrecognized benthic habitat worldwide. The research, publications and NSF funded workshops has included fundamental research on the biodiversity and functioning of all of these communities. Work on the role of rhodoliths in the global carbon cycle and has led to international recognition and conservation of these habitats. Current research has broadened to fundamental research, ecology and management of these habitats in California.

2. *Temperature effects on the recovery of kelp forest ecosystems*. The current proposal is a collaborative effort to examine how the recovery of kelp forests is influenced by temperature. I contribute to the current proposal through my lab and field based research on the effects of temperature on macroalgal growth and physiology. This includes predicting how changes in the dynamics of biomass and morphology of habitat forming macroalgae to community level biodiversity. I have a long-term involvement with developing an conducting kelp forest monitoring techniques.

3. *Integration and Transfer Knowledge on Underwater Research Techniques.* Co-wrote a manual on underwater research techniques. This resource is widely used and referenced and which provides up to date techniques and current literature used in subtidal research. Act as a Diving Safety Officer promoting rigorous, safe diving and productive research diving techniques. Teaching field based graduate and undergraduate level courses in marine science and subtidal macroalgal techniques. Innovations in training includes new approaches to data collection methods in subtidal research techniques.

4. *Developed innovative teaching tools*. Developed a 'Marine Botany Laboratory Manual' for learning life history, taxonomic identification, structure and function of marine algae for the UC Santa Cruz marine botany course. Currently used for eight years as part of the UCSC and SDSU curriculum.

5. *Professional Contributions*. I act as a reviewer of primary literature for numerous journals including: Ecology, Marine Ecology Progress Series, Journal of Phycology, Palaios, Hyrdobiologia, Botanica Marina, Ciencias Marinas. I have acted as a reviewer for funding agencies including: National Science Foundation, NOAA/HURL, AAUS – American Academy of Underwater Sciences, BOD of AAUS.

(e) Collaborators & Other Affiliations

Ivano Aiello (Moss Landing Marine Laboratories), Don Croll (UC Santa Cruz), Michael Foster (Moss Landing Marine Laboratories), Scott Hamilton (Moss Landing Marine Laboratories), Rikk Kvitek (CSUMB), Laurie McConnico (UABCS – La Paz, BCS, Mexico), John Pearse (Hopkins Marine Station), Pete Raimondi (University of California Santa Cruz), Rafael Riosmena Rodriguez (UABCS – La Paz, BCS, Mexico)

Graduate and Postdoctoral Advisors

Peter T. Raimondi, James Estes, Dan Doak (University of California Santa Cruz), Michael S. Foster, J. Nybakken, James T. Harvey (Moss Landing Marine Laboratories)

Graduate Students Advised: 8 M.S. Students (MLML, San Jose State University)

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Massachusetts Boston

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jarrett Byrnes

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1.	0.00	0.00	0.00		
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL SCHOLARS	12.00	0.00	0.00	**45,320**	
2. (**1**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	12.00	0.00	0.00	**40,176**	
3. (**1**) GRADUATE STUDENTS				**14,000**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**99,496**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**25,443**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**124,939**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**8,070**	
2. FOREIGN				**15,700**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**35,370**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**30,542**	
6. OTHER				**4,200**	
TOTAL OTHER DIRECT COSTS				**70,112**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**218,821**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 52.5000, Base: 218821)**					
TOTAL INDIRECT COSTS (F&A)				**114,881**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**333,702**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**333,702**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jarrett Byrnes

ORG. REP. NAME*

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Massachusetts Boston

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jarrett Byrnes

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1.	0.00	0.00	0.00		
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL SCHOLARS	12.00	0.00	0.00	**46,680**	
2. (**1**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	6.00	0.00	0.00	**20,691**	
3. (**1**) GRADUATE STUDENTS				**14,000**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**81,371**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**20,006**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**101,377**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**6,802**	
2. FOREIGN				**5,800**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**1,404**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**30,933**	
6. OTHER				**8,300**	
TOTAL OTHER DIRECT COSTS				**40,637**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**154,616**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 52.5000, Base: 139533)**					
TOTAL INDIRECT COSTS (F&A)				**73,255**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**227,871**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**227,871**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jarrett Byrnes

ORG. REP. NAME*

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Massachusetts Boston

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jarrett Byrnes

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1.	0.00	0.00	0.00		
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL SCHOLARS	12.00	0.00	0.00	**48,080**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**14,000**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**62,080**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**14,242**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**76,322**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**14,872**	
2. FOREIGN				**5,800**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**1,404**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**31,692**	
6. OTHER				**10,800**	
TOTAL OTHER DIRECT COSTS				**43,896**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**140,890**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 52.5000, Base: 112805)**					
TOTAL INDIRECT COSTS (F&A)				**59,223**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**200,113**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**200,113**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jarrett Byrnes

ORG. REP. NAME*

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 4

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Massachusetts Boston

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jarrett Byrnes

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1.	0.00	0.00	0.00		
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**1**) POST DOCTORAL SCHOLARS	0.60	0.00	0.00	**24,761**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**24,761**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**7,295**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**32,056**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**5,802**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**1,404**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**3,000**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**31,874**	
6. OTHER				**8,300**	
TOTAL OTHER DIRECT COSTS				**44,578**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**82,436**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 52.5000, Base: 50562)**					
TOTAL INDIRECT COSTS (F&A)				**26,545**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**108,981**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**108,981**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jarrett Byrnes

ORG. REP. NAME*

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Massachusetts Boston

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jarrett Byrnes

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1.	0.00	0.00	0.00		
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**0**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**4**) POST DOCTORAL SCHOLARS	36.60	0.00	0.00	**164,841**	
2. (**2**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	18.00	0.00	0.00	**60,867**	
3. (**3**) GRADUATE STUDENTS				**42,000**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**267,708**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**66,986**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**334,694**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**35,546**	
2. FOREIGN				**27,300**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**39,582**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**3,000**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**125,041**	
6. OTHER				**31,600**	
TOTAL OTHER DIRECT COSTS				**199,223**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**596,763**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**273,904**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**870,667**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**870,667**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jarrett Byrnes

ORG. REP. NAME*

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

Budget and Justification

A. Senior Personnel: We request support for a postdoctoral research associate, Dr. Kira Krumhansl, for years one through the first half of year four of the grant. This postdoc will coordinate the network participants, lead all removal experiments in the field, and conduct additional research on thinning densities in New England. The postdoc will also aid the research technician in the co-ordination and management of network data in years two through four. During the latter half of year four, the postdoc will supplement their funding by lecturing at UMB.

We request summer and additional semester of support for a graduate student for the first three years of the grant. Graduate students will assist in the observational experiment and be primarily responsible for carrying out the manipulative experiment. In year one, the graduate student will aid the research technician in the preparation and shipping of materials to other network members. In year two and three, the graduate student will assist the postdoc in the maintaining of network data sets. In year four and half of years one through three, the student will be supported by TA-ships and additional funding opportunities at UMB.

	Year 1	**Year 2**	**Year 3**	**Year 4**
Postdoc	45,320	46,680	48,080	24,761
Graduate Student	14,000	14,000	14,000	

B. Other Personnel: We request support for a research technician Ted Lyman in year 1 and half of year two ($40,176 in year 1, $20,691 in year 2 based on current university salary). He has worked at the Byrnes lab manager for one year, and before was the Dive Safety Officer at Northeastern University's Marine Science Center. He also has a background in IT support at biomedical startups. This technician position will encompass several duties: 1) ensuring that all participants meet the required scientific diving status at all institutions used and conduct additional training as needed in year 1, 2) preparing and shipping materials to network participants, 3) implementing the data management plan for the network, including building a component of the network's website to host data, and creating protocols for the rapid addition of new data. In year 2 his salary will be supplemented by co-teaching an Underwater Research course for undergraduates. Continued data management will be taken up by the graduate student and postdoc in years three and four.

C. Fringe: 1.73% rate applies to PI for summer compensation and 27.99% rate plus $28.00/bi-weekly per FTE applies to the base salary of benefited Post Doc appointment. 1.42% applies to the Graduate student stipend in the summer only. Fringe Rate is negotiated between DHHS and the Commonwealth of Massachusetts. Fringe rates includes: General Fringe, Health & Welfare, Medicare, Unemployment Insurance, Universal Health Insurance and Worker's Compensation Insurance.

D. Equipment: All together, we have 35 manipulation sites and 59 observational sites listed. At each site, we will install two benthic temperature loggers. For that, we will use Hobo Pendant Loggers ($59 each) with PVC housings. This saves substantially on TidBits ($112 each) as well as allowing for replacement batteries. As the SBC LTER already provides temperature, we will not send them additional loggers. Byrnes has also installed loggers at 5 sites. Collaborators will also be sent the software and download unit as necessary ($156 each). For fish richness and additional video sampling, we will send each site two GoPro cameras ($295 each) and PVC for appropriate stands that we have developed over the last year ($10). To reduce shipping charges, we will package and ship these materials to all sites from UMB at an estimated total cost of $2,600. We also include $420 for two gallons of marine epoxy.

E. Travel – 1) Domestic Travel:
NW Atlantic Manipulations (Q1): The Byrnes lab and co-ordinating postdoc will facilitate the graduate student travel during the one month of NW Atlantic Manipulations in year one and three. This will include one week at the Shoals Marine Lab ($1650), 21 days of travel ($80/day travel and lodging per person for a cost of $5880), and tank fills (20 dives with 3 divers each at $6.50/fill is $390). We will provide a truck, with $540 covering university milage rates.

NW Atlantic Observations (Q2): UMB will cover costs for Grabowski, Dijkstra, and Witman to work out of the Shoals Marine Lab ($135/day and $66 for a ferry) for a total of $5868.00. This covers diving, lab use costs, and room and board at SML. PI Byrnes and the postdoc will be mentoring undergraduates at SML who will dive on the transects, and hence they will incur no costs. PI Byrnes will provide a lab truck for travel to Long Island and Rhode Island estimating $330 in gas costs.

NE Pacific Manipulation Travel (Q2): We include $1000 for travel by the postdoc and UMB graduate student in years two and three to assist with the Northeastern Pacific manipulation. PI Edwards will handle food, travel, and lodging.

2) International Travel:
SE Pacific Manipulation (Q2): The co-ordinating postdoc will lead a trip with two other network graduate students (one from UMB) to Chile to perform the manipulation along a thermal gradient working with Dr. Alejandro Pérez-Matus for three. Travel for the postdoc and one UMB student is estimated at $2,000 and travel, lodging, and board are estimated at $6,000 for three weeks by Pérez-Matus. Pérez-Matus will generously supply all boat time, tanks, and tank fills.

Postdoctoral Travel (Supporting Q2): As has been learned from other research networks, the coordinating postdoc is central to facilitating continuity and standardization within the network. As such, they will be sent to each manipulation to enhance co-ordination, and potentially add additional thinning manipulations if time allows. Budget estimates come from PIs in the relevant locations.

	Year 1	Year 2	Year 3	Year 4
Travel to Australia	2500			
Travel, room, board through Australia	5200			
Travel to New Zealand			2500	
Travel, room, board through New Zealand (inter-island travel, boat time)			3300	
Travel to UK		1000		
Travel, Room, Board in UK		4800		
Additional Australia Field Costs (cross-country travel, boat time)	3000			
Additional NZ Field Costs (Gear, Boat Time)			3000	

F. Participant Support Cost: N/A

G. Other direct costs (Equipment Lease and Repair):

NW Atlantic Manipulation (Q1): For the manipulation in the fall of year 1 and year 3, we have budgeted $390 for 60 tank fills at the cost of $6.50 per fill. We will provide the necessary quadrats and transect tapes from our lab's supplies, as well as any needed replacement gear.

UMB Materials (Q2): For surveys conducted in New England, we have budgeted for boat time at Cat Cove Marine Lab and for rentals in Long Island in years 2-4, tank fills at our local rate of $7/tank, the R/V Heiser at the Shoals Marine Lab joint work by PIs Byrnes, Grabowski, Dijkstra, and Co-PI Witman, miscellaneous gear replacements due to damage, and annual servicing for four sets of gear as follows:

Item	Cost per Year
Annual Gear Service for 4 full sets of gear ($300/set)	1,200.00
Misc Field Gear Replacements Annually	500.00
Boat Fees at Salem State for 30 days at $100/day	3,000.00
5 Days Long Island Boat Rental at $150/day	750.00
SML Boating - R/V Heiser 3 days at $1425/day	4,275.00
Fills for 36 Dives for 3 Divers in Massachusetts at $6.50/fill	702.00
Fills for 50 dives with 3 divers in RI and Long Island at $6.50/fill	702.00

Publication: We also include $3,000 over the course of the grant for Open Access publication costs.

Subawardees: Subawardee Caselle will conduct surveys in the Channel Islands and facilitate the experimental manipulation by the network students, postdoc, and PI Edwards. For this, she is requesting 2 weeks of summer salary per year, 15 days of boat time per year, supplies, and equipment for a sum of 51,142.00 over four years. Subawardee Witman will be accompanying PIs Byrnes, Dijkstra, and Grabowski to survey sites on Star Island that he has worked on since the 1970s. He will also survey sites at far offshore at Murray Rock on the R/V Gulf Challenger. For this he requests 1 week of summer salary per year. This comes to a sum of 27,018.02 over four years.

H. Total Direct cost: $ YEAR 1 218,821; YEAR 2 $159,615; YEAR 3 $140,890; YEAR 4 $82,436.

H. Indirect Rate is 52.5%: F&A Rate of 52.5% is negotiated between DHHS and the university.
Indirect funds requested in each year: Year 1 $114,881; Year 2 $73,255; Year 3 $59,223; Year 4 $26,545

I. Total costs requested in each year: Year 1 $333,702; Year 2 $227,870; Year 3 $200,113; Year 4 $108,981

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Brown University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jon Witman

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jon Witman - PI**	0.00	0.00	0.25	**3,160**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.25	**3,160**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**3,160**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**980**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**4,140**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**160**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**2,200**	
TOTAL OTHER DIRECT COSTS				**2,200**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**6,500**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 62.5000, Base: 6499)**					
TOTAL INDIRECT COSTS (F&A)				**4,062**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**10,562**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**10,562**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jon Witman

ORG. REP. NAME*

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Brown University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jon Witman

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jon Witman - PI**	0.00	0.00	0.25	**3,286**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.25	**3,286**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**3,286**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**1,019**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**4,305**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**160**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**2,200**	
TOTAL OTHER DIRECT COSTS				**2,200**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**6,665**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 62.5000, Base: 6665)**					
TOTAL INDIRECT COSTS (F&A)				**4,166**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**10,831**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**10,831**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jon Witman

ORG. REP. NAME*

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Brown University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jon Witman

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jon Witman - PI**	0.00	0.00	0.25	**3,418**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.25	**3,418**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**3,418**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**1,059**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**4,477**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**160**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**2,200**	
TOTAL OTHER DIRECT COSTS				**2,200**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**6,837**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 62.5000, Base: 6837)**					
TOTAL INDIRECT COSTS (F&A)				**4,273**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**11,110**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**11,110**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jon Witman

ORG. REP. NAME*

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 4

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Brown University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jon Witman

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jon Witman - PI**	0.00	0.00	0.25	**3,554**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.25	**3,554**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**3,554**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**1,102**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**4,656**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**160**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**2,200**	
TOTAL OTHER DIRECT COSTS				**2,200**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**7,016**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 62.5000, Base: 7016)**					
TOTAL INDIRECT COSTS (F&A)				**4,385**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**11,401**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**11,401**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jon Witman

ORG. REP. NAME*

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Brown University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jon Witman

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jon Witman - PI**	0.00	0.00	1.00	**13,418**	
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	1.00	**13,418**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**13,418**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**4,160**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**17,578**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**640**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**8,800**	
TOTAL OTHER DIRECT COSTS				**8,800**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**27,018**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**16,886**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**43,904**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**43,904**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jon Witman

ORG. REP. NAME*

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

Budget Justification **Jon Witman**

Collaborative Research: A global experimental network to examine kelp forest ecosystems response to changing climate and local disturbances

A. Personnel: One week of summer salary is requested for Dr. Jon Witman each calendar year of the project. He will spend half of the week conducting scuba based research to re-sample 2 long term study sites in the southern Gulf of Maine and the other half processing data collected from the surveys.

Other: Two days of research vessel time is needed each summer during the 4 years of the project to transport researchers to the study sites at Murray Rock and Star Island. The Star Island site can be accessed The Shoals Marine Lab using their vessel at $900 per day, while the Murray Rock is site is farther offshore necessitating a larger vessel from the University of New Hampshire at $1,300/ day.

E. Travel
E1. Domestic Travel: Gas and fees are requested to drive to the embarkation point (Portsmouth NH) from Brown University for 2 days per year at $80 per trip

Fringe Benefit Rates
The fringe benefit rate applied for full time faculty at Brown University is 31.7% from 6/30/2013 thereafter. An annual inflationary increase of 4.0% is applied for salary and fringe benefit expenses.

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of California-Santa Barbara

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jennifer Caselle

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jennifer Caselle - PI**	1.00	0.00	0.00	**7,991**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	1.00	0.00	0.00	**7,991**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**7,991**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**2,815**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**10,806**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**1,000**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**4,051**	
TOTAL OTHER DIRECT COSTS				**5,051**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**15,857**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 26.0000, Base: 15857)**					
TOTAL INDIRECT COSTS (F&A)				**4,123**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**19,980**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**19,980**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jennifer Caselle

ORG. REP. NAME*

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Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of California-Santa Barbara

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jennifer Caselle

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jennifer Caselle - PI**	1.00	0.00	0.00	**8,152**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	1.00	0.00	0.00	**8,152**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**8,152**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**3,251**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**11,403**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**4,051**	
TOTAL OTHER DIRECT COSTS				**4,551**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**15,954**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 26.0000, Base: 15954)**					
TOTAL INDIRECT COSTS (F&A)				**4,148**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**20,102**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**20,102**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jennifer Caselle

ORG. REP. NAME*

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of California-Santa Barbara

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jennifer Caselle

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jennifer Caselle - PI**	1.00	0.00	0.00	**8,314**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	1.00	0.00	0.00	**8,314**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**8,314**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**3,469**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**11,783**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**4,051**	
TOTAL OTHER DIRECT COSTS				**4,551**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**16,334**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 26.0000, Base: 16334)**					
TOTAL INDIRECT COSTS (F&A)				**4,247**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**20,581**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**20,581**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jennifer Caselle

ORG. REP. NAME*

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 4

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of California-Santa Barbara

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jennifer Caselle

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jennifer Caselle - PI**	1.00	0.00	0.00	**8,481**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	1.00	0.00	0.00	**8,481**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**8,481**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**3,717**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**12,198**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**4,051**	
TOTAL OTHER DIRECT COSTS				**4,051**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**16,249**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 26.0000, Base: 16249)**					
TOTAL INDIRECT COSTS (F&A)				**4,225**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**20,474**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**20,474**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jennifer Caselle

ORG. REP. NAME*

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of California-Santa Barbara

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jennifer Caselle

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jennifer Caselle - PI**	4.00	0.00	0.00	**32,938**	
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	4.00	0.00	0.00	**32,938**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**32,938**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**13,252**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**46,190**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**2,000**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**16,204**	
TOTAL OTHER DIRECT COSTS				**18,204**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**64,394**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**16,743**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**81,137**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**81,137**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jennifer Caselle

ORG. REP. NAME*

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C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

BUDGET JUSTIFICATION

Jennifer Caselle: UCSB
Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances

Personnel

Funds are requested to support the PI Caselle in overseeing the Santa Barbara channel portion of the West coast work. One month of salary per year is requested for PI Caselle at UCSB. In year one, Caselle will manage the fieldwork for kelp removals and monitoring at two sites in the SB Channel. In years 2-4 Caselle will oversee the field work and the preparation and interpretation of PISCO–UCSB kelp forest data sets for analysis. In year 4 Caselle will contribute to analysis, interpretation and writing.

Benefit rates for all university and federal personnel are standard university and federal rates.

Supplies

We request $1,000 in year 1 and $500 in years 2 and 3. This will cover dive gear replacement, underwater paper, rebar, z-spar and all miscellaneous supplies related to the kelp clearing experiments.

Equipment

There are no equipment costs associated with this proposal.

Travel

No travel is requested for UCSB. Travel to workshops will be reimbursed by UCSC.

Other Direct Costs

Vessel time - I estimate that the proposed survey will require 15 days in the field to perform the kelp clearing experiment and monitor the clearing. UCSB small boats cost $225.00/day ($138/day + 3 hrs. @ $29/hr.). For 15 days we request $3,375 per year.

SCUBA tank fills at UCSB cost $1.17 per fill and we will require 20 fills per day for 15 days of diving, (total $351 per year).

Finally, vehicle costs are based on mileage from UCSB to the harbor. We will use Caselle's lab truck to pull boats. ($225 per year)

Communication costs are requested for phone and fax charges associated with the project. Personnel associated with this project are located at several institutions on the West coast and we will require periodic communication by phone, fax and web conferencing. ($100 per year)

Indirect Costs

The UC Santa Barbara off-campus indirect cost rate is 26.0%.

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Alaska Fairbanks Campus

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Brenda Konar

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Brenda H Konar**	0.50	0.00	0.00	**5,212**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.50	0.00	0.00	**5,212**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**24,033**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**29,245**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**4,516**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**33,761**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**1,998**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**21,820**	
TOTAL OTHER DIRECT COSTS				**22,320**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**58,079**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Facilities and Administration (Rate: 50.0000, Base: 42259)**					
TOTAL INDIRECT COSTS (F&A)				**21,130**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**79,209**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**79,209**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Brenda Konar

ORG. REP. NAME*
Andrew Gray

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***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Alaska Fairbanks Campus

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Brenda Konar

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Brenda H Konar**	0.50	0.00	0.00	**5,363**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.50	0.00	0.00	**5,363**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**24,033**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**29,396**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**4,719**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**34,115**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**1,998**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**23,402**	
TOTAL OTHER DIRECT COSTS				**23,402**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**59,515**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Facilities and Administration (Rate: 50.0000, Base: 42113)**					
TOTAL INDIRECT COSTS (F&A)				**21,057**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**80,572**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**80,572**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Brenda Konar

ORG. REP. NAME*
Andrew Gray

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Alaska Fairbanks Campus

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Brenda Konar

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Brenda H Konar**	0.50	0.00	0.00	**5,519**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.50	0.00	0.00	**5,519**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**26,653**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**32,172**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**5,007**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**37,179**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**1,998**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**15,368**	
TOTAL OTHER DIRECT COSTS				**15,368**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**54,545**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Facilities and Administration (Rate: 50.0000, Base: 45177)**					
TOTAL INDIRECT COSTS (F&A)				**22,589**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**77,134**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**77,134**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Brenda Konar

ORG. REP. NAME*
Andrew Gray

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 4

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Alaska Fairbanks Campus

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Brenda Konar

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Brenda H Konar**	0.50	0.00	0.00	**5,679**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.50	0.00	0.00	**5,679**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**26,653**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**32,332**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**5,236**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**37,568**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**1,998**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**16,304**	
TOTAL OTHER DIRECT COSTS				**16,304**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**55,870**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Facilities and Administration (Rate: 50.0000, Base: 45566)**					
TOTAL INDIRECT COSTS (F&A)				**22,783**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**78,653**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**78,653**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Brenda Konar

ORG. REP. NAME*
Andrew Gray

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of Alaska Fairbanks Campus

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Brenda Konar

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Brenda H Konar**	2.00	0.00	0.00	**21,773**	
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	2.00	0.00	0.00	**21,773**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**4**) GRADUATE STUDENTS				**101,372**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**123,145**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**19,478**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**142,623**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**7,992**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**76,894**	
TOTAL OTHER DIRECT COSTS				**77,394**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**228,009**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**87,559**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**315,568**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**315,568**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Brenda Konar

ORG. REP. NAME*
Andrew Gray

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C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances

Project dates: August 1, 2014 to July 31, 2018

University of Alaska Fairbanks; PI Brenda Konar

Budget Justification

(i) Salaries and Wages

(a) Senior Personnel. **Brenda Konar (UAF PI)**
2 weeks per year (348 hours total @ $57.36/hour). Konar will share responsibility for project administration and reporting, directly supervise one Ph.D. student, help conduct field sampling and compile data, and contribute to analyses and manuscript preparation for all objectives. Forecasted salaries in all years are incremented by 2.9% for increases.

(b) Other Personnel.
Ph.D.Student—One PhD student, 12 months total: 4 summer months (348 summer hrs) and 8 academic months (696 academic hrs) in each year. The graduate student is to be supported part-time (20 hr/wk) during the 8 academic months per year and part time (20 hr/wk) in the 4 summer months per year. The Ph.D. student will work collaboratively, along with the PIs, to coordinate and conduct field work towards completion of all project objectives.

(ii) Fringe Benefits

Staff benefits are applied according to UAF's provisional benefit rates for FY14 with the Office of Naval Research (ONR). A 31.2% fringe benefit rate applies to Dr. Konar and an 8.2% rate applies to the student summer only. A copy of the provisional rate proposal is available at: http://www.alaska.edu/cost-analysis/downloads/Negotiated/FY11-13_FA_Neg.pdf. PI annual rate (12 months) includes the 1.5% annual leave rate and forecasted 2.9% annual increases. Health insurance for one Ph.D. student is included per UAF guidelines with a 7% cost increase per year for annual increases.

(iii) Equipment

No equipment is requested in this proposal.

(iv) Travel

There will be approximately 2 trips per year from Fairbanks Alaska to the Kasitsna Bay Laboratory in Seldovia, Alaska. Funds are requested for 1205 travel miles (1205 miles x 0.565/ trip), and Water taxi/ ferry travel for 1 van and 8 adults ($318/trip).

No foreign travel requested.

(v) Participant Support

None requested.

(vi) Other Direct Costs

(a) Materials and Supplies
Funds are requested year one to support the cost of field materials and supplies such as rebar, splash zone epoxy, and underwater paper.
(b) Student Services
Tuition is included for a Ph.D. student during years 1-4. Non-resident tuition (18 credits) is $15,820 (year 1) and $17,402 (year 2) and Alaska resident tuition (18 credits) is $9,368 (year 3) and $10,304 (year 4), incremented by 10% per year.

(c) Contractual Services
Funds are requested for lab analysis/fees ($5000/year), and gear maintenance fees ($1,000/year)

(vii) Indirect Costs

Facilities and Administrative (F&A) Costs are negotiated with the Office of Naval Research and the rate for research is calculated at 50% of the Modified Total Direct Costs (MTDC). MTDC includes Total Direct Costs minus tuition, scholarships, subaward amounts over $25,000, and equipment. A copy of the agreement is available at: http://www.alaska.edu/cost-analysis/downloads/Negotiated/FY11-13_FA_Neg.pdf.

UNIVERSITY OF ALASKA FAIRBANKS

PROJECT TITLE: Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances
PI: Konar
START DATE: 1 AUG, 2014
END DATE: 31 JULY, 2018

							Year 1		Year 2		Year 3		Year 4		Total Project
SALARIES AND WAGES							**Hours**		**Hours**		**Hours**		**Hours**		
Senior Personnel			Hourly Wage	Leave Rate	Yearly Increas										
Total Number of Hours	Employee Name														
348.00	Konar, B.	F9 - Faculty (UNAC)	$57.36	1.5%	1.029		87.0	$5,212	87.0	$5,363	87.0	$5,519	87.0	$5,679	**$21,773**
					Total Senior Personnel			$5,212		$5,363		$5,519		$5,679	$21,773
Student Employees															
Number of Students															
1	PhD student (pre-comp)	GT - Graduate, summer	$23.02	0.0%	1		348.0	$8,011	348.0	$8,011	0.0	$0	0.0	$0	**$16,022**
1	PhD student (pre-comp)	GN - Graduate, academic	$23.02	0.0%	1		696.0	$16,022	696.0	$16,022	0.0	$0	0.0	$0	**$32,044**
1	PhD student (post-comp)	GT - Graduate, summer	$25.53	0.0%	1		0.0	$0	0.0	$0	348.0	$8,884	348.0	$8,884	**$17,768**
1	PhD student (post-comp)	GN - Graduate, academic	$25.53	0.0%	1		0.0	$0	0.0	$0	696.0	$17,769	696.0	$17,769	**$35,538**
					Total Other Personnel			$24,033		$24,033		$26,653		$26,653	$101,372
						TOTAL SALARIES AND WAGES		**$29,245**		**$29,396**		**$32,172**		**$32,332**	**$123,145**
FRINGE BENEFITS															
Senior Personnel	Konar, B.	F9 - Faculty (UNAC)			31.2%			$1,626		$1,673		$1,722		$1,772	**$6,793**
					Total Senior Personnel			$1,626		$1,673		$1,722		$1,772	**$6,793**
Student Employees															
	PhD student (pre-comp)	GT - Graduate, summer			8.2%			$657		$657		$0		$0	**$1,314**
	PhD student (pre-comp)	GN - Graduate, academic			0.0%			$0		$0		$0		$0	**$0**
	PhD student (post-comp)	GT - Graduate, summer			8.2%			$0		$0		$728		$728	**$1,456**
	PhD student (post-comp)	GN - Graduate, academic			0.0%			$0		$0		$0		$0	**$0**
			Grad Student Health Insurance (Enter manually)					$2,233		$2,389		$2,557		$2,736	**$9,915**
					Total Other Personnel			$2,890		$3,046		$3,285		$3,464	**$12,685**
						TOTAL FRINGE BENEFITS		**$4,516**		**$4,719**		**$5,007**		**$5,236**	**$19,478**
						TOTAL SALARIES AND BENEFITS		**$33,761**		**$34,115**		**$37,179**		**$37,568**	**$142,623**
TRAVEL			Number												
1. Domestic Travel	**Description**		**Yr 1**	**Yr 2**	**Yr 3**	**Yr 4**	**Item Cost**	**Yearly Increase**							
	Fairbanks AK to Sedovia AK														
Mileage	1205 miles x 0.565		2	2	2	2	Kasitna Bay Lab 680.83	1.1		$1,362		$1,362		$1,362		$1,362	**$5,448**
	Water taxi / ferry 8 adults x														
Ground Transportation	$33.00, 1 van x $54.00 ea		2	2	2	2	318	1		$636		$636		$636		$636	**$2,544**
						Total Domestic Travel				$1,998		$1,998		$1,998		$1,998	$7,992
						TOTAL TRAVEL				**$1,998**		**$1,998**		**$1,998**		**$1,998**	**$7,992**
CONTRACTUAL SERVICES		**Description**													
3052 - Lab Analysis/Services (Lab Testing)		Lab analysis/fees								$5,000		$5,000		$5,000		$5,000	**$20,000**
Other Contractual Service (include description)		gear maintenance								$1,000		$1,000		$1,000		$1,000	**$4,000**
						Total Other Contractual Srvs				$6,000		$6,000		$6,000		$6,000	**$24,000**
						TOTAL CONTRACTUAL SERVICES				**$6,000**		**$6,000**		**$6,000**		**$6,000**	**$24,000**
COMMODITIES		**Description**													
4012 - Supplies (Professional, Technical, and Scientific - Lab Supplies)		rebar, splashzone epoxy, and underwater paper								$500		$0		$0		$0	**$500**
						TOTAL COMMODITIES				**$500**		**$0**		**$0**		**$0**	**$500**
A. MTDC (total costs subject to F&A)										**$42,259**		**$42,113**		**$45,177**		**$45,566**	**$175,115**
B. Facilities and Administration (F&A)						**Select Activity**		**50.0%**		**$21,130**		**$21,057**		**$22,589**		**$22,783**	**$87,558**
STUDENT SERVICES															
Number of Students	Tuition (http://www.uaf.edu/register/expenses/#tuitcalc)					$ Per Credit	# credits	Total							
1	Alaska Resident Tuition (graduate level)					$391	18	$7,038	1.1	$0		$0		$9,368		$10,304	**$19,672**
1	Non-Resident Tuition (graduate level)					$799	18	$14,382	1.1	$15,820		$17,402		$0		$0	**$33,222**
								TOTAL STUDENT SERVICES		**$15,820**		**$17,402**		**$9,368**		**$10,304**	**$52,894**
C. Total Costs Exempt from F&A										**$15,820**		**$17,402**		**$9,368**		**$10,304**	**$52,894**
D. Total Direct Costs (A+C)										**$58,079**		**$59,515**		**$54,545**		**$55,870**	**$228,009**
E. Total Sponsor Request (B+D)										**$79,209**		**$80,572**		**$77,134**		**$78,653**	**$315,567**

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Northeastern University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jonathan Grabowski

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jonathan Grabowski - Associate Professor**	0.00	0.00	0.50	**5,941**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.50	**5,941**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**4**) GRADUATE STUDENTS				**10,609**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**16,550**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**2,380**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**18,930**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**1,667**	
TOTAL OTHER DIRECT COSTS				**2,167**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**21,097**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **NU Full indirect (Rate: 54.5000, Base: 19430)**					
TOTAL INDIRECT COSTS (F&A)				**10,589**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**31,686**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**31,686**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jonathan Grabowski

ORG. REP. NAME*
Lawrence Barnett

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Northeastern University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jonathan Grabowski

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jonathan Grabowski - Associate Professor**	0.00	0.00	0.50	**6,120**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.50	**6,120**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**4**) GRADUATE STUDENTS				**10,927**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**17,047**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**2,451**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**19,498**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**1,520**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**1,667**	
TOTAL OTHER DIRECT COSTS				**2,167**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**23,185**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **NU Full indirect (Rate: 54.5000, Base: 21518)**					
TOTAL INDIRECT COSTS (F&A)				**11,727**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**34,912**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**34,912**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jonathan Grabowski

ORG. REP. NAME*
Lawrence Barnett

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Northeastern University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jonathan Grabowski

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jonathan Grabowski - Associate Professor**	0.00	0.00	0.50	**6,303**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.50	**6,303**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**4**) GRADUATE STUDENTS				**11,255**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**17,558**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**2,525**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**20,083**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**1,520**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**1,667**	
TOTAL OTHER DIRECT COSTS				**2,167**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**23,770**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **NU Full indirect (Rate: 54.5000, Base: 22103)**					
TOTAL INDIRECT COSTS (F&A)				**12,046**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**35,816**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**35,816**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jonathan Grabowski

ORG. REP. NAME*
Lawrence Barnett

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 4

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Northeastern University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jonathan Grabowski

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jonathan Grabowski - Associate Professor**	0.00	0.00	0.50	**6,492**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.50	**6,492**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**4**) GRADUATE STUDENTS				**11,593**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**18,085**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**2,601**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**20,686**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**1,667**	
TOTAL OTHER DIRECT COSTS				**2,167**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**22,853**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **NU Full indirect (Rate: 54.5000, Base: 21186)**					
TOTAL INDIRECT COSTS (F&A)				**11,546**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**34,399**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**34,399**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jonathan Grabowski

ORG. REP. NAME*
Lawrence Barnett

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Northeastern University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jonathan Grabowski

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jonathan Grabowski - Associate Professor**	0.00	0.00	2.00	**24,856**	
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	2.00	**24,856**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**16**) GRADUATE STUDENTS				**44,384**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**69,240**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**9,957**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**79,197**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**3,040**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**2,000**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**6,668**	
TOTAL OTHER DIRECT COSTS				**8,668**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**90,905**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**45,908**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**136,813**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**136,813**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jonathan Grabowski

ORG. REP. NAME*
Lawrence Barnett

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

Northeastern University - Budget Justification

A. Salaries and Wages- Personnel

Funds are requested for salary support for PI Grabowski (0.5 month in each project year) with a projected 3% salary increase for each future year. Grabowski will be responsible for overseeing the successful completion of all aspects of the proposed research conducted at the Nahant site, and will assist with sampling at other sites in the region. Funds are also budgeted for one semester of support per year for a PhD graduate student, with the remaining support stemming from teaching assistantships. Because the proposed study meshes well with the overarching research in the Grabowski lab, I anticipate using these funds to support current students in my lab, of which 4 are currently AAUS diver certified.

B. Fringe Benefits

Fringe Benefits are calculated as 26.4% of Grabowski's time. For the graduate student, summer interns, and temporary outreach technician, fringe benefits are calculated as 7.65% of salary/stipend.

C. Travel

Domestic travel

Travel is requested year's 2 and 3 to send 1 graduate student to San Diego to assist with the western North America experimental efforts: $400 for airfare and $160 for food and lodging per day x 7 days = $1520 in both project years).

D. Equipment

None requested

E. Other

Funds are budgeted in each project year ($500/yr) to cover the cost of general supplies, air fills, and dive equipment maintenance. Funds are budgeted to cover the cost of graduate student tuition (1,667/yr.).

J. Indirect Costs

Indirect costs are charged at Northeastern University's federally negotiated rate of 54.5% on all expenses other than tuition and equipment, which are not charged indirect costs.

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
San Diego State University Foundation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Matthew Edwards

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Matthew S Edwards - PI**	0.00	0.00	0.99	**8,745**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.99	**8,745**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**19,500**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**28,245**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**5,501**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**33,746**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**5,000**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**4,000**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**4,000**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**42,746**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 26.0000, Base: 42746)**					
TOTAL INDIRECT COSTS (F&A)				**11,114**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**53,860**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**53,860**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Matthew Edwards

ORG. REP. NAME*
Dena Plemmons

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
San Diego State University Foundation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Matthew Edwards

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Matthew S Edwards - PI**	0.00	0.00	0.99	**9,007**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.99	**9,007**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**20,085**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**29,092**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**5,666**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**34,758**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**5,000**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**3,000**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**3,000**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**42,758**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 26.0000, Base: 42758)**					
TOTAL INDIRECT COSTS (F&A)				**11,117**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**53,875**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**53,875**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Matthew Edwards

ORG. REP. NAME*
Dena Plemmons

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
San Diego State University Foundation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Matthew Edwards

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Matthew S Edwards - PI**	0.00	0.00	0.99	**9,277**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.99	**9,277**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**20,688**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**29,965**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**5,836**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**35,801**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**5,000**	
2. FOREIGN				**3,000**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**3,000**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**3,000**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**46,801**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 26.0000, Base: 46801)**					
TOTAL INDIRECT COSTS (F&A)				**12,168**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**58,969**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**58,969**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Matthew Edwards

ORG. REP. NAME*
Dena Plemmons

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
San Diego State University Foundation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Matthew Edwards

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Matthew S Edwards - PI**	0.00	0.00	2.97	**27,029**	
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	2.97	**27,029**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**3**) GRADUATE STUDENTS				**60,273**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**87,302**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**17,003**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**104,305**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**15,000**	
2. FOREIGN				**3,000**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**10,000**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**10,000**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**132,305**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**34,399**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**166,704**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**166,704**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Matthew Edwards

ORG. REP. NAME*
Dena Plemmons

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C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

BUDGET JUSTIFICATION

A. Senior Personnel **$ 27,029**

Co-Principle Investigator's Summer Salary (2014-2018)

These funds will cover one month of summer salary for M. Edwards during each of the first three years of the project. Dr. Edwards will be in charge of organizing and leading all field trips, data and sample collection for sites in San Diego and Mexico, and assist with Monterey.

B. Other Personnel **$ 60,273**

Graduate Student Researcher (2014-2018)

These funds are to cover stipends for one SDSU graduate student in each of the first three years of the study as part of his/her graduate research program. This student will work with co-PI Edwards and the project post doc to do the field sampling and experimental manipulations, and to help coordinate activities with other students.

C. Fringe Benefits **$17,003**

Principle Investigator	$ 6,757
Graduate Student Researchers (GSR)	$10,246

D. Travel and Field Research **$ 18,000**

These funds will be used to cover costs associated with travel to and from field sites (fuel for research boat and tow vehicle, food and lodging). Specifically, funds are requested for work in Point Loma and La Jolla kelp forests, Baja kelp forests and Monterey kelp forests.

E. Permanent Equipment **$ 0**

No permanent equipment is requested.

F. Other Direct Costs **$ 10,000**

These funds will be used to purchase supplies needed for doing the subtidal surveys (transect tapes, clipboards, u/w paper), dive gear repair and replace, hardware for maintaining and marking experimental sites, research permits, and minor boat repairs.

Total direct costs	$ 132,305
Total Indirect Costs @ 26%	$ 34,399
Total Project Costs	**$ 166,704**

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Stanford University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Fiorenza Micheli

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Fiorenza Micheli - Professor**	0.00	0.00	0.20	**2,063**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.20	**2,063**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**2,063**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**609**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**2,672**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**8,300**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**1,500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**1,500**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**12,472**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 30.2000, Base: 12472)**					
TOTAL INDIRECT COSTS (F&A)				**3,767**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**16,239**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**16,239**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Fiorenza Micheli

ORG. REP. NAME*
Nicole Pobuta

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Stanford University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Fiorenza Micheli

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Fiorenza Micheli - Professor**	0.00	0.00	0.20	**2,125**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.20	**2,125**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**2,125**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**627**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**2,752**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**3,850**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**0**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**6,602**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 30.2000, Base: 6602)**					
TOTAL INDIRECT COSTS (F&A)				**1,994**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**8,596**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**8,596**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Fiorenza Micheli

ORG. REP. NAME*
Nicole Pobuta

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Stanford University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Fiorenza Micheli

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Fiorenza Micheli - Professor**	0.00	0.00	0.20	**2,189**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.20	**2,189**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**34,934**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**37,123**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**2,392**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**39,515**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**2,100**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**11,104**	
TOTAL OTHER DIRECT COSTS				**11,104**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**52,719**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 30.2000, Base: 41615)**					
TOTAL INDIRECT COSTS (F&A)				**12,568**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**65,287**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**65,287**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Fiorenza Micheli

ORG. REP. NAME*
Nicole Pobuta

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 4

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Stanford University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Fiorenza Micheli

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Fiorenza Micheli - Professor**	0.00	0.00	0.20	**2,254**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.20	**2,254**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**0**) GRADUATE STUDENTS				**0**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**2,254**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**665**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**2,919**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**2,100**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**0**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**0**	
TOTAL OTHER DIRECT COSTS				**0**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**5,019**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **MTDC (Rate: 30.2000, Base: 5019)**					
TOTAL INDIRECT COSTS (F&A)				**1,516**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**6,535**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**6,535**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Fiorenza Micheli

ORG. REP. NAME*
Nicole Pobuta

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
Stanford University

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Fiorenza Micheli

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Fiorenza Micheli - Professor**	0.00	0.00	0.80	**8,631**	
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.80	**8,631**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**34,934**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**43,565**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**4,293**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**47,858**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**16,350**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**1,500**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**11,104**	
TOTAL OTHER DIRECT COSTS				**12,604**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**76,812**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**19,845**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**96,657**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**96,657**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Fiorenza Micheli

ORG. REP. NAME*
Nicole Pobuta

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

Budget justification: Stanford University

Salaries:

Summer salary support, based on an annual salary of $159,000, is requested for Micheli (0.25 mo/year in each of the four years) who will coordinate and conduct ecological field work in central California and Baja California, and will work with other project participants in the design and implementation of field monitoring and experiments, data analyses, and reporting and publication of results.

Support is also requested for one graduate student, Ms Natalie Low, in year 3. Low's work on this project will form the basis of part of her thesis. Low will interact extensively at group meetings and during fieldwork with other project participants, thereby receiving training in interdisciplinary research approaches and integration.

Fringe Benefits:
Stanford and the Office of Naval Research (ONR) have agreed on final Fringe Benefits and Vacation Accrual/Disability Sick Leave rates for fiscal year 2013. The final rate agreement is dated May 21, 2013. The rates are 29.5% for faculty and staff, 28.4% for post docs, 5.0% for graduate research assistants and 8.2% for contingent employees.

Equipment:

No major equipment is requested.

Travel:

Domestic travel: Low requests funds for travel and subsistence during fieldwork in southern California, where she will join other project participants to establish and monitor experiments. Support for two trips to Santa Barbara, California, in year 1, in winter to conduct the clearings and in spring to monitor short term recovery, and for one trip in the spring of year 2, to assess long term recovery is requested. Each trip will be one week long. Low will travel to Santa Barbara by car, so only gas mileage, lodging and food are requested. We are requesting $1700 in year 1 and $850 in year 2.

Micheli and Low request funds for travel and subsistence during fieldwork in Baja California, Mexico, in each of the 4 years. We anticipate 2 trips in year 1 (in winter and spring, approx. 10 days long, to conduct experimental clearings and monitor short term recovery). We will travel to Isla Natividad by car, and funds are requested for gasoline, food and lodging during the trips. Additional support is requested for a technician or field assistant who will help in the field in years 1. In the last three years of the project, one field visit each year will be conducted by two people in early spring to assess long term recovery and present results to local communities. We are requesting $6,100 in year 1 and $2,500 in year 2, and $2,100 in years 3 and 4.

Funds are also requested to support travel by Low to participate in experiments at the northeastern Atlantic sites. Two trips to Boston are requested in the fall of year 1 and 2 of the project. Only funds for airfares, $500 roundtrip, for each of the two trips are requested as lodging and transportation will be provided onsite to the participating graduate students.

Materials and Supplies:
Funds ($1,500) are requested, in year one, to purchase miscellaneous supplies for the experiment (including rebar and Z-spar to deploy the sensors, subsurface buoys to mark the plots, underwater slates and paper, miscellaneous diving supplies) to complement what already available in Micheli's lab, and to pay for research permit fees (approx. $500).

Other direct costs: Tuition
Tuition is requested for the graduate student (Low). Low will have achieved candidate status in year 3 of this project and tuition is charged at the reduced Terminal Graduate Registration (TGR).

Inflation:
Beginning in year 2, a 3% annual inflation rate has been applied to salaries and travel and supplies.

Facilities, and Administrative costs:

Per provisional agreement dated August 30, 2012 between Stanford University and the Office of Naval Research, effective September 1, 2012 the provisional cost rates for on-campus research for fiscal year 2013 is 57.0% on modified direct costs (excludes capital equipment, patient care and tuition and subawards in excess of $25,000) and the off-campus rate is 30.2% on modified total direct costs.

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of New Hampshire

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jennifer Dijkstra

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jennifer Dijkstra - none**	0.50	0.00	0.00	**3,310**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.50	0.00	0.00	**3,310**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**22,902**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**26,212**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**897**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**27,109**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**2,000**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**216**	
5. SUBAWARDS				**0**	
6. OTHER				**19,347**	
TOTAL OTHER DIRECT COSTS				**21,563**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**48,672**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Off-campus-F&A MTDC (Rate: 26.0000, Base: 13707) (Cont. on Comments Page)**					
TOTAL INDIRECT COSTS (F&A)				**10,983**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**59,655**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**59,655**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jennifer Dijkstra

ORG. REP. NAME*
Cheryl Moore

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 1

**** I- Indirect Costs**
On-campus-F&A MTDC (Rate: 47.5000, Base 15618)

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION: **University of New Hampshire**

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR: **Jennifer Dijkstra**

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jennifer Dijkstra - none**	0.50	0.00	0.00	**3,409**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.50	0.00	0.00	**3,409**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**23,210**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**26,619**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**905**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**27,524**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**600**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**1,300**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**222**	
5. SUBAWARDS				**0**	
6. OTHER				**20,758**	
TOTAL OTHER DIRECT COSTS				**22,280**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**50,404**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Off-campus-F&A-MTDC (Rate: 26.0000, Base: 13715) (Cont. on Comments Page)**					
TOTAL INDIRECT COSTS (F&A)				**11,134**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**61,538**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**61,538**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME: **Jennifer Dijkstra**

ORG. REP. NAME*: **Cheryl Moore**

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 2

**** I- Indirect Costs**
On-campus-F&A-MTDC (Rate: 47.5000, Base 15932)

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of New Hampshire

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jennifer Dijkstra

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jennifer Dijkstra - none**	0.50	0.00	0.00	**3,512**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.50	0.00	0.00	**3,512**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**25,447**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**28,959**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**914**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**29,873**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**600**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**1,300**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**229**	
5. SUBAWARDS				**0**	
6. OTHER				**6,715**	
TOTAL OTHER DIRECT COSTS				**8,244**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**38,717**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Off-campus-F&A-MTDC (Rate: 26.0000, Base: 13826) (Cont. on Comments Page)**					
TOTAL INDIRECT COSTS (F&A)				**12,229**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**50,946**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**50,946**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jennifer Dijkstra

ORG. REP. NAME*
Cheryl Moore

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 3

**** I- Indirect Costs**
On-campus-F&A-MTDC (Rate: 47.5000, Base 18176)

SUMMARY PROPOSAL BUDGET

YEAR 4

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of New Hampshire

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jennifer Dijkstra

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jennifer Dijkstra - none**	0.50	0.00	0.00	**3,617**	
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.50	0.00	0.00	**3,617**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**25,806**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**29,423**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**923**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**30,346**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**1,300**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**235**	
5. SUBAWARDS				**0**	
6. OTHER				**7,149**	
TOTAL OTHER DIRECT COSTS				**8,684**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**39,030**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Off-campus-F&A-MTDC (Rate: 26.0000, Base: 13340) (Cont. on Comments Page)**					
TOTAL INDIRECT COSTS (F&A)				**12,275**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**51,305**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**51,305**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jennifer Dijkstra

ORG. REP. NAME*
Cheryl Moore

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET COMMENTS - Year 4

**** I- Indirect Costs**
On-campus-F&A-MTDC (Rate: 47.5000, Base 18541)

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
University of New Hampshire

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Jennifer Dijkstra

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1. **Jennifer Dijkstra - none**	2.00	0.00	0.00	**13,848**	
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	2.00	0.00	0.00	**13,848**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**4**) GRADUATE STUDENTS				**97,365**	
4. (**0**) UNDERGRADUATE STUDENTS				**0**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**111,213**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**3,639**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**114,852**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**1,200**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**5,900**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**902**	
5. SUBAWARDS				**0**	
6. OTHER				**53,969**	
TOTAL OTHER DIRECT COSTS				**60,771**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**176,823**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**46,621**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**223,444**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**223,444**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Jennifer Dijkstra

ORG. REP. NAME*
Cheryl Moore

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

University of New Hampshire
Dr. Jennifer Dijkstra, Co-PI

Budget Justification

A. **Senior Personnel:** Funds are requested to support Dr. Jennifer Dijkstra PhD, (0.5 months)**.** Dijkstra will work together with other PIs in the region to complete experimental field work at two sites at the Isles of Shoals, ME/NH and one site in southern Maine. In addition, she will conduct quantitative surveys at an additional site at the Isles of Shoals. Manipulations and surveys are SCUBA based and will take place over 1.5 weeks during each summer for the next 4 years. In addition, she will supervise a graduate student that will participate in experimental manipulations at the Isles of Shoals, ME/NH, and twice in San Diego, CA. She will also participate in data analysis and synthesis.

Salaries are inflated at an annual rate of 3% per published UNH guidelines.

B. Other Personnel:

Graduate Students: Support for one graduate student is sought for the duration of the study period. Stipend, tuition and summer salary will cover one graduate student for each year of the proposed study (total 4 years) that will be advised by Dr. Dijkstra. The graduate student will participate in the manipulative experiments at the Isles of Shoals, Maine and in San Diego (year 2 and 3) and will carry-out their own independent research project.

C. Fringe Benefits:

Fringe benefits will be charged according to UNH's current federally-approved benefits rates for the project period, at the "partial fringe benefits" rate of 8.3% for faculty and graduate student summer salary.

D. Equipment: None

E. Travel:

Funds are requested to support travel to San Diego in Year 2 and 3 for sampling. Requested funds are for travel to the airport and plane tickets only. The Co-PI in San Diego will cover lodging and meals for the student.

F. Participant Support Costs: None

G. Other Direct Costs:

Materials and Supplies: Funds are requested to purchase z-spar and rebar, incidentals such as equipment failures or repairs during the study period.

Publication Costs / Documentation / Dissemination: None

Consultant Services: None.

Computer Services: Funds are requested for data storage and technical computer services (see budget excel spreadsheet and facilities).

Subawards: None

Other: Funds are requested for tuition and health benefits for 1 PhD graduate student for each year of the grant.

I. **Indirect Costs (F&A):** Facilities & Administrative (indirect) costs are calculated according to UNH's current negotiated rate agreement with the Federal government. For the proposed budget, both an on-campus and off-campus rate with a Modified Total Direct Costs base (modified for NSF requirements) is applied. The applicable rates, as shown on our Federal agreement is 47.5% for the work completed on-campus and 26% for the work completed off-campus. The US Department of Health and Human Services is UNH's cognizant federal agency.

SUMMARY PROPOSAL BUDGET

YEAR 1

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
San Jose State University Foundation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Scott Hamilton

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1.	0.00	0.00	0.00		
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**24,480**	
4. (**1**) UNDERGRADUATE STUDENTS				**4,320**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**28,800**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**3,053**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**31,853**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**1,450**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**3,900**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**5,760**	
TOTAL OTHER DIRECT COSTS				**9,660**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**42,963**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Facilities and Administration (Rate: 26.0000, Base: 42963)**					
TOTAL INDIRECT COSTS (F&A)				**11,170**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**54,133**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**54,133**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Scott Hamilton

ORG. REP. NAME*
Michele vaccaro

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INDIRECT COST RATE VERIFICATION		
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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 2

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
San Jose State University Foundation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Scott Hamilton

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1.	0.00	0.00	0.00		
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**24,480**	
4. (**1**) UNDERGRADUATE STUDENTS				**4,320**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**28,800**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**3,341**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**32,141**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**1,450**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**2,100**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**5,760**	
TOTAL OTHER DIRECT COSTS				**7,860**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**41,451**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Facilities and Administration (Rate: 26.0000, Base: 41451)**					
TOTAL INDIRECT COSTS (F&A)				**10,777**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**52,228**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**52,228**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Scott Hamilton

ORG. REP. NAME*
Michele vaccaro

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 3

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
San Jose State University Foundation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Scott Hamilton

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1.	0.00	0.00	0.00		
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**24,480**	
4. (**1**) UNDERGRADUATE STUDENTS				**4,320**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**28,800**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**3,628**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**32,428**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**2,100**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**5,760**	
TOTAL OTHER DIRECT COSTS				**7,860**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**40,288**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Facilities and Administration (Rate: 26.0000, Base: 40288)**					
TOTAL INDIRECT COSTS (F&A)				**10,475**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**50,763**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**50,763**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Scott Hamilton

ORG. REP. NAME*
Michele vaccaro

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 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

YEAR 4

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
San Jose State University Foundation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Scott Hamilton

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1.	0.00	0.00	0.00		
2.					
3.					
4.					
5.					
6. (**0**) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**1**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**1**) GRADUATE STUDENTS				**12,240**	
4. (**1**) UNDERGRADUATE STUDENTS				**4,320**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**16,560**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**2,253**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**18,813**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**0**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**2,100**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**5,760**	
TOTAL OTHER DIRECT COSTS				**7,860**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**26,673**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE) **Facilities and Administration (Rate: 26.0000, Base: 26673)**					
TOTAL INDIRECT COSTS (F&A)				**6,935**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**33,608**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**33,608**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Scott Hamilton

ORG. REP. NAME*
Michele vaccaro

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INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

 ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

SUMMARY PROPOSAL BUDGET

Cumulative

FOR NSF USE ONLY		
PROPOSAL NO.	DURATION (months) Proposed	Granted
AWARD NO.		

ORGANIZATION
San Jose State University Foundation

PRINCIPAL INVESTIGATOR / PROJECT DIRECTOR
Scott Hamilton

A. SENIOR PERSONNEL: PI/PD, Co-PI's, Faculty and Other Senior Associates (List each separately with title, A.7. show number in brackets)	NSF Funded Person-months CAL	ACAD	SUMR	Funds Requested By proposer	Funds granted by NSF (if different)
1.	0.00	0.00	0.00		
2.					
3.					
4.					
5.					
6. ( ) OTHERS (LIST INDIVIDUALLY ON BUDGET JUSTIFICATION PAGE)	0.00	0.00	0.00	**0**	
7. (**0**) TOTAL SENIOR PERSONNEL (1 - 6)	0.00	0.00	0.00	**0**	
B. OTHER PERSONNEL (SHOW NUMBERS IN BRACKETS)					
1. (**0**) POST DOCTORAL SCHOLARS	0.00	0.00	0.00	**0**	
2. (**0**) OTHER PROFESSIONALS (TECHNICIAN, PROGRAMMER, ETC.)	0.00	0.00	0.00	**0**	
3. (**4**) GRADUATE STUDENTS				**85,680**	
4. (**4**) UNDERGRADUATE STUDENTS				**17,280**	
5. (**0**) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)				**0**	
6. (**0**) OTHER				**0**	
TOTAL SALARIES AND WAGES (A + B)				**102,960**	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)				**12,275**	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)				**115,235**	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING $5,000.)					
TOTAL EQUIPMENT				**0**	
E. TRAVEL 1. DOMESTIC (INCL. CANADA, MEXICO AND U.S. POSSESSIONS)				**2,900**	
2. FOREIGN				**0**	
F. PARTICIPANT SUPPORT COSTS					
1. STIPENDS $ **0**					
2. TRAVEL **0**					
3. SUBSISTENCE **0**					
4. OTHER **0**					
TOTAL NUMBER OF PARTICIPANTS (**0**) TOTAL PARTICIPANT COSTS				**0**	
G. OTHER DIRECT COSTS					
1. MATERIALS AND SUPPLIES				**10,200**	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION				**0**	
3. CONSULTANT SERVICES				**0**	
4. COMPUTER SERVICES				**0**	
5. SUBAWARDS				**0**	
6. OTHER				**23,040**	
TOTAL OTHER DIRECT COSTS				**33,240**	
H. TOTAL DIRECT COSTS (A THROUGH G)				**151,375**	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)					
TOTAL INDIRECT COSTS (F&A)				**39,357**	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)				**190,732**	
K. RESIDUAL FUNDS				**0**	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)				**190,732**	

M. COST SHARING PROPOSED LEVEL $ **0** AGREED LEVEL IF DIFFERENT $

PI/PD NAME
Scott Hamilton

ORG. REP. NAME*
Michele vaccaro

FOR NSF USE ONLY		
INDIRECT COST RATE VERIFICATION		
Date Checked	Date Of Rate Sheet	Initials - ORG

C ***ELECTRONIC SIGNATURES REQUIRED FOR REVISED BUDGET**

G. BUDGET JUSTIFICATION (MLML)

Salaries
This project is labor intensive the field. It will require the time of three co-PIs (Hamilton, Graham and Steller), one one graduate student (TBA), and numerous student assistants. The PIs have decades of combined experience conducting subtidal research on kelps, invertebrates, and fishes in kelp forests in California and across the globe, which will ensure the success of the proposed research.

Drs. Hamilton, Steller and Graham will not request salary support but will dedicate time to the project including project administration and logistics, participation in field research, graduate student training and mentoring, data analysis, and the dissemination of results.

We request funding for one Master's student at MLML (TBA) for Years 1-3 at 49% time during the academic year and 100% time during the summer field season. We request half the graduate student support in year 4. The graduate student will develop a Master's project related to the goals of the proposed project. This student will be responsible helping to conduct kelp removal experiments in the Northeast Pacific and Northwest Atlantic and will coordinate observational experiments of kelp forests along the central CA coast. The student will also participate in data entry, data management, data analysis, and manuscript writing. Additional support, if needed (Master's students typically take 3-4 years to complete a degree at MLML), will come from teaching assistant positions.

We also request funding for student assistants to help with diving related fieldwork. These students will be paid $18/hr and we request 240 hrs of time each year in years 1-4.

Each year the Department of Health and Human Services reviews and approves the SJSU Research Foundation, fiscal agent and auxiliary of SJSU, fringe benefit rates which are effective as of July 1st of each year. Rates are subject to change and the current rate at time of award will be used.

The total salary and benefit budget in Yr 1 is $31,853; in Yr 2 is $32,141; in Yr 3 is $32,428; and in Yr 4 is $18,813.

Travel
We request funding for the graduate student to travel to Boston in year 1 and 2 to help conduct fieldwork with our collaborating institutions on the east coast. We request $700 in airfare and transportation costs each year and $750 in per diem. Other travel costs will be borne by the lead institution.

The total travel budget in Yr 1 is $1,450; in Yr 2 is $1,450, in Yr 3 is $0; and in Yr 4 is $0.

Equipment
No equipment requested

Supplies
We request funding for supplies to conduct field and laboratory components of the project including:

a) Dive gear including regulators, wetsuits, buoyancy compensators, dive computers, etc. ($2,000 in year 1, $500 years 2-4)
b) CPR, first aid, and dive training ($100 per year, years 1-4)
c) Underwater paper ($150 per year, years 1-4),
d) Transect tapes and slates ($400 year 1, $100 per year, years 2-4)
e) Airfills ($1000 per year, years 1-4)
f) Miscellaneous supplies ($250 per year, years 1-4)

Total supply budget is: $3900 in Yr 1, $2,100 in Yr 2, $2,100 in Yr 3, and $2,100 in Yr 4.

Other Direct Costs
We request funding for vehicle and boat recharge costs to access the dive sites and conduct fieldwork. Each year we request $5,760 in years 1-4 .

The total other direct costs budget each year is $5,760

Indirect Costs
The Department of Health and Human Services is the federal cognizant agency which reviews and approves both the fringe benefit and facilities and administrative fees for San Jose State University Research Foundation. The current fringe rate the time of award will be applied. The current approved off-campus rate of 26% has been applied to the total modified direct costs (total direct costs less: stipends, participant costs, equipment over $5,000, subcontracts exceeding $25,000 and tuition).

The total indirect costs on the modified total direct costs in Yr 1 are $11,170; in Yr 2 are $10,777; in Yr 3 are $10,475; and in Yr 4 are $6,935.

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Jarrett Byrnes	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate and Local Disturbances

Source of Support: NSF

Total Award Amount: $ 870,667 Total Award Period Covered: 08/01/14 - 07/31/18

Location of Project: Boston, MA

Person-Months Per Year Committed to the Project. Cal: 0.00 Acad: 0.00 Sumr: 1.00

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Food Web Structure as a Driver of Multiple Ecosystem Function in Tidal Marshes

Source of Support: MIT Sea Grant

Total Award Amount: $ 165,536 Total Award Period Covered: 02/01/14 - 01/31/16

Location of Project: Boston, MA

Person-Months Per Year Committed to the Project. Cal: 0.00 Acad: 1.00 Sumr: 0.00

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Summ:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Jennifer Caselle	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Senior Per: Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate and Local Disturbances

Source of Support: UMASS Boston/NSF BIO OCE

Total Award Amount: $ 870,667 Total Award Period Covered: 08/01/14 - 07/31/18

Location of Project: UCSB

Person-Months Per Year Committed to the Project. Cal: 1.00 Acad: 0.00 Sumr: 0.00

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: CAMEO:Comparative Approach to predicting the consequences of an impending reinvasion: Top-Predator effects on California nearshore fisheries

Source of Support: NSF OCE-1041489

Total Award Amount: $ 122,482 Total Award Period Covered: 07/15/10 - 06/30/14

Location of Project: University of Califoria, Santa Barbara

Person-Months Per Year Committed to the Project. Cal: 0.25 Acad: 0.00 Sumr: 0.00

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: South Coast MPA Kelp and Shallow Rock Ecosystems: Baseline Data Collection and Long-Term Trends Using Historical Data (R/MPA-27-B)

Source of Support: UC Sea Grant College Program

Total Award Amount: $ 269,804 Total Award Period Covered: 09/01/11 - 06/30/14

Location of Project: University of California, Santa Barbara

Person-Months Per Year Committed to the Project. Cal: 3.00 Acad: 0.00 Sumr: 0.00

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Integrative Assessment of Baseline Ecological and Socioeconomic Conditions and Initial Changes within the South Coast MPA region (R/MPA-23, Caselle, Blanchette)

Source of Support: UC Sea Grant College Program

Total Award Amount: $ 265,000 Total Award Period Covered: 09/01/11 - 06/30/14

Location of Project: University of California, Santa Barbara

Person-Months Per Year Committed to the Project. Cal: 3.00 Acad: 0.00 Sumr: 0.00

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Understanding the California Current Large Marine Ecosystem Under Climate Change: Delivering Sound Science for Policy (F)720A-C, Gaines, Warner, Washburn, Blanchette,

Source of Support: Oregon STate University

Total Award Amount: $ 189,910 Total Award Period Covered: 01/01/12 - 12/31/13

Location of Project: University of California, Santa Barbara

Person-Months Per Year Committed to the Project. Cal: 1.50 Acad: 0.00 Summ: 0.00

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Jennifer Caselle	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Coral Reef Research in a Rare, Undisturbed Ecosystem: UCSB and Palmyra Atoll (1-12-065/2)

Source of Support: Marisla Foundation
Total Award Amount: $ 525,000 Total Award Period Covered: 03/30/12 - 03/30/15
Location of Project: University of California, Santa Barbara
Person-Months Per Year Committed to the Project. Cal: 3.72 Acad: 0.00 Sumr: 0.00

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Regional Importance of Manmade Structures as Rockfish Nurseries (UCSC MCA 12-005)

Source of Support: UC Santa Cruz
Total Award Amount: $ 181,424 Total Award Period Covered: 04/01/12 - 03/31/14
Location of Project: University of California, Santa Barbara
Person-Months Per Year Committed to the Project. Cal: 0.25 Acad: 0.00 Sumr: 0.00

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Understanding Coral Reef Resilience to Advance Science and Conservation (SB130041, Caselle, Warner)

Source of Support: The Coral Reef Alliance
Total Award Amount: $ 173,652 Total Award Period Covered: 12/07/12 - 06/30/14
Location of Project: University of California, Santa Barbara
Person-Months Per Year Committed to the Project. Cal: 0.50 Acad: 0.00 Sumr: 0.00

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Understanding the California Current Large Marine Ecosystem Under Climate Change: Delivering Sound Science for Policy (F0767A-C, Blanchette, Caseele, Gaines, Warner,

Source of Support: Oregon State University
Total Award Amount: $ 232,045 Total Award Period Covered: 03/22/12 - 12/31/13
Location of Project: University of California, Santa Barbara
Person-Months Per Year Committed to the Project. Cal: 1.50 Acad: 0.00 Sumr: 0.00

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Understanding the California Current Large Marine Ecosystem Under Climate Change: Delivering Sound Science for Policy 2014 (Blanchette, Caselle, Gaines, Warner,Washburn)

Source of Support: Oregon State University
Total Award Amount: $ 232,045 Total Award Period Covered: 01/01/14 - 12/31/14
Location of Project: University of California, Santa Barbara
Person-Months Per Year Committed to the Project. Cal: 1.50 Acad: 0.00 Summ: 0.00

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.C.2.h for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Jon Witman	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Senior Per: Collaborative Research: A global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate and Local Disturbances

Source of Support: NSF Bio Oce

Total Award Amount: $ 870,667 Total Award Period Covered: 08/01/14 - 07/31/18

Location of Project: Brown University

Person-Months Per Year Committed to the Project. Cal: 0.00 Acad: 0.00 Sumr: 0.25

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Effects of predator diversity on the strength of trophic cascades in an oceanic benthic ecosystem

Source of Support: NSF/OCE

Total Award Amount: $ 628,896 Total Award Period Covered: 03/15/11 - 02/28/14

Location of Project: Brown University

Person-Months Per Year Committed to the Project. Cal: 2.00 Acad: 0.00 Sumr: 0.00

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Summ:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

UAF Konar Current and Pending

Investigator name: Brenda Konar	**Affiliation: University of Alaska Fairbanks**								
Has the current proposal been submitted to any other funding source?		**NO**	**If "Yes" list name of funding source:**						
Current Support									
Project Title	Supporting Agency	2013	2014	2015	2016	2017	Start/End Dates	Award Amounts	Location of Research
Chukchi Sea Offshore Monitoring in Drilling Area (COMIDA): Hann Shoal Ecosystem Study	University of Texas at Austin	1.5	0.5	0.5			1 SEP 2011 to 31 AUG 2016	$264,913	Alaska
Long-term monitoring of Ecological Communities in Kachemak Bay: a comparison and control for Prince William Sound	Exxon Valdez Oil Spill Trustee Council	0.5	0.5	0.5			1 JUL 2011 to 30 JUN 2016	$220,737	Alaska
CANIMIDA2	BOEM (with University of Texas)	0.25	0.1	0.25	0.25	0.25	1 JUN 2012 to 31 MAY 2017	$53,571	Alaska
Pending Support									
Project Title	Potential Supporting Agency	2013	2014	2015	2016	2017	Start/End Dates	Requested Amount	Location of research
Recovery of shallow subtidal fish habitats two decades after the Exxon Valdez oil spill	OSRI	0.25	0.75	0.75	0.25		1 JUL 2013 to 30 JUN 2016	$294,558	Alaska
Sedimentation impacts on Arctic coastal boulder communities: an expansion of the ANIMIDA III Project	Northern Pacific Research Board		0.3	0.3	0.25		1 JUL 2013 to 30 JUN 2016	$62,253	Alaska
Habitat Degradation Due to Melting Glaciers	Alaska Sea Grant						01-FEB-2014 to 31-JAN-2015	$74,423	Alaska
Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances **THIS PROPOSAL**	National Science Foundation		0.25	0.25	0.25	0.25	01-AUG-2014 to 31-JUL-2018	$315,567	Alaska

CURRENT AND PENDING SUPPORT

Investigator: J.H. Grabowski (PI)

Status: Current

Title: Collaborative Research: the influence of predators on community structure and resultant ecosystem functioning at a biogeographic scale

Source of Support: NSF, Biological Oceanography

Award Amount: $131,305 (NU Portion)

Award Period: 06/15/10 – 05/31/14 (no cost extension)

Location: Northeastern University, Marine Science Center & UNC-Chapel Hill, Institute of Marine Sciences

Person-Months per Year Committed to the Project. Cal: 0.00 Acad: 0.00 Sumr: 1.00

Investigators: J.H. Grabowski (PI), S. Vollmer (co-PI), B. Harris (co-PI), K. Stokesbury (co-PI)

Status: Current

Title: Identifying source-sink dynamics in sea scallop populations of the northwest Atlantic

Source of Support: 2013 NOAA Scallop RSA

Award Amount: $276,859

Award Period: 05/01/13 – 04/30/15

Location: Northeastern University, Marine Science Center

Person-Months per Year Committed to the Project. Cal: 0.00 Acad: 0.00 Sumr: 1.00

Investigators: J.H. Grabowski (PI)

Status: Current

Title: Archival tagging and age validation efforts to assess monkfish movement, age structure, and growth in the Gulf of Maine

Source of Support: 2013 NOAA Monkfish RSA

Award Amount: $35,582 (NU Portion)

Award Period: 05/01/13 – 04/30/15

Location: Northeastern University, Marine Science Center

Person-Months per Year Committed to the Project. Cal: 0.00 Acad: 0.00 Sumr: 0.25

Investigators: J.H. Grabowski (PI)

Status: Current

Title: Tisbury Great Pond Oyster Habitat Restoration: Monitoring program

Source of Support: The Nature Conservancy

Award Amount: $36,300

Award Period: 05/28/13 – 12/31/14

Location: Northeastern University, Marine Science Center

Person-Months per Year Committed to the Project. Cal: 0.00 Acad: 0.00 Sumr: 0.25

Investigators: J.H. Grabowski (PI), S. Scyphers (co-PI) & M. Ruth (co-PI)

Status: Pending

Title: Social and ecological factors influencing shoreline hardening in the Northeast: Implications for vulnerability, resilience, and informed decision making

Source of Support: Sea Grant

Award Amount: $301,201

Award Period: 02/01/2014 – 01/31/16

Location: Northeastern University, Marine Science Center

Person-Months per Year Committed to the Project. Cal: 0.00 Acad: 0.00 Sumr: 1.00

Investigators: J.H. Grabowski (PI)

Status: Pending

Title: Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances

Source of Support: NSF, Biological Oceanography

Award Amount: $136,814 (NU Portion)

Award Period: 08/01/2014 – 07/31/18

Location: Northeastern University, Marine Science Center

Person-Months per Year Committed to the Project. Cal: 0.00 Acad: 0.00 Sumr: 0.50

CURRENT & PENDING – Matthew Edwards

Current

FSML: Seawater System Improvements, *Implementation of Environmental Monitoring, and Data Access and Dissemination*
NSF
$199,764
05/01/11-04/30/13
0.0 summer-months

Naval Base Point Loma ocean-side subtidal marine vertebrate and invertebrate inventory
US Army Corps of Engineers (w/ T. Anderson)
$78,232
8/01/12 – 1/01/14
1.0 summer-months

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Fiorenza Micheli

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: CNH: Enhancing resilience of coastal ecosystems and human communities to oceanographic variability: social and ecological feedbacks

Source of Support: NSF -CNH

Total Award Amount: $1,349,569 Total Award Period Covered: 09/01/2012-08/31/2016

Location of Project: Baja California, Mexico

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 0.5

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Building Ocean Resilience: an incentive based approach for marine

Source of Support: Comunidad y Biodiversidad – Walton Foundation

Total Award Amount: $144,800 Total Award Period Covered: 12/01/2011-11/30/2014

Location of Project: Baja California, Mexico

Person-Months Per Year Committed to the Project. Cal: Acad: 0 Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal: Shark Abundance Baselines

Source of Support: PEW – Lenfest Ocean Program

Total Award Amount: $ 284,000 Total Award Period Covered: 12/01/2011-11/30/2014

Location of Project: Hopkins Marine Station, Pacific Grove, CA, USA

Person-Months Per Year Committed to the Project. Cal: Acad: 0 Sumr: 0

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances (this proposal)

Source of Support: NSF

Total Award Amount: $ 96,657 Total Award Period Covered: 08/01/2014-07/31/2018

Location of Project: California, USA and Baja California, Mexico

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 0.25

Support: ☐ Current ☐ Pending Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately pre-

ceding funding period.

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Jennifer Dijkstra	Other agencies to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Collaborative Research: A global experimental network to examine kelp forest ecosystems response to changing climate and local conditions (This Proposal)

Source of Support:

Total Award Amount: $244,041 Total Award Period Covered August 1, 2014 to August 1, 2018

Location of Project: Isles of Shoals, University of New Hampshire

Person-Months Per Year Committed to the Project. 0.5 Cal: 0 Acad: Sumr: 0.5

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. 0 Cal: 0 Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. 0 Cal: 0 Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Scott Hamilton	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Response of Calcified and Fleshy Macroalgae to Warming and Ocean Acidification: From Single Species to Community Interactions

Source of Support: Regents of The University of California

Total Award Amount: $102,169 Total Award Period Covered: 02/01/2012-01/31/2014

Location of Project: Moss Landing, CA

Person-Months Per Year Committed to the Project. Cal: 0.0 Acad: 0.0 Sumr: 2.0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Effects of Ocean Acidification on Olfactory Senses, Swimming Physiology, and Gene Expression in Juvenile Rock Fish

Source of Support: Regents of The University of California

Total Award Amount: $39,971 Total Award Period Covered: 02/01/2013-01/31/2014

Location of Project: Moss Landing, CA

Person-Months Per Year Committed to the Project. Cal: 0.0 Acad: 0.0 Sumr: 2.0

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Using advanced tracking technologies to study movement patterns of California Halibut in Monterey Bay

Source of Support: Regents of The University of California

Total Award Amount: $ 310,337 Total Award Period Covered: 02/01/2014-01/31/2016

Location of Project: Moss Landing, CA

Person-Months Per Year Committed to the Project. Cal: 0.0 Acad: 0.0 Sumr: 1.0

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Collaborative Research: Understanding how top-down and bottom-up factors regulate productivity, life history variation, and trophic ecology of coral reef fishes

Source of Support: National Science Foundation

Total Award Amount: $492,773 Total Award Period Covered: 02/01/2014-01/31/2017

Location of Project: Moss Landing, CA

Person-Months Per Year Committed to the Project. Cal: 0.0 Acad: 0.0 Sumr: 1.0

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances – THIS PROPOSAL

Source of Support: National Science Foundation

Total Award Amount: $225,396 Total Award Period Covered: 08/01/2014-07/31/2018

Location of Project: Moss Landing Marine Laboratories

Person-Months Per Year Committed to the Project. Cal: 0.1 Acad: 0.0 Sumr: 0.0

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Scott Hamilton	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title Collaborative Research – Population persistence of coral reef fish: scaling up from individuals to metapopulations

Source of Support: National Science Foundation

Total Award Amount: $319,469 Total Award Period Covered: 02/01/2014-01/31/2018

Location of Project: Moss Landing, CA

Person-Months Per Year Committed to the Project. Cal: 0.0 Acad: 0.0 Sumr: 1.0

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: 0.0 Acad: 0.0 Sumr: 0.0

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: 0.0 Acad: 0.0 Sumr: 0.0

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: 0.0 Acad: 0.0 Sumr: 0.0

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered

Location of Project: Moss Landing Marine Laboratories

Person-Months Per Year Committed to the Project. Cal: 0.0 Acad: 0.0 Sumr: 0.0

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Michael Graham	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Contract Between the Phycological Society of America and San Jose State University Research Foundation

Source of Support: Phycological Society of America

Total Award Amount: $ 480,401 Total Award Period Covered: 01/01/2012-12/31/2016

Location of Project: Moss Landing Marine Laboratories

Person-Months Per Year Committed to the Project. Cal: 0 Acad: 1.0 Sumr: 1.0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Effects of Ocean Acidification on Olfactory Senses, Swimming Physiology, and Gene Expression in Juvenile Rock Fish. Lead PI: Scott Hamilton

Source of Support: Regents of The University of California

Total Award Amount: $39,971 Total Award Period Covered: 02/01/2013-01/31/2014

Location of Project: Moss Landing, CA

Person-Months Per Year Committed to the Project. Cal: 0.1 Acad: 0.0 Sumr: 0.0

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances – THIS PROPOSAL. Lead PI: Scott Hamilton

Source of Support: National Science Foundation

Total Award Amount: $225,396 Total Award Period Covered: 08/01/2014-07/31/2018

Location of Project: Moss Landing Marine Laboratories

Person-Months Per Year Committed to the Project. Cal: 0.1 Acad: 0.0 Sumr: 0.0

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Diana Steller	Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: MISO-2 Dive

Source of Support: Naval Postgraduate School

Total Award Amount: $6,767 Total Award Period Covered: 04/01/2013-09/30/2013

Location of Project: Moss Landing, CA

Person-Months Per Year Committed to the Project. Cal: 0.1 Acad: 0.0 Sumr: 0.0

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances – THIS PROPOSAL. Lead PI: Scott Hamilton

Source of Support: National Science Foundation

Total Award Amount: $225,396 Total Award Period Covered: 08/01/2014-07/31/2018

Location of Project: Moss Landing Marine Laboratories

Person-Months Per Year Committed to the Project. Cal: 0.1 Acad: 0.0 Sumr: 0.0

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: $ Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

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Facilities, Equipment and Other Resources

UMB Laboratory: On the UMB campus, students will be placed in the PI's fully equipped research laboratory in the Biology Department. The 600 sq. ft. lab is fully supplied with computers, a fume hood for sample processing, and sample freezer, a full range of shop tools, dissecting scopes, and other equipment for lab work. A new building, the Integrated Sciences Complex, where the PI and lab will move, is scheduled to open in May 2014.

UMB Computer: UMass Boston has extensive computer resources for this project. Each research lab has an array of internet- connected Macs and PCs. UMB has 10 computer labs with over 250 PCs and printers available for student use, as well as specialty computer facilities and computer teaching laboratories. The PI will provide computer facilities in his lab for student work.

UMB Office Support: The Program Coordinator has dedicated office space with computer equipment as well as access to a full array of support equipment such as copy and fax machines. The Directors and all participating faculty have appropriate office space. The offices of the Biology Department and the Dean of the College of Science and Mathematics have staff and supplies that support this project and our shipping needs.

UMB Field Equipment: PI Byrnes's lab is currently equipped with the necessary equipment for a subtidal research program: wet and dry suits for lab personnel, full sets of dive gear - including BCDs, regulators, mask, fins, and weights – and a full suite of field sampling gear (PVC quadrats, transect tapes, etc). The lab also has several underwater digital still and video cameras for sampling sites and recording identifying photographs of organisms. PI Byrnes is currently in the process of purchasing a 20' marine skiff with trailer and vehicle.

Cat Cove Marine Lab: For Sampling in Salem Sound, PI Byrnes will work out of Salem State's Cat Cover Marine Lab. CCML provides a 20' skiff with easy access to the islands in Salem Sound and flowing seawater tables.

Shoals Marine Lab: For sampling at SML, PI Byrnes, Grabowski, Dijkstra, and subawardee Witman will work from UNH and Cornell's Shoals Marine Lab. SML provides multiple inflatable boats with access to the entire archipelago. Additionally, the larger R/V Heiser and Kingsbury can be used to access more difficult sites or carry large numbers of divers. SML provides housing accommodations and board for all scientists. It also provides tank fills and facilities for equipment storage and maintenance.

Facilities Statement – UCSB (Jennifer Caselle)

The UCSB PI has access to research dive boats and scuba tanks, and a field lab for staging local fieldwork for this project.

UCSB has the largest AAUS dive program in the country and can provide reciprocity and training for the mobile teams of graduate students who will conduct the bulk of the fieldwork for this project.

Facilities, Equipment and Other Resources

LABORATORY:
Photo quadrat analysis and other types of benthic community data analyses will be conducted in Jon Witman's lab at Brown University. Witman's laboratory is well equipped to support the research proposed. Lab capacities include a room for all field, laboratory, and experimental equipment needed to conduct the proposed research with ample space for additional needs. It also includes an imaging analysis room which can be easily darkened without interrupting work of others in the broader lab space. The Witman lab is located on Brown University's campus in the BioMed Building.

COMPUTER:
Jon Witman's laboratory at Brown University has all the needed computer facilities to carry out the research outlined in this proposal. It contains two iMac desktop computers, a graphics tablet for digitizing images, a printer, binocular microscopes and an image analysis room.

OFFICE:
Jon Witman's laboratory has ample office space for the proposed.

EQUIPMENT:
Witman owns equipment for quantitative underwater photography of benthic communities, such as a digital quadrapod system that will be available for the project at no extra cost to the grant. All the other standard underwater research equipment from transect tapes to scuba diving gear is also available for the project.

UAF Facilities, Equipment and Other Resources

LABORATORY:
No laboratory facilities are needed at the University of Alaska Fairbanks to complete this project. The project will take place at NOAAs Kasitsna Bay Lab, which is co-managed by UAF.

CLINICAL:
None

ANIMAL:
None

COMPUTER:
The principal investigator has an office and lab at the University of Alaska Fairbanks that are equipped with PCs. The PI will bring a PC to use in the field that is equipped with the programs needed (Sigma Scan, Excel, Statview, and Primer)

OFFICE:
The principal investigator has a permanent private office at the University of Alaska Fairbanks, in addition to laboratory space.

MAJOR EQUIPMENT:
No equipment is requested.

OTHER RESOURCES:
The School of Fisheries and Ocean Sciences, Institute of Marine Science, has fiscal/business offices which will provide fiscal/administrative and clerical/grant management support for the project. The University of Alaska Fairbanks has a very strong research component and an annual research budget in excess of $30 million. The campus houses several research institutes; many of the faculty members have joint appointments between these and the more traditional teaching colleges.

Facilities, Equipment, and Other Resources

Northeastern University, Marine Science Center
Northeastern University's Marine Science Center (MSC) is located in Nahant, MA, just five miles NNE of the entrance to Boston Harbor. The MSC is well suited for this study because (1) it is located in the middle of the Northwest Atlantic region of the proposed study and is the location of one of the specific sites, (2) has ample lab and office space to stage and conduct the proposed research, and (3) operates a fully functioning AAUS dive program with its own compressor and tanks. Grabowski's primary laboratory was recently completed (January 2012) as a state-of-the-art fish ecology and benthic habitat research lab. Grabowski also has an additional lab at the MSC for fish otolith ageing, benthic sample processing, experimental setup and construction, etc.

The following relevant equipment for this study is housed in these labs: 3 PC work stations each with Arc-GIS and other relevant software, 4 dissecting scopes including an Olympus SZX9 Stereozoom with Luminera 3 MP camera and connected to a PC with Image Pro 7.0 imaging software, 1 drying oven, 4 electronic balances, and ample freezer capacity.

The MSC has access to two 4-WD trucks, a van, and two 15-22' boats, which are maintained by full-time technical support staff on campus in Boston and staff at the MSC.

FACILITIES

SDSU offers the Edwards' laboratory and office space for processing samples and analyzing data. SDSU has a research diving program that supports diver training and gear repair. Edwards has a 21' Parker research vessel, two Achilles 12.6' inflatable boats, and a field dive compressor for supporting dive activities. SDSU provides an analytical laboratory where samples can be analyzed, space for storing samples and field gear, and computers to store and analyze data. SDSU also provides dedicated space at the Coastal Marine Laboratory where the gear is stored.

FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. Use additional pages if necessary.

Laboratory:
The PI has access to library facilities, machine and wood shops, and aquarium space at the Hopkins Marine Station, each staffed by full time facilities professionals.

Clinical:
N/A

Animal:
N/A

Computer:
The PIs' location (Hopkins Marine Station of Stanford University) maintains a computer network connected to the Internet. Maintenance includes two professional computer technicians and network administrator at the Station as well as professional assistance from the main Stanford University campus. The PIs have adequate computers and printers for common use by lab members. The PIs also have access to a PC, Dual core processor running Linux: Ubuntu 10.10 64 bit, 4GB RAM and 512GB hard disk, allowing remote login and simulation running from anywhere in the world.

Office:
The PI has a private office at the Hopkins Marine Station, with phone, wireless and ethernet connections. Three additional offices are used by postdocs and students in the PI's lab.

Other: Specific Lab Space for PI
The PI has a 2,300 sqft laboratory space at the Hopkins Marine Station. The laboratory includes three offices, wet and dry fully equipped laboratories, a meeting room equipped for presentations and remote video and audio conferences, a workshop, and storage space.
Graduate student N. Low will work on the project for the first two years of the project while receiving Stanford support. Therefore, funds are requested only in year 3 of the project.

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate, identify the location and pertinent capabilities of each.

The PIs' groups own diving equipment (full sets for Micheli and the graduate student, and two additional full sets for diving assistants, as well as 12 scuba tanks, oxygen kits and miscellaneous supplies for diving), underwater digital still and video cameras, and laptop computers for use in the field. The PI's group owns a field vehicle (a Toyota Tacoma 4-wheel drive truck) for travel to and from the field sites.

OTHER RESOURCES: Provide any information describing the other resources available for the project. Identify support services such as consultant, secretarial, machine shop, and electronics shop, and the extent to which they will be available for the project.
Include an explanation of any consortium/contractual/subaward arrangements with other organizations.

The Hopkins Marine Station has a full-time clerical assistant, a financial manager, and two computer support staff, who will assist with the project administration and technical support.

FACILITIES, EQUIPMENT & OTHER RESOURCES

FACILITIES: Identify the facilities to be used at each performance site listed and, as appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Use "Other" to describe the facilities at any other performance sites listed and at sites for field studies. Use additional pages if necessary.

Clinical:

Animal:

Computer:
The Center for Coastal and Ocean Mapping has a robust daily backup system that is in place for all computers at the Center. Recently written tapes are held in a fire-proof safe, whereas archived datasets are sent offsite to an Iron Mountain data protection facility where they are stored in an environmentally controlled vault. The Center has a full suite of commercial packages for image and data processing. All computers and peripherals are operational and fully integrated into both Center and University networks.

Office: Dijkstra has an office space and computers with appropriate statistical and graphical software.

Other:
The facilities available at the University of New Hampshire include bench space for sample and experiment preparation. Storage for diving equipment and field sampling gear. Dijkstra also has space at the Coastal Marine Laboratory that houses flow-through tanks and a dry lab. There is also a newly constructed pier in which several boats are available to faculty and staff to access sites.

MAJOR EQUIPMENT: List the most important items available for this project and, as appropriate, identify the location and pertinent capabilities of each.

Technical Diving Equipment –
Technical open circuit (i.e., SCUBA) equipment and accessories
SCUBA tanks
Digital camera systems with underwater housing

Test tanks: The University of New Hampshire has two large tanks designed to test equipment (http://ccom.unh.edu/facilities/test-tanks)
Research vessels: The center operates 2 research vessels, 40 ft. R/V Coastal Surveyor and the 34 ft. R/V Cocheco (http://ccom.unh.edu/facilities/research-vessels)
Machine shop (http://ccom.unh.edu/facilities/labs-and-workspace)

I. FACILITIES, EQUIPMENT AND OTHER RESOURCES (MLML)

Office space
Resources include access to office space for all personnel (including graduate students). Office resources include computing, library, telephone, and all necessary clerical resources. Office space is available for any visiting personnel while at MLML.

Fieldwork and Diving
MLML maintains a facility for small boats and diving operations. Space is provided in the dive locker for gear for PIs and students. The MLML dive safety program oversees all safety aspects of diving and provides logistical support and maintenance of an AAUS membership. We have a nitrox compressor system (funded by NSF) and over 80 scuba cylinders for diving operations. A fleet of small boats includes three 17ft Boston Whalers, three inflatables ranging from 11-15 ft in length, one 22 ft RHIB Hurricane, and a 30 ft aluminum hull landing craft boat called the R/V Sheila B. Larger vessels include the 55 ft R/V John Martin, and the 165 ft Pt. Sur (part of the UNOLS fleet). We will utilize a variety of these vessels to conduct kelp removal experiments and observational surveys at the study sites in central California. MLML also has a variety of trucks and vans to tow and launch these small vessels.

Data Management Plan

(1) Products of Research - Products derived from this project will consist of abundance and point count data from surveys before and after kelp manipulations and accompanying temperature data from Q1, a suite of field measures from annual full community surveys including point counts, abundances of mobile and sessile species (Q2), annual temperature measurements recorded in 15 minute intervals from sites in Q2, and modeled daily maximum significant wave height measurements from Wavewatch III for each site sampled in Q2. We will also have video of fish swimming at transects during sampling of Q2.

(2) Data and Script Storage – All measurements will be recorded on standardized data sheets for each region. For Q2, we have already developed sheets for the NW Atlantic and NE Pacific based on the SBC LTER's community monitoring protocols. Before entry, sheets will be scanned as high quality jpgs and saved on a network-wide Dropbox (http://dropbox.com) account in folders labeled with date and site. We will do the same with compressed fish videos. Data will be entered into standardized Microsoft Excel templates and randomly spot-checked by site members before being uploaded into the Dropbox. This network-wide Dropbox is already in use; it was created during the network's NCEAS working group, and is already used to co-ordinate data sets from different sites. Both Q1 and Q2 will have a complete section of their own containing well named folders and files with relevant data, analytic scripts, protocols, etc. After being synched in the Dropbox, we will merge data for each question into a separate master comma separated files via an R script. These scripts and other annotated scripted analysis files in R, BUGS, Matlab, etc., be saved on the network dropbox and stored in a Git repository to maintain version control. Data will be backed up nightly on external drives, and all data will be burned to DVD annually.

(3) Dissemination Methods – Final quality controlled versions of the data and meta-data will be submitted to the Knowledge Network for Biocomplexity (KNB) to ensure long-term storage and dissemination. We will use KNB's tool Morpho to generate metadata that conforms to the Ecological Metadata Language (EML) standard. For ease of access, we will also provide data via our network's website http://www.kelpecosystems.org. Before accessing data, users will have to fill in a form identifying who they are, their affiliation, and their email address so that we can maintain records of data use for reporting purposes. Analytic scripts will likewise be accessible via a section of the website. Versions used for manuscripts will be included as appendices.

(4) Policies for Data Sharing and Public Access – For Q1, primary data authors will retain first rights to the manipulative experiment data until resulting publications are produced or for two years after the final data point is collected. If a portion of the manipulative data is used before the entire set is complete, it will be made public immediately. For the observational data in Q2, all quality controlled data will be available will be made available either within two years of collection, when a manuscript is published using the data, or whenever the primary data collector deems it appropriate – whichever occurs first. This means that some portion of the data will be made public before year 3. Users of data not yet part of a network publication will be asked to consult with the data authors to discuss potential collaboration. Users of data after publication will be required to provide credit by citing the data's access number in their publication.

(5) Roles and Responsibilities – The research technician will be responsible for implementing the DMP's architecture in year one. Thereafter Byrnes and the network postdoc will assume primary responsibility for monitoring the implementation of the data management plan's procedures by all personnel.

Postdoctoral Mentoring Plan

We request funds to support a network postdoc for the duration of the grant. Members of other networks such as the *Zostera* Experimental Network (ZEN), the Nutrient Network (NutNet), and others at the 2012 ESA symposium on collaborative research networks all agreed that a central co-ordinating postdoc was essential for the function of such networks. We agree, and feel that this will be a key position. Moreover, this project will be a unique and fantastic opportunity for the Postdoctoral Scholar due to the broad research experience, the extensive networking with colleagues, and opportunities to mentor a wide variety of students inherent in this position. Having recently completed postdoctoral fellowships at the highly collaborative SBC LTER and National Center for Ecological Analysis and Synthesis where he led multiple working groups, PI Byrnes is committed to actively supporting and closely mentoring the fellow in not only research, but helping them develop skills in teaching, mentoring, networking, and analytic and data management skills.

To achieve this, PI Byrnes will meet with the postdoc at the beginning of their tenure to design and execute a plan over the course of the project. This plan will include a research agenda and professional development agenda that incorporates the following:

1) Research skills – The proposed research requires the integration of intensive fieldwork, data management, and analytic skills. The postdoc will receive training where necessary to supplement any deficits, and will attend upcoming Software Carpentry workshops in Boston that target these areas.

2) Coordination – The postdoc will be responsible for coordinating work with multiple PIs and students. In addition to many wonderful opportunities for new collaboration, this will also require a development of skills in detailed logistics and diplomacy that will prove invaluable throughout the postdoc's career. These are skills that Byrnes's has developed as a workshop leader, and will share useful experience and responsibilities.

3) Outreach – As part of our broader impacts, the postdoc will engage in blogging, discussions on Google Hangouts, Twitter, will interact with our Zooniverse team, and more. They will be encouraged to use these and other avenues (e.g., crowdfunding) to communicate the science of the network to a broader audience. Eventually, they will take part in conducting courses

4) *Mentoring* – The postdoc will participate as a mentor to undergraduate subtidal research interns at the Shoals Marine Laboratory. Byrnes has been doing this for the past year, and SML is looking to expand the subtidal program in the next three years. The postdoc will also mentor students within the network during trips for manipulations. They will be encouraged to mentor students in the lab and department.

5) Teaching – The postdoc will be encouraged to participate in guest lecturing for week-long units on kelp forest ecology and/or climate change in Byrnes's undergraduate marine biology course. Byrnes will mentor them as they develop new lecture materials in order to learn how to create new course materials for undergraduates from scratch. This is a skill vital to success in the next stage of their career.

6) Research dissemination – Byrnes will mentor the postdoc in effective preparation of manuscripts, conference presentations, and multi-author coordination. The postdoc will take the lead on the thinning manuscript as well as an early comparative manuscript covering results of their choosing from early sampling for Q2.

7) Career Counseling – Finally, considering their career goals, the postdoc will be mentored to develop a strong job application package for future positions as their tenure draws to a close. This will include active discussions in lab meetings for all lab personnel as well as application and job talk development.

Documentation of Collaborative Arrangements

Following are letters of support from partners from sites mentioned in this proposal:

D. Reed	University of California Santa Barbara, SBC LTER
K. Dunton	University of Texas at Austin
M. Novak	Oregon State University
E. Parnell	UC San Diego
R. Steneck	University of Maine, Orono
A. Perez-Matus	Pontificia Universidad Católica de Chile
G. Torres-Moye & G. Montaño Moctezuma	Universidad Autonoma de Baja California
J. Watson	Vancouver Island University
A. Salomon	Simon Frasier University
N. Shears	University of Auckland
C. Hepburn	University of Otago
D. Smale	Marine Biological Association of the United Kingdom
M. Burrows	Scottish Marine Institute Oban
N. O'Connor	Queen's University
J. Griffin	University of Swansea
P. Moore	Aberystwyth University
I. Sousa Pinto	University of Porto
S. Connell	University of Adelaide
T. Wernberg	University of Western Australia

UNIVERSITY OF CALIFORNIA, SANTA BARBARA

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DAN REED
TELEPHONE: (805) 893-8363
FAX: (805) 893-8062
E-MAIL: dan.reed@lifesci.ucsb.edu

UNIVERSITY OF CALIFORNIA
MARINE SCIENCE INSTITUTE
SANTA BARBARA, CALIFORNIA 93106-6150

August 10, 2013

Dear Jarrett,

This letter is to confirm the strong interest of the Santa Barbara Coastal Long Term Ecological Research (SBC LTER) project in your proposed project "Collaborative Research: A global experimental network to examine kelp forest ecosystems response to changing climate & local disturbances ". As you know a major goal of the SBC LTER is to develop a predictive understanding of how land and ocean processes alter the biological structure and ecological functions of giant kelp forests over the long-term under varying conditions of climate and local disturbance (both natural and human induced). Of considerable interest to our project are the interactive effects of ocean climate (manifested as changes in temperature and nutrients) and local disturbance (caused by storm waves, herbivore outbreaks and fishing) on the biomass and production of giant kelp and the trophic structure of the kelp forest community. To address these issues we collect a wealth of data on a diverse array of physical, chemical and biological variables on land and in the coastal ocean. Most relevant to your proposed project are time-series data at our long-term kelp forest sites pertaining to temperature, nutrients, waves, and the abundance and biomass of more than 200 species of kelp forest algae, invertebrates and fish,

We are very excited to be part of the newly formed Kelp Ecosystem Ecology Network (KEEN). As a member of the US LTER Network we routinely participate in comparative research activities with other sites in the LTER Network. However, because SBC LTER is the only kelp forest site in the LTER Network our participation in these cross-site efforts to date has been restricted to comparisons and synthetic analyses of general ecological themes (e.g. primary production, species diversity, disturbance) across a diverse array of terrestrial and marine habitats exemplified by the 25 LTER. The highly coordinated research encompassed by KEEN provides SBC LTER with an unprecedented opportunity to evaluate our research findings in the context of other kelp forest systems around the globe. That KEEN has chosen to adopt many of SBC LTER's sampling protocols greatly facilitates our ability to make to meaningful comparisons with other kelp forest systems.

As a collaborator SBC LTER will contribute data from five kelp forest sites in the Santa Barbara Channel for the purpose of addressing the general question "*How does temperature interact with a common disturbance (storm waves) to affect kelps and their associated communities across the globe?* We have been collecting community data at these five sites since 2000; satellite data on giant kelp biomass, SST and swell height at these sites are available as far back as 1984. The existing time series data available for our sites will provide an important historical context for evaluating data collected for your proposed project. Additionally, SBC LTER has kelp removal experiments ongoing at these five sites. We are excited to share these data with your project to examine questions pertaining to the ability of kelp forest communities to recover from disturbance.

SBC LTER researchers benefitted greatly from their participation in the synthetic kelp forest working group at NCEAS that you spearheaded, and they are excited about the products that are being developed

from it. This speaks highly of your abilities to lead and organize a project of this magnitude. Our enthusiasm for your proposed project stems not only from our interest in global collaborations pertaining the role of climate forcing in kelp forest systems, but also in our confidence in your abilities to lead this effort. We wish you the best of luck with your proposal and look forward to many promising collaborations.

Sincerely,

Dan Reed
Lead Principal Investigator
Santa Barbara Coastal Long Term Ecological Research project

MARINE SCIENCE INSTITUTE

THE UNIVERSITY OF TEXAS AT AUSTIN

750 Channel View Drive • Port Aransas, TX 78373-5015 • (361) 749-6711 • FAX (361) 749-6777

12 August 2013

Dr. Jarrett Byrnes
Assistant Professor
Department of Biology
University of Massachusetts Boston
100 Morrissey Blvd.
Boston, MA 02125

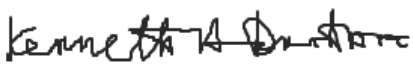
Dear Jarrett,

Thank you for the invitation to join the Kelp Ecosystem Ecology Network (KEEN). I am excited to participate and include my long-term network of kelp monitoring in the Alaskan Arctic which I started in 1978. My commitment includes the occupation of three sites along the eastern Beaufort Sea coast: two in Stefansson Sound (in the "Boulder Patch") and one in Camden Bay. My focus will be entirely on assessments (no removal experiments) because of the extremely slow growth of kelp in this extreme environment.

My work on the arctic kelp communities has been reported in numerous journal publications. Our nearly continuous record of kelp growth in relation to ambient irradiance in the Boulder Patch since 1978 is unmatched in the literature. I can contribute significantly to KEEN goals and objectives using my current database as a foundation. I will include KEEN methodology alongside my existing grant to study these communities through 2016 as funded by BOEM. I also have other proposals pending. I have a 27 foot Boston Whaler to use as a as a research platform and a variety of equipment on site to conduct diving studies. My work with KEEN will focus on the addition of long-term experimental studies to examine kelp recolonization and demography with respect to physical factors that include light, temperature and salinity.

KEEN represents a unique opportunity for the scientific community and you have my full and enthusiastic support.

Sincerely,



Kenneth H. Dunton
Professor

Dept. of Zoology, College of Sciences
Oregon State University, 3029 Cordley Hall, Corvallis, Oregon 97331-2914
T 541-737-3610 | **F** 541-737-3120 | http://people.oregonstate.edu/~novakm

August 12, 2013

To: Jarrett Byrnes, UMass Boston
Re: Letter of Support

Dear Jarrett,

I am writing to express my enthusiastic support for the collaborative NSF Biological Oceanography proposal you are leading ("*A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances*") and to thank you for inviting me to participate. I look forward to contributing to the project's success by leading the fieldwork efforts proposed for the Oregon coast and by participating in the subsequent analysis and conceptual synthesis of each region's results.

Research in my lab focuses primarily on how the direct and indirect interactions of species affect the way that marine and freshwater communities respond to disturbances, be these acute pulses or prolonged press perturbations. The two experiments you have proposed are thus well-aligned with the lab's interests (particularly so for their focus on kelp forests, on which I have worked in both the Gulf of Maine and California). Further, the complexity of species interactions and community dynamics motivates a common effort in my lab to bridge between mathematical theory and the realities of nature. I therefore look forward to having my students and I engage with the many other labs of the proposal to develop a global picture of the future that kelp forest ecosystems will face.

I am thus very excited to be part of this proposal, not only for the opportunities it will provide to work with you and the rest of the network, but also because of the important insights into kelp forest dynamics that the research will uncover.

Sincerely,

Mark Novak
Assistant Professor
Dept. of Zoology
Oregon State University

UNIVERSITY OF CALIFORNIA, SAN DIEGO

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

Ed Parnell
SCRIPPS INSTITUTION OF OCEANOGRAPHY

9500 GILMAN DRIVE Mail Code 0227
LAJOLLA, CALIFORNIA USA 92093-0227

9 August, 2013

Jarrett Byrnes
Department of Biology, University of Massachusetts Boston
100 Morrissey Blvd; Boston, MA 02125

Dear Jarrett,

I am writing to let you know of my eagerness to participate in and provide support your KEEN project addressing the resilience and successional patterns of kelp over a large national and global scale. As you probably know, Paul Dayton and I have been studying the ecology of kelp forests and the effects of humans on the coastal ecosystem off San Diego for decades. As part of our support, we have several qualified research divers to conduct underwater surveys and manipulations throughout San Diego, and we also have logistical support in terms of a full diving locker, equipment, and vessels. We offer our help in both the observational and manipulative aspects of the proposed work. Currently, we have support through various funding agencies including California Sea Grant and NOAA that will continue for several more years, therefore we will be available to help you through the duration of this project. We believe that such a replicated and coordinated large scale effort will lead to many new insights into the ecology of kelp forests and are very eager to participate.

Sincerely,

Ed Parnell, Ph.D.
Associate Research Oceanographer

School of Marine Sciences

THE UNIVERSITY OF MAINE

5706 Aubert Hall, Room 360
Orono, Maine 04469-5706
Tel: 207-581-4381
Fax: 207-581-4388
www.umaine.edu

13 August 2013

Dr. Jarrett Byrnes
Department of Biology
U. Mass Boston
<Jarrett.Byrnes@umb.edu>

Dear Jarrett,

I fully support the collaborative effort you are leading for the NSF Biological Oceanography proposal entitled "*A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate and Local Disturbances"*. This is a truly rare and valuable opportunity to study the dynamics of kelp forests during this time of rapid climate change. I know of no project of this scope proposed anywhere in the world.

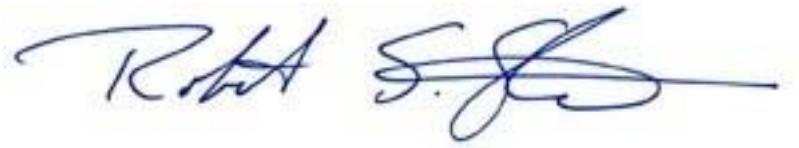
I have been studying kelp forests of the western North Atlantic (primarily in the Gulf of Maine) since 1975. By the 1980s I extended my work to the Pacific Northwest working with R. T. Paine and others in Washington State. I lead two research projects studying kelp forests of the Aleutians (with J. Estes, covering over 700 km of Aleutian coastline during each trip). I headed up the kelp forest group for an NCEAS workshop that culminated in the *Science* publication by Jackson et al 2001 on historical ecology. I have lead workshops and research projects focused on kelp forests that resulted in both original research and review papers (eg. Steneck et al 2002, 2004; 2008, 2013). So, clearly I have a sustained professional interest in kelp forest dynamics and for this reason, I'm extremely excited about your proposal.

I can assist this effort several ways. First, I propose that research continue at sites I've studied in Maine since the 1970s. This allows long term stability to be evaluated and rates of change to be precisely documented. Second, I asked Chris Rigaud who teached a course at the University of Maine entitled: *Introduction to Research Diving* (SMS 491) if as part of his annual class that they measure specific aspects of kelp forests identified in the NSF proposal as part of the student's training. He has agreed and I have agreed to present lectures on the biology and ecology of kelp forests to his students. The timing and fit with this NSF proposal is perfect. Finally, the proposed site in Maine is near Darling Marine Center which is the marine laboratory for the University of Maine and because of that, detailed oceanographic data exists for this site going back to the 1960s. Bootbay Harbor is one a few kilometers from my long term kelp research area and Maine's Department of Marine Resources has maintained sea surface temperatures there since 1906 (longest record in the Gulf of Maine).

I intend to contribute with the field work by diving and by using my Remotely Operated Vehicle to oversee students. I will also use the ROV to see if new methods of kelp forest ecology could be conducted using this tool.

I'm excited to be part of this. I appreciate you including me. Please let me know via e-mail if there are any other ways I can help.

Sincerely,



Robert S. Steneck
Professor of Marine Biology, Oceanography and Marine Policy

cc. Maria Mahoney <Maria.Mahoney@umb.edu>,

PONTIFICIA UNIVERSIDAD CATOLICA DE CHILE

Letter of Support – Dr. Jarrett Byrnes
University of Massachusetts Boston

August 12th, 2013
Dear Jarrett,

Foremost I thank you for inviting me to participate in and contribute to your KEEN project and NSF proposal entitled "A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances". I also would like to thank you for including the southwestern Pacific as part of these large-scale mensurative and manipulative experiments. Chile has an extensive coast encompassing an important portion of the SW Pacific. The entire Chilean rocky coast is covered with kelps and there are few studies that have attempted to grasp the processes occurring in their subtidal ecosystem. At a coarse resolution, this proposal aims to estimate if the effects of global climate change are redundant from one region to another, which will provide a mechanistic understanding of the global change on this ecosystem. Without this replicated and coordinated methodology, our understanding of one of the large anthropogenic impacts will be compromised.

I will collaborate in this large-scale study by a) leading the field observational experiment (Q2) in two sub regions of the SW Pacific, including two sites at the temperate-warm central-northern Chile and another two at a temperate-cold southern Chile, b) assisting and providing logistical support for the graduate student and postdoc manipulative experiment (Q1) team while they are in Chile, c) monitoring the experiments at those sub-regions, cd) synthesize/analyze data, and e) discussion of results with the KEEN team.

I have extensive experience in subtidal ecology from temperate regions. My previous work includes mensurative and manipulative experiments in Australia, New Zealand, Oceanic and Continental Chile. Currently, through government initiation funding for

research (FONDECYT 11110351 “Direct and indirect interactions between fishes: evaluating mutualism in temperate ecosystems”), I´m hosting a productive lab in a fully equipped center for coastal studies (ECIM), leading the subtidal projects for numerous field survey works.

Being part of this project will be cornerstone for my young research career. I look forward and eager to get involve in this proposed work.

Sincerely,

Dr. Alejandro Perez Matus
Research Associate
Subtidal Ecology Lab & Marine Conservation Center
Estación Costera de Investigaciones Marinas, Las Cruces
Facultad de Ciencias Biológicas
Pontificia Universidad Católica de Chile

Universidad Autónoma de Baja California

Ensenada, B.C., México, 08/09/2013

Letter of support

To: Jarrett Byrnes, University of Massachusetts Boston

Dear Jarrett,

We appreciate being invited to participate in the Kelp Ecosystem Ecology Network (KEEN) and are willing to collaborate with the resources available at our University and with our expertise working in the Baja California (BC) MEX kelp forests habitats. We are excited to participate as international collaborators in the NSF collaborative research "A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances" and are prepared to conduct the manipulative and observational experiments following the standardized KEEN protocols.

In BC, forests of the giant kelp *Macrocystis pyrifera* are critical habitats that sustain diverse biological assemblages and important fishery species. During the past decade, our group has been studying here the patterns of connectivity and temporal and spatial variability within the benthic and pelagic communities of kelp forests habitats. Our goal has been to incorporate ecological knowledge to support science-based decisions for the long-term conservation of our coastal ecosystems, and as oceans warm up, assessing climate change effects has become of paramount significance. We are familiar with the local pelagic and benthic species, have experience working with local fishermen, are authorized to do field work in Mexican waters and have a team of trained and certified divers with experience to work collecting data based on direct observations and using submarine video recordings. In our most recent project funded by CONACYT (our Mexican NSF equivalent), we mapped the kelp forests from our region based on ASTER satellite images, characterized de pelagic and benthic communities of 13 kelp forests from the Pacific Ocean mainland coasts of Baja California and studied the relationship between habitat complexity and species diversity. We plan to continue working in kelp forests habitats in BC during the next years and have submitted a new project to PROMEP to continue working on the kelp forests from the islands of BC and which will allow us to aid the KEEN global project.

We will commit to work as members of the KEEN network on the Sacramento Reef site (29°43'55.6" N/115°46'32.0"W) in Baja California, MEX, conducting the manipulative and observational experiments as global replicates. We will bring to the project the support provided by our Institution for subtidal research including diving equipment required for field observations, University vehicles for terrestrial transportation, one boat for coastal studies, two laboratories equipped for sample analyses and data processing and contacts with local fishermen groups and environmental authorities.

We are excited to be part of the network and look forward to work with you and the rest of the KEEN members.

Sincerely,

Dr. Guillermo Torres Moye

Facultad de Ciencias Marinas, UABC

Dra. Cira Gabriela Montaño Moctezuma

Instituto de Investigaciones Oceanológicas, UABC

VANCOUVER ISLAND
UNIVERSITY

Faculty of Science & Technology
900 Fifth St., Nanaimo BC V9R 5S5
Canada
Tel: 250-740-6375 • Fax: 250-740-6482
www.viu.ca

Dr. Jarrett Byrnes
Assistant Professor
Department of Biology
University of Massachusetts Boston
100 Morrissey Blvd.
Boston, MA 02125

August 10, 2013

Dear Jarrett and Colleagues;

I wish to thank you for inviting me to participate in and contribute to your NSF proposal entitled, "*A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances*". I look forward to helping form the Kelp forest network, assessing how kelp forest communities vary on a global scale and are responding to climate change and local disturbances.

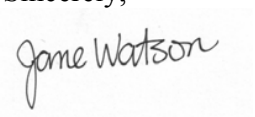
I have studied temporal and spatial variation in kelp forests off the west coast of Canada for the last 25 years, and have also worked on kelp forest ecosystems throughout the north Pacific and to some degree the southern hemisphere. This work is largely subtidal using both monitoring (fixed and random plots monitored for 25 years) and experimental approaches. In conjunction with the kelp forest research I am involved in long-term collaborative projects with Fisheries and Oceans Canada to document sea otter population ecology along the British Columbia coast, this collaboration has existed since 2000.

I can bring, as leveraging, the funding (sources: institutional, not for profit society and government) and field survey work from my research on the west coast of Vancouver Island (as described above). For this project I will document changes at two sites one located in Checleset Bay and one located in Barkley Sound examining changes in the kelp forest community over the next 2-3 years. My field crew usually consists of 4 individuals, usually 3 students (various levels, but predominantly undergraduate) and myself. I have the equipment (custom 6m welded aluminum skiff with 115hp engine, compressor, dive gear and associated field equipment) necessary to support this work. I conduct half of the research (Barkley Sound) from Bamfield Marine Sciences Centre, which is owned and operated by the five western Canadian Universities, and work out of a field camp based in the coastal community of Kyuquot in the more remote Checleset Bay. Visitors can easily be accommodated at the Bamfield Marine Sciences Centre, and

with prior warning can be accommodated at our field camp in Kyuquot. I am in the field for 4-6 weeks each summer and anticipate spending about 1-2 weeks each year on the assessment work associated with the proposed research.

I am excited to be a part of the collaborative Kelp Ecosystem Ecology Network (KEEN) and to participate in this very exciting proposal to examine how kelp forest responses to climate change and local disturbances on a global scale.

Sincerely,



Professor, Biology Department
Vancouver Island University

SFU

Coastal Marine Ecology
and Conservation Lab

DR. ANNE K. SALOMON, Assistant Professor
School of Resource and Environmental Management
Simon Fraser University, Burnaby, BC Canada V5A 1S6
T 778.782.8739 | C 778.866.1646 | F 778.782.4968 |www.rem.sfu.ca

August 13th, 2013

Re: Letter in Support of KEEN

Dear Review Committee,

I am writing in strong support of the 'Kelp Ecosystem Ecology Network" (KEEN) proposal. I am an applied kelp forest ecologist and assistant professor at Simon Fraser University (SFU) with an active field program in northern British Columbia, Canada focused on understanding the mechanisms driving high latitude kelp forest dynamics.

As the Principle Investigator of the Coastal Marine Ecology and Conservation lab at SFU, I bring several important resources to this global initiative. First and importantly, the rocky reefs of northern British Columbia are remote and difficult to access, so very limited research on these kelp forests has been done. My students and I have been conducting research off the remote islands of Haida Gwaii and BC'S Central Coast for 5 years now, so, we bring an understanding of the natural history of the area and 5 years of empirical (survey and experimental) data to contribute to this larger effort. We also now have access to a remote and brand new research facility (Hakai Beach Institute) and boats which will support our collaborative KEEN activities. Lastly, I currently supervise 2 post docs, 4 PhD students and 3 Master's students, so we have the personnel to support this research, as well as my lab's operating funds (NSERC Discovery Grant).

Regarding KEEN initiatives, my lab and I will be monitoring several kelp forest sites on BC's Central Coast and will be participating in the larger experimental manipulations of kelp cover. I am thrilled to be collaborating with other kelp forest researchers from around the world on this exciting and novel research initiative.

Please feel free to contact me if you have any questions.

Sincerely,

Anne Salomon

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

N.T. Shears, PhD, BSc
Senior Lecturer
Leigh Marine Laboratory/Department of Statistics
University of Auckland
Private Bag 92019, Auckland 1142, New Zealand
Ph 64 9 923 2958
Email: n.shears@auckland.ac.nz
www.stat.auckland.ac.nz/~shears

14th August 2013
To: Jarrett Byrnes, PI Kelp Ecosystems Ecology Network

Dear Jarrett,

Thank you for the opportunity to be part of the Kelp Ecosystems Ecology Network (KEEN). I am extremely excited about this project and the potential to collaborate on a global experiment with kelp forest researchers worldwide.

I am a Senior Lecturer (tenured) at the University of Auckland and have a research program based at the Leigh Marine Laboratory. My research focuses on rocky reef ecology, with particular focus on shallow reef ecosystems that are typically dominated in kelp. In particular, my research utilizing marine reserves to study kelp forest trophic cascades and the role of predators in controlling sea urchins is widely known worldwide and has been highly cited.

The overall aim of KEEN to better understand how the resilience of kelp forests will be impacted by climate change is the same as my own current research program. In 2012, I received a prestigious early career Rutherford Discovery Fellowship to investigate the effects of climate change on kelp forests over a 5 year period (2012-2016). As part of this research I planned (and budgeted) to carry out kelp forest removals analogous to those being proposed by KEEN. Therefore, I am in a very fortunate position where we already have funding and personnel to carry out the proposed KEEN experiments and surveys here in New Zealand. My Fellowship will cover all field expenses, a research technician, as well as providing two PhD student scholarships over three years. I am currently in the process of selecting a PhD student that will take on this experiment as a major component of their PhD research. It is also envisaged that this project will attract other graduate students to work on related aspects of kelp forest productivity and resilience, as well as the response of the associated community to disturbance.

Specifically we propose to carry out experimental observations and removals at four locations spread around the North Island of New Zealand. Within each location we will have two sites where experiments and surveys will be carried out. This research will be coordinated out of the Leigh Marine Laboratory where we have a well-established diving program that meets New Zealand Occupational Health and Safety requirements (equivalent to AUS). We have ready access to coastal kelp forests immediately adjacent to the Leigh Marine Laboratory in the Leigh Marine Reserve and a variety of research vessels to access more remote research locations. In general, the laboratory offers a productive and friendly environment and we would welcome visiting students and scientists.

I am very excited to be part of this great initiative and the opportunity to nest our research within a global framework. I wish you all the best in securing funding to make this happen!

Yours sincerely,

Dr Nick Shears
n.shears@auckland.ac.nz
Ph:+64 9 923 2958

UNIVERSITY of OTAGO
Te Whare Wānanga o Otāgo
NEW ZEALAND

17th July 2013

Jarrett Byrnes
Department of Biology, University of Massachusetts Boston
100 Morrissey Blvd; Boston, MA 02125

Tēna Koe Jarret,

Being involved in the KEEN research program is a great opportunity to provide a global context to my research on the functioning of coastal ecosystems and fisheries and specifically *Macrocystis* kelp forests. I will be leading experiments in *Macrocystis* kelp forests on New Zealand's South and Stewart Island. I am a lecturer at the Department of Marine Science at the University of Otago and have completed a PhD in the ecology and physiology of *Macrocystis pyrifera*. I have been directly involved in research on kelp forest ecosystems for the last 15 years. I have published research on key drivers of primary productivity in kelp forest system and likely future changes in ecosystem function due to anthropogenic-driven change. My on-going programme to track the light, nutrient, carbonate and temperature environment in kelp forests in study sites in Southern New Zealand allows an opportunity to complete clearance and observational experiments proposed in the KEEN programme with limited cost. My lab group includes approximately 15 PhD and MSc students who will be very keen to support this project and we have the facilities, funding and capability to complete the proposed research with no requirements for financial support. I look forward to being involved in this international team and hope that data provided by this programme helps better highlight the local and global importance of kelp forests to coastal ecosystems

Please contact me if more information is required

Nāku, nā

Christopher Hepburn PhD

Lecturer
Director of the Aquaculture and Fisheries Degree
chris.hepburn@otago.ac.nz
Office +6434798304

Letter of support for KEEN network

Dr Dan Smale – Marine Biological Association of the UK

10th August 2013

RE: Support for KEEN project led by Jarrett Byrnes, University of Massachusetts Boston

Dear Jarrett,

I am writing to confirm my full support for, and participation with, the Kelp Ecosystems Ecology Network (KEEN) and for the associated NSF proposal *'A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances'*. Kelp dominated ecosystems are found across the world's temperate coastlines and represent some of the most productive and biodiverse habitats on Earth, with huge socio-economic importance. However, to truly understand how these ecosystems will respond to global environmental change, ecologists must adopt a collaborative, international, multi-disciplinary approach. By spear-heading a global network of leading kelp ecologists, this project will facilitate complex field-based experiments conducted at a global scale coherent with the scale over which key stressors (i.e. climate change) operate. In doing so, the project will significantly advance our knowledge of the resilience of kelp ecosystems to both global and local stressors. Moreover, the KEEN network will open dialogue between, and facilitate the exchange of ideas, experience and techniques amongst, international leaders in temperate marine ecology. This will ultimately stimulate cutting-edge research and foster continued global collaboration.

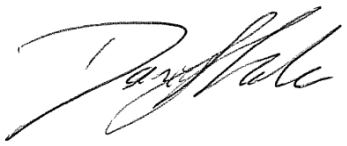
I am a Research Fellow at the Marine Biological Association of the UK, one of the longest-running marine institutes in the world. I am still an Early Career Researcher (PhD completed in 2008), yet I have published 33 marine ecology papers in journals such as *Science*, *Nature Climate Change* and *Proc Roy Soc B*. Most of my research has focussed on documenting biodiversity patterns in kelp-dominated habitats and understanding the processes that drive them. I am particularly interested in how seawater warming – both gradual long term and acute short-term events – impact the structure and functioning of kelp forests in the UK and Australia. I have recently been awarded a prestigious 5-year fellowship by the Natural Environment Research Council (NERC UK) to examine the resilience of kelp dominated habitats to climate variability and, as such, my core research programme is strongly aligned to the objectives of KEEN. This fellowship will provide the funding and logistical support needed to conduct subtidal fieldwork. I have extensive experience of

conducting complex field experiments in challenging conditions, from the ice-laden shores of Antarctica to the wave-beaten coastline of Western Australia.

I will offer significant 'in-kind' support to the project, by (i) dedicating >20 days of both my time and my technician's time throughout the duration of the project, (ii) dedicating resources (i.e. diver's time, boat time, fuel) to conduct the fieldwork outlined in the proposal, (iii) participating in the exchange of data and ideas through the network, and engaging in the preparation and publication of scientific outputs. Specifically, I will set up experimental clearings and monitor their recovery at 2 locations in the southwest of England, as well as contributing 'observational' data from a range of survey locations (at least 3) of varying wave exposures/average sea temperatures. I am also willing to host visiting students/PIs/post-docs at the MBA in Plymouth as required. The MBA has a long and illustrious history of experimental community ecology in marine ecosystems, being at the forefront of the discipline for 125 years. The MBA maintains, and adds to, the world's longest running marine biological dataset, and has housed some of the most distinguished marine biologists of the last century (e.g. Prof Alan Southward). The MBA will be a valuable international partner on the project, because (i) it houses exceptional marine biologists that will provide direct input to the research and stimulate ideas, (ii) it maintains long-term datasets on the structure of intertidal and subtidal marine communities in the northeast Atlantic, and has gathered considerable ecological knowledge of these systems, and (iii) it has access to essential boating and diving facilities.

I strongly believe the KEEN network will facilitate step-wise progression in the discipline if temperate marine ecology and will significantly advance our ability to understanding and predict the response of kelp forest ecosystems to rapid environmental change in the 21st Century. In doing so, the project will have direct benefits for marine management and biodiversity conservation. It is for these reasons that I am excited to be a part of this ambitious and innovative project.

Yours sincerely



Dr Dan Smale

Research Fellow

Marine Biological Association of the UK,

Citadel Hill, Plymouth, PL1 2PB.

DIRECTOR: PROFESSOR LAURENCE MEE

14 August 2013

Dear Jarrett

Thank you for inviting me to join the NSF KEEN proposal as an international collaborator. This is a great opportunity to be part of an international group to further our understanding of kelp ecosystems. I can offer the facilities of the Scottish Association for Marine Sciences at the Scottish Marine Institute near Oban in Argyll on the west coast of Scotland. Kelp is an important part of current work at SAMS on two fronts: one to develop the necessary systems for seaweed farming for algae-based products, including biofuels, and secondly to determine the role of kelp in coastal carbon budgets. We host the UK National Facility for Scientific Diving (NFSD), funded by the UK Natural Environment Research Council, and have ready access to field sites for experimental manipulations and longer-term monitoring. The NFSD has funds to support scientific diving for projects such as KEEN, and can provide qualified and experienced divers as well as hosting visitors. I intend to apply to NFSD for financial support to allow us to host a site for the KEEN manipulations on the west coast of Scotland, together with the other UK KEEN collaborators (Dr Pippa Moore at the University of Aberystwyth and Dr John Griffin at the University of Swansea).

My interests lie in relating and modeling the distribution patterns of kelp species in relation to major environmental drivers around the UK, predominantly wave exposure, temperature and water quality. This collaboration will give the opportunity to attempt this approach to a much broader geographical area. The research planned for KEEN also complements work planned for IMMERSE, a joint proposal to NERC submitted in June 2013 and pending a decision. Our work in IMMERSE will assess the fate of kelp-derived detritus in UK coastal systems, using a combination of estimates of production and transect surveys to measure stable isotopes of carbon.

I wish you every success with your proposal,

Best wishes

M.T. Burrows

Mike Burrows

Department of Ecology,
Scottish Association for Marine Science,
Scottish Marine Institute, Oban, Argyll, PA37 1QA
Scotland, UK

School of Biological Sciences

Medical Biology Buiilding
97 Lisburn Road
BT 9 7 BL
U.K.
Tel: + 44 (0) 28 9097 2127
Email:
n.oconnor@qub.ac.uk

13th August 2013

To: Jarrett Byrnes, PI KEEN Network

Letter of Support Dr Nessa E. O'Connor
Queen's University Belfast

Dear Jarrett,

Thank you for inviting me to participate and contribute to your NSF project – Global Response of Kelp Forest Ecosystems to Climate Change and Disturbance. The importance of kelp forests for provisioning ecosystem services has been highlighted recently in Europe and understanding kelp ecosystem dynamics under changing environmental conditions is an issue of urgent global importance, which is seriously under-funded. The aims of the KEEN network encapsulate a truly global approach to a global issue based on the principles of synthesis ecology. I look forward to participating as a node within the UK/ Ireland sub-team, a region that we currently know relatively little about even the basic ecology of our kelp systems. However, we have detected shifting patterns of kelp species distribution, which appears to be correlated with warmer oceanic conditions. As you know, the paucity of even descriptive data for this region was flagged by earlier discussions of this group as part of an NCEAS working group preparing for meta-analysis. I hope that, with our involvement, we can provide data (descriptive and from experimental manipulations) for the north of Ireland, where we straddle a biogeographic boundary for many kelp and fucoid species. This network provides a unique platform to test environmental change hypotheses at a global level but also at local scales that will enable better-informed policy and management decisions.

I am currently building a new research team (marine biodiversity) at QUB and have recently been confirmed in post (tenured). My lab currently receives funding from the Natural Environment Research Council of the UK (NERC), the Royal Society, Northern Ireland Departments of Education and Learning and Agriculture and Rural Development and EU INTERREG programmes and comprises myself and four PhD students studying topics such as determining if loss of biodiversity varies among habitats and under different environmental conditions in marine ecosystems; disentangling the effects of multiple stressors including climate change, pollution and invasive species in coastal ecosystems; characterising interactions between native and invasive benthic species; and predicting the effects of climate change on aquaculture installations. I also co-supervise another four PhD students (studying sustainable aquaculture issues, restoration of native benthic species and spatial patterns of marine biodiversity) and a postdoc (subtidal mussel reef restoration). I am member of the NERC Consortium – Coastal Biodiversity and Ecosystem Services Sustainability (CBESS) led by Prof. David Paterson at St. Andrews University. As part of the CBESS project, I plan to employ an ecoinformatics postdoc (starting early 2014) and together we will tackle the issue of scaling up from small-scale biodiversity surveys to large-scale ecosystem system services provisioning. I have also recently been invited to become the marine representative with the British Ecological Society and will aim to bridge the work of marine ecologists to the wider ecological community.

Queen's University Belfast

I am also part of a large-consortium bid (led by Dr. Paul Somerfield at Plymouth Marine Lab) for the NERC *Marine Food Webs and their Impacts on Ecosystem Services* programme, where I hope to quantify the kelp-derived detritus in our coastal food webs and understand the contribution of kelp to the functioning of marine ecosystems under different disturbance gradients. Cumulatively, the UK-Ireland partners of the KEEN network will provide essential data from an under-studied region with an ecology that differs from other parts of Europe (e.g. Norway, Portugal) and will provide data from kelp beds through monitoring and experimental manipulation across a latitudinal gradient, which represents a biogeographic boundary and a gradient of human disturbance (e.g. nutrient concentration) at different scales. These partners have already discussed and prioritised this research and planned how we will collaborate to reach maximum efficiency to achieve this at a regional scale (e.g. Smale, Burrows, Moore, O'Connor and Hawkins, *Threats and knowledge gaps for ecosystem services provided by kelp beds: a northeast Atlantic perspective* (accepted in *Ecology and Evolution*). Personally, I have a skill set that I think will enhance this network as shown form my track record of using an empirical approach in coastal ecosystems and to test and develop ecological concepts (e.g. O'Connor et al., 2013. Distinguishing between direct and indirect effects of predators in complex ecosystems. *Journal of Animal Ecology*; O'Connor & Donohue, 2013. Environmental context determines multi-trophic effects of consumer loss. *Global Change Biology*; Donohue, O'Connor et al., 2013. The dimensionality of ecological stability. *Ecology Letters*).

The QUB Marine Lab at Portaferry, Co. Down is located on Strangford Lough and is well equipped for lab and field-based marine research and for scientific diving (including two boats and full SCUBA kit with communications for our dive team). I have been in regular discussions with our dive officer about the practicalities (and extensive health and safety requirements) of our involvement and have also discussed the objectives of the KEEN project and any potential planning issues with the chief of the marine science team within the appropriate local authority (Marine Division, Northern Ireland Environment Agency) who is very keen for us to participate. Also, our dive officer has extensive experience sampling kelp beds for legislative monitoring purposes and has published several papers on the technical aspects of sampling kelp communities. We have selected three locations for the sampling and manipulation experiment in Northern Ireland; at Strangford Lough (54^0 28'36.74"N 5^0 35'09.28"W), Donaghadee (54^0 38'35.36"N 5^0) and Rathlin Island (55^0 16'50.045"N 6^0 17'28.09"W) and hope to participate fully for the duration of the project.

I am extremely excited about this project as it tackles issues that in my opinion are at the forefront of fundamental ecology and global change biology.

Yours sincerely,

Dr. Nessa E. O'Connor
Lecturer in Marine Biology
(Assistant Professor)

College of Science
Coleg Gwyddoniaeth

Swansea University
Prifysgol Abertawe

Department of Biosciences
Swansea University
Singleton Park
Swansea
SA2 8PP, Wales, UK

Letter of support: Dr John Griffin, Swansea University, UK.

August 12th 2013

To: Dr Jarrett Byrnes, PI Kelp Ecosystem Ecology Network

Dear Jarrett,

Thank you for the invitation to participate in the Kelp Ecosystem Ecology Network (KEEN). I believe this project represents a unique opportunity to uncover how a marine ecosystem responds to climate change as mediated both by global presses (e.g., increasing mean temperature) and local pulses (e.g., increasing extreme weather events), and I would therefore be thrilled to take part.

In collaboration with Prof. Mike Burrows and Drs Dan Smale, Nessa O'Connor and, in particular Pippa Moore who is located close to me at Aberystwyth University, I will conduct KEEN research at two sites in west Wales, UK. These sites will be Stackpole (51°37'21N, 4°53'52W), for the global observational experiment, and Manorbier (51°38'37N, 4°,48',47W), for the manipulative experiment.

I am an early-career researcher and Assistant Professor at Swansea University, UK. My lab addresses questions at the interface of community and ecosystem ecology using field observations, experiments and meta-analyses. Our particular focus is on the response of coastal ecosystems to global changes and how species interactions mediate these responses. For example, with collaborators at the University of Florida, I am investigating how a positive interaction between mussels and cordgrass mediates the resilience of salt marshes to extreme drought stress. While I work in multiple systems, much of my work has focused on marine macroalgal assemblages. During my PhD I investigated the role of functional diversity among macroalgal species on rocky reefs, and I am further developing this line of research in my new post at Swansea. Importantly, I have experience coordinating and leading research subtidally. The objectives of KEEN are therefore consistent with - and yet expand - my current research focus.

My contribution to the project would take three forms. First, and most importantly, I will ensure that observations and experiments are performed to the highest standard of rigour here

in Wales, in order to contribute high-quality data to KEEN. Second, to investigate how the functional traits of kelp mediate their response to climate change and impacts on ecosystem functions, I will coordinate and fund (using my secured European Union grant) collection of relevant functional trait data across the KEEN network . Third, I will commit student projects (2 x MSc, 3 x BSc) to the program to help ensure the success of the primary KEEN experiments and to investigate complementary questions that arise during the experiments.

Participation in the project will be funded through two secured funding sources. First, I have recently secured a 4-year European Union Career Integration Grant ($135,000), part of which I will use to fund KEEN activities here in Wales. Second, I have recently developed a project with an EU-funded program based at Swansea that aims to help marine-facing businesses ('SEACAMS' http://www.swansea.ac.uk/seacams/). We will work with a local marine ecological consultancy (http://marineseen.com/) to test and compare alternative sampling regimes, including methods used by all KEEN partners, allowing a proportion of data collected to contribute to our KEEN experiments. SEACAMS will provide a dive team and boat for 40 dives, representing a considerable investment in the project (> $35,000). Funding for additional activities will be sought from the UK government's research funding body, Natural Environment Research Council (NERC), with a proposal led by Dr Pippa Moore and in collaboration with all other UK KEEN partners to be submitted in December 2013. Importantly, funding for participation in KEEN is already secured and will be further ensured by the collaboration between myself and Dr Pippa Moore at the Wales node of KEEN (herself a recipient of an EU career integration grant).

In summary, I am thoroughly supportive of the goals of KEEN and both willing and able to contribute to the network.

Yours sincerely,

John Griffin

Dr Pippa Moore
Darlithydd mewn Ddyfriog Bioleg
IBERS
Sefydliad y Gwyddorau Biolegol, Amgylcheddol a Gwledig
Adeilad Edward Llwyd,
Campws Penglais
Aberystwyth
Ceredigion SY23 3DA

Ffôn: (01970) 622293
Ffacs: (01970) 628642
Ebost: pim2@aber.ac.uk
www.aber.ac.uk/ibers

Dr Pippa Moore
Lecturer in Aquatic Biology
IBERS
Institute of Biological, Environmental and Rural Sciences
Edward Llwyd Building
Penglais Campus
Aberystwyth
Ceredigion SY23 3DA

Tel: (01970) 622293
Fax: (01970) 628642
Email: pim2@aber.ac.uk
www.aber.ac.uk/ibers

12/08/2013

Dear Jarrett,

Firstly I would like to thank you for inviting me to be involved in this network. It is only through global collaborations such as this that we will be able to generalise patterns of kelp ecosystem responses to climate warming and other anthropogenic stressors that are so desperately required in order to inform management and policy. I can confirm that with UK colleagues I will undertake both the manipulative and observational experiment at four sites within the United Kingdom. In particular, I will be leading the experiments undertaken in south-west Wales in conjunction with my colleague Dr John Griffin at Swansea University.

I am a climate change ecologist with particular expertise in how climate change and other anthropogenic stressors are altering the structure and functioning of shallow-water marine assemblages. Within a UK context, I have used long-term datasets (> 50 yrs) to demonstrate that recent warming has lead to changes in the distribution, abundance and phenology of a range of shallow-water marine algae and invertebrates including the kelps *Alaria esculenta* and *Laminaria ochroleuca*. Experimental work has demonstrated that warming is likely to alter the strength and direction of biotic interactions including algal-herbivore and predator-prey interactions. I am currently actively involved in research determining the effects of multiple stressors on the structure and function of UK and Australian kelp forests and am therefore well placed and qualified to participate in the KEEN network.

In committing to the KEEN network I will be able to provide in-kind support of my time equivalent to £2,400 per year plus £1,600 per year for boats in order to undertake the fieldwork in south-west Wales. This will be leveraged from existing grant income via a European Union Marie Curie Career Integration Grant. Moreover, I will be able to provide suitably qualified (i.e. HSE Part IV qualified) undergraduate and postgraduate student divers to undertake the observations and manipulative experiment at zero cost. I also have one PhD student undertaking research on the impacts of multiple stressors in shallow-water marine assemblages, including kelp communities in the UK and Western Australia (collaborating with KEEN member Dr Thomas Wernberg), who will be involved with the KEEN experiments will also undertake complimentary research.

In addition to leveraging money from existing grants to fund the two KEEN experiments that we are committed to undertaking the UK team are actively seeking additional funding via NERC in order to undertake kelp focused research within the UK. This research grant will be submitted in December 2013 and will use space for time manipulations in order to determine the effects of warming, increased wave action and changes in turbidity on population and community level responses in UK kelp systems.

This research grant, if successful, will fully compliment the research being undertaken within the KEEN network and will enable us to leverage more money in order to extend our commitment to the KEEN network. The UK team will also seek support via the NERC National Diving Facility in order to support the experiments that we will undertake as part of KEEN. If successful this would provide a NERC Dive Team and boat to undertake all fieldwork components of this project.

I can confirm that I will co-ordinate, with Dr John Griffin, a team of UK divers in order to undertake both the observational experiment and the manipulative experiment in south-west Wales. In addition, I will support as needed fieldwork in the rest of the UK that will be co-ordinated by UK colleagues. In the first instance I can confirm that we will monitor the manipulative experiment for two years, however, if our proposed grant applications are successful we will extend this to the full four years.

Thank you again for inviting me to be part of this network. I wish you every success with the grant and look forward to collaborating with you and the rest of the KEEN network in order to undertake this important research programme.

Regards

Dr Pippa Moore

ciimar
Centro Interdisciplinar
de Investigação
Marinha e Ambiental

Porto, 9th of August 2013

Letter of support for Collaborative Research: A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances

CIIMAR is a leading marine research centre in Portugal and has a very substantial interest and work on the understanding of the marine environment to support good management and sustainable use of marine resources. The Laboratory of Coastal Biodiversity that I lead, is an active research group with several current projects concerning the biology and ecology of kelps, ranging in scope from ecophysiology, cultivation for the optimization of production of kelp biomass for biofuels and other applications to kelp forests ecology and effects of climate change. I'm leading or participating in several European and international projects and my international activities include being part of the Portuguese Delegation to the Convention for Biological Diversity (CBD) and for the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) that aims at using the knowledge produced on ecosystem and their services for better policy and management decisions at global level. In addition I co-chair the Marine Working Group and I'm member of the Steering Committee of GEO BON, the Biodiversity Observation Network that is lead by NASA and Diversitas and that is the Biodiversity component of GEO, (Global Earth Observation) an Intergovernmental International Institution.
Several kelp species including *Laminaria hyperborea* and *Saccharina latissima* have their warm range-limits in Portugal and the limits of the known forests have been migrating north in the last decade. For Portugal it is therefore particularly important to understand how increasing water temperatures and other pressures are likely to affect these marginal kelp populations and the ecosystem services they provide. Already, there are strong indications that kelp beds in Southern Europe are declining due to temperature increases and other human factors.

As the research leader of the group I am very excited about the proposed collaboration within the present project. The proposed project and ongoing collaborations will expand the work we are currently doing in Portugal and Europe, adding substantial perspective and new aspects to this work. We are currently engaged in two other international kelp projects: KNEU - an European project where we are looking to the trends of kelp forests around Europe and the connection between changes in kelp and decrease of fisheries, and KEEN – the global kelp ecosystems network that has been joined by many of the current participants of this proposal. The proposed collaboration will help consolidate our position in these networks. We also have several running national projects and the lab has around 30 researchers including four senior researchers, seven post-docs, eight PhD and several technicians, master student, and a number of under-graduate students. As the proposed collaboration aligns closely with many of our current activities we can assist the project by using all the facilities necessary in Portugal: a well-equipped marine laboratory with all the necessary facilities for the proposed work, such as several cultivation units of different sizes for experiments where kelp are kept and cultivated for several projects, specialist ecophysiological equipment such as a diving PAM Fluorometer, a car and access to boat and diving equipment. I have a PhD student who has just commenced a project in this area and other students and technician that will assist with the diving and the identification of organisms and other tasks. Should the proposal be successful, it will also represent a unique opportunity for international mentoring of our postgraduate students. We will do our field work in three locations in the North of Portugal at the south border of our kelp forests.

It is my expectation that the proposed project will lead to joint publications and funding applications, student exchanges, comparative experiments and collaborations well into the future.

Best Regards,

Isabel de Sousa Pinto

Prof Isabel Sousa Pinto

Rua dos Bragas, n.º 289
4050-123 Porto | Portugal
Tel.: (351) 223 401 800
Fax: (351) 223 390 608
secretariado@ciimar.up.pt
www.ciimar.up.pt

THE UNIVERSITY of ADELAIDE

SOUTHERN SEAS ECOLOGY LABORATORIES
SCHOOL OF EARTH & ENVIRONMENTAL SCIENCES
UNIVERSITY OF ADELAIDE, SA 5005, AUSTRALIA

PROFESSOR SEAN D. CONNELL
Future Fellow, Australian Research Council
ph +61 8 8313 6125, fax +61 8 8313 4364
email sean.connell@adelaide.edu.au
http://www.marinebiology.adelaide.edu

15 August 2013

Dear Jarrett

RE: Letter of Support for Jarrett Byrnes

I am very interested in participating in this very exciting KEEN Network as a coordinator and researcher within the Australian components of the observational and experimental research. My laboratory would be interested in directly assisting with work on the south coast and east coast of Australia.

I am a marine ecologist who has published work on patterns of kelp-understory associations across Australia and New Zealand. Given that this project focuses on reexamining many of my sites and doing similar experiments to my previous research projects, I believe that I am in a good position to assist.

What I bring to the project is experience from many hundreds of dives across the Australian coast in which I have been observing experimental responses to kelp stressors, loss and recovery across 5500 km of coast. Some of this has been reviewed in my book Marine Ecology (Oxford University Press).

I can support the project through my expertise and knowledge of rates of kelp recovery across Australia, knowledge of sites with appropriate covers of kelp. Pending legal advice from my university, I can assist with risk assessments for fieldwork and provide laboratory facilities for members of the network. I work within a laboratory with staff and students that are in communication with colleagues across temperate Australia. This combination of experience and contacts would be of value to the network. I have contacts of companies that meet Australian legal standards for boat operations and government agencies that regulate scientific activities (i.e. scientific permits). These contacts may avoid lengthy delays that regularly increase the cost burden of projects.

As a final statement, I am excited by the possibilities that this global project may achieve. Jarrett Byrnes is an excellent marine ecologist and I believe that he will achieve great things from this project. He has outstanding skills as a facilitator and this KEEN network is testament to that fact.

I believe that I am in a rather good position to assist Jarrett Byrnes achieve his goals.

Yours sincerely,

Sean D. Connell

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Marine Ecology in a Changing World

Perth, 12 August 2013

DR THOMAS WERNBERG
ARC Future Fellow & Associate Professor
UWA Oceans Institute (M096)
School Plant Biology
39 Fairway, Crawley WA 6009, Australia
T 61 8 6369 4047
F 61 8 6488 4585
E thomas.wernberg@uwa.edu.au
W http://wernberglab.org

CRICOS Provider No.00126G

Dr Jarret Byrnes
Department of Biology
University of Massachusetts Boston
100 Morrissey Blvd; Boston, MA 02125
USA

Re. A Global Experimental Network to Examine Kelp Forest Ecosystems Response to Changing Climate & Local Disturbances

Dear Jarrett,

I am writing to let you know my intent to participate in the global experimental network, where I will represent Western Australia. I will set up one experimental site and carry out observations at three sites, over the following years as agreed.

I have almost 15 years of experience with kelp research in Australasia, and having worked in kelp forests across Australia, New Zealand, South Africa and Europe I am familiar with many of the kelp systems included in the experiment. The proposed work aligns well with the core research in my group, where comparative ecological and ecophysiological experiments along latitudinal gradients feature prominently (e.g., Wernberg et al 2010, Ecol Lett). I see many opportunities for value-adding between the respective programs. Having previously undertaken similar experiments and surveys across the temperate coastline of continental Australia and Tasmania, I am very familiar with the proposed experiments and survey methods, and I have extensive baseline data from the Australasian region.

I am in an ongoing position at UWA and currently have funding to 2016, so I should be able to carry through to the end of the proposed program. UWA has an active scientific diving program and my group has access to all the infrastructure and facilities required, including processes to manage diving health and safety, laboratories, cars, boats, diving gear, etc. With a handful of active scientific divers in my research group, there will be enough people to undertake the work.

In addition to the field work, I will be hosting the 10th International Temperate Reefs Symposium in Perth in January 2014. As discussed, this provides a suitable venue for an initial coordinating meeting with broad attendance, and I welcome the opportunity to facilitate and co-host such a kelp network meeting with you. Similarly, I am committed to working closely with my Australasian colleagues, to pursue a concerted effort and our own parallel funding.

I believe this is an exciting opportunity to unite kelp ecologists in what is likely to be a truly unique 'once-in-a-life-time' opportunity to produce a globally coherent test of how kelp forests are likely to respond to increasing temperatures and intensifying disturbance regimes. Importantly, climate change or not, the quantitative global assessment of kelp forest ecology is an interesting and worthwhile undertaking in its own right!

Sincerely,

Thomas Wernberg

Prof. Masahiro NAKAOKA
Akkeshi Marine Station
Field Science Center for Northern Biosphere
Hokkaido University
Aikappu, Akkeshi, Hokkaido 088-1113, JAPAN
Phone: +81-153-52-2056 / Fax: +81-153-52-2042
Email: nakaoka@fsc.hokudai.ac.jp

August 12th, 2013

Dear Jarrett,

I'm writing to express my interest in participating the global network of kelp ecosystem research by KEEN (Kelp Ecosystem Ecological Network) and support for its proposed research project investigating global patterns and dynamics of kelp ecosystem, and my willingness to lead the effort at Akkeshi, Hokkaido, Japan.

As you know, kelp forest is one of the most prominent ecosystems along the northeastern part of Asia including northern Japan. Not only it supports high biodiversity and ecosystem functioning, the Laminaria kelp itself is a major food resource in Japan, and we have been relying on it for a long time. However, the loss of kelp forest has been a great concern since 1970-80's, and we still do not know what are the real causes, how much they can survive in future. A global analyses of kelp forests between both hemispheres and between the Pacific and the Atlantic may lead to understand the generality and specificity of process of kelp ecosystem changes in relation to various human activities, which will also be valuable for effective conservation and management of our coastal areas. The proposed research is thus complementary to our interests and I expect that it will be mutually beneficial.

I understand that, even if the NSF proposal is successful, our utilization on your resources will be limited as a non-US participant. However, we already obtained some funding to carry out field observational research (Question 2 in the proposal) according to the protocol given by the proposal, and thus can contribute to provide our data on global analyses. In addition, I am happy to hear that there will be opportunities for student exchanges among partner sites that could help contribute to the labor required in the research. I am happy to be a host of US post-docs and students, as I have a good amount of experience.

I look forward to working with you and wish you good luck with the proposal.

Sincerely,

Masahiro Nakaoka
Director and professor of Akkeshi Marine Station, Hokkaido University