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PI/PD Name: Christine R Whitcraft

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: 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

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PI/PD Name: Matthew C Ferner

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: David S Johnson

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: James Nelson

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)
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- ☐ Visual Impairment
- ☐ Mobility/Orthopedic Impairment
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- ☒ None

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

SUGGESTED REVIEWERS:
Not Listed

REVIEWERS NOT TO INCLUDE:
Not Listed

Co-PI Name	COI Last Name	COI First Name	COI Institution	COI type
Byrnes	Bracken	Matt	UC, Irvine	Collaborator
Byrnes	Miller	Luke	San Jose State University	Collaborator
Byrnes	Stachowicz	John J.	UC Davis	Graduate Advisor
Byrnes	Reed	Daniel C.	UC Santa Barbara	Postdoctoral Sponsor
Byrnes	Cardinale	Bradley J.	University of Michigan	Postdoctoral Sponsor
Byrnes	Haupt	Alison	California State Monterey Bay	Postgraduate Scholor Sponsor
Byrnes	Balvanera	Patricia	UNAM	Co-Author
Byrnes	Bolton	John	University of Cape Town	Collaborator
Byrnes	Cavanaugh	Kyle	UCLA	Co-Author
Byrnes	Connell	Sean	University of Adelaide	Collaborator
Byrnes	Duffy	J. Emmett	Tannenbaum Marine Observatory Network	Co-Author
Byrnes	Edwards	Kyle	University of Hawaii	Collaborator
Byrnes	Gamfeldt	Lars	University of Gothenburg	Co-Author
Byrnes	Gonzalez	Andrew	McGill University	Co-Author
Byrnes	Holbrook	Sally	UC Santa Barbara	Co-Author
Byrnes	Hooper	David	Western Washington University	Co-Author
Byrnes	Isbell	Forest	University of Minnesota	Co-Author
Byrnes	Johnson	Craig	University of Tasmania	Collaborator
Byrnes	Ling	Scott	University of Tasmania	Collaborator
Byrnes	Konar	Brenda	University of Alaska Fairbanks	Collaborator
Byrnes	Krumhansl	Kira	Simon Fraiser University	Collaborator
Byrnes	Michaeli	Fiorenza	Stanford University	Collaborator
Byrnes	Norderhaug	Kjell-Magnus	Norwegian Institute for Water Research	Collaborator
Byrnes	Novak	Mark	Oregon State University	Collaborator
Byrnes	O'Connor	Mary	University of British Columbia	Co-Author
Byrnes	Perez-Matus	Alejandro	Pontificia Universidad Católica de Chile	Collaborator
Byrnes	Reynolds	Pamela	UC Davis	Co-Author
Byrnes	Salomon	Anne	Simon Fraiser University	Collaborator
Byrnes	Schmitt	Russ	UC Santa Barbara	Co-Author
Byrnes	Shears	Nick	University of Auckland	Collaborator
Byrnes	Sousa Pinto	Isabel	University of Porto	Collaborator
Byrnes	Wernberg	Thomas	University of Western Australia	Collaborator
Ferner	Bergamaschi	Brian	U.S. Geological Survey	Collaborator
Ferner	Boss	Emmanuel	Univ. of Maine	Collaborator
Ferner	Bundy	Marie	NOAA National Ocean Service	Co-committee member
Ferner	Buskey	Edward	Univ. of Texas	Co-committee member
Ferner	Byrd	Kristin	U.S. Geological Survey	Collaborator
Ferner	Byrnes	Jarrett	Univ. of Massachusetts	Collaborator
Ferner	Callaway	John	Univ. of San Francisco	Collaborator
Ferner	Chang	Andrew	mithsonian Environmental Research Cente	Collaborator
Ferner	Cheng	Brian	mithsonian Environmental Research Cente	Collaborator
Ferner	Cherry	Julia	Univ. of Alabama	Collaborator
Ferner	Crooks	Stephen	Environmental Science Associates	Collaborator
Ferner	Culver	Mary	NOAA National Ocean Service	Co-committee member
Ferner	Drexler	Judith	U.S. Geological Survey	Collaborator
Ferner	Duffy	Emmett	Smithsonian Institution	Collaborator
Ferner	Eslinger	David	NOAA National Ocean Service	Co-committee member
Ferner	Feagin	Rusty	Texas A&M University	Collaborator
Ferner	Gaylord	Brian	Univ. of California-Davis	Collaborator
Ferner	Grosholz	Ted	Univ. of California-Davis	Collaborator
Ferner	Hodin	Jason	Univ. of Washington	Collaborator
Ferner	Johnson	David	WHOI/VIMS	Collaborator

Ferner	Kroeger	Kevin	U.S. Geological Survey	Collaborator
Ferner	Lacy	Jessie	U.S. Geological Survey	Collaborator
Ferner	Lowe	Christopher	Stanford	Collaborator
Ferner	Megonigal	Patrick	mithsonian Environmental Research Cente	Collaborator
Ferner	Morris	James	Univ. of South Carolina	Collaborator
Ferner	Parker	Alex	California Maritime Academy	Collaborator
Ferner	Raposa	Kenny	Narragansett Bay NERR	Collaborator
Ferner	Reay	William	Chesapeake Bay Virginia NERR	Co-committee member
Ferner	Schile	Lisa	mithsonian Environmental Research Cente	Collaborator
Ferner	Schooler	Shon	Univ. of Wisconsin	Co-committee member
Ferner	Siegel	Stuart	San Francisco Bay NERR	Collaborator
Ferner	Simard	Marc	NASA Jet Propulsion Laboratory	Collaborator
Ferner	Sloop	Christina	Blue Earth Consulting	Collaborator
Ferner	Smee	Delbert	Texas A&M - Corpus Christi	Collaborator
Ferner	Smith	Erik	Univ. of South Carolina	Collaborator
Ferner	Sutton-Grier	Ariana	NOAA National Ocean Service	Collaborator
Ferner	Takekawa	John	U.S. Geological Survey	Collaborator
Ferner	Troxler	Tiffany	Florida International Univ.	Collaborator
Ferner	Trueblood	Dwight	NOAA National Ocean Service	Co-committee member
Ferner	Vasey	Mike	San Francisco Bay NERR	Collaborator
Ferner	Veloz	Sam	Point Blue Conservation Science	Collaborator
Ferner	Wasson	Kerstin	Elkhorn Slough NERR	Collaborator
Ferner	Weissburg	Marc	Georgia Institute of Technology	Ph.D. Advisor
Ferner	Weller	Donald	mithsonian Environmental Research Cente	Collaborator
Ferner	Wilson	Kristin	Wells NERR	Collaborator
Ferner	Windham-Myers	Lisamarie	U.S. Geological Survey	Collaborator
Ferner	Woo	Isa	U.S. Geological Survey	Collaborator
Ferner	Woodrey	Mark	Mississippi State Univ.	Collaborator
Ferner	Zabin	Chela	mithsonian Environmental Research Cente	Collaborator
Johnson	Fagherazzi	Sergio	Boston University	Collaborator
Johnson	Robinson	Robinson (Wally)	Boston University	Collaborator
Johnson	Deegan	Linda	Marine Biological Laboratory	Post-doctoral advisor
Johnson	Heard	Richard	University of Southern Mississippi	Collaborator
Johnson	Warren	Scott	Connecticut College	Collaborator
Johnson	Wolheim	William	University of New Hampshire	Collaborator
Johnson	Giblin	Anne	Marine Biological Laboratory	Collaborator
Johnson	Wigand	Cathy	Environmental Protection Agency	Collaborator
Johnson	Fleeger	John	Louisiana State University	Ph.D. Advisor
Johnson	Harms	Kyle	Louisiana State University	Collaborator
Johnson	Brown	Ken	Louisiana State University	Collaborator
Johnson	Kimbro	David	Northeastern University	Collaborator
Johnson	Hughes	Randall	Northeastern University	Collaborator
Nelson			Marine Biological Laboratory	Institutional
Nelson	Chanton	Jefferey	Florida State University	Ph.D. Advisor
Nelson	Coleman	Felicia	Florida State University	Co-Editor
Nelson	DeVries	Doug	National Marine Fisheries	Co-Author
Nelson	Gardner	Christopher	National Marine Fisheries	Co-Author
Nelson	Koenig	Christopher	Florida State University	Co-Author
Nelson	Landing	William	Florida State University	Co-Author
Nelson	Stallings	Christopher	Florida State University	Collaborator
Nelson	Wilson	Rachel	Florida State University	Collaborator
Nelson	Deegan	Linda	Marine Biological Laboratory	Collaborator

Nelson	Peterson	Bruce	Marine Biological Laboratory	Collaborator
Nelson	Anne	Giblin	Marine Biological Laboratory	Collaborator
Nelson	Bowen	Jennifer	University of Massachusettes Boston	Collaborator
Nelson	Thomas	Mozeder	Brynn Mawr	Collaborator
Nelson	Johnson	David	Virginia Institute of Marine Science	Collaborator
Whitcraft			CSU Long Beach	Institutional
Whitcraft	Crooks	Jeff	Tijuana Estuary NERR	Collaborator
Whitcraft	Gaskin	John	USDA - Sidney, Montana	Collaborator
Whitcraft	Grewell	Brenda	USDA - Davis, CA	Collaborator
Whitcraft	Levin	Lisa	UC San Diego, SIO	Ph D advisor
Whitcraft	Schroeter	Steve	UC Santa Barbara	Collaborator
Whitcraft	Talley	Drew	University of San Diego	Post-doctoral advisor
Whitcraft	Talley	Theresa	CA SeaGrant Extension	Collaborator
Whitcraft	Allen	Bengt	CSU Long Beach	Collaborator
Whitcraft	Dillon	Jesse	CSU Long Beach	Collaborator
Whitcraft	Lowe	Chris	CSU Long Beach	Collaborator
Whitcraft	Keller	Jason	Chapman University	Collaborator
Whitcraft	Spautz	Hildie	CA Department of Fish and Wildlife	Collaborator
Whitcraft	Zembal	Dick	Orange County Sanitation District	Collaborator
Whitcraft	Grainier	Letitia	San Francisco Estuary Insitute	Collaborator
Whitcraft	Nordstrom	Marie	Åbo Akademy University	Collaborator

COVER SHEET FOR PROPOSAL TO THE NATIONAL SCIENCE FOUNDATION

PROGRAM ANNOUNCEMENT/SOLICITATION NO./DUE DATE	☐ Special Exception to Deadline Date Policy	FOR NSF USE ONLY
NSF 15-609 01/27/16		**NSF PROPOSAL NUMBER**

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

DEB - Ecosystem Studies

DATE RECEIVED	NUMBER OF COPIES	DIVISION ASSIGNED	FUND CODE	DUNS# (Data Universal Numbering System)	FILE LOCATION
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EMPLOYER IDENTIFICATION NUMBER (EIN) OR TAXPAYER IDENTIFICATION NUMBER (TIN)	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)
956106694		

NAME OF ORGANIZATION TO WHICH AWARD SHOULD BE MADE	ADDRESS OF AWARDEE ORGANIZATION, INCLUDING 9 DIGIT ZIP CODE
California State University-Long Beach Foundation	**California State University-Long Beach Foundation** **6300 State Univ. Dr.** **Long Beach, CA. 908154670**
AWARDEE ORGANIZATION CODE (IF KNOWN) **0011395001**	
NAME OF PRIMARY PLACE OF PERF **California State University-Long Beach**	ADDRESS OF PRIMARY PLACE OF PERF, INCLUDING 9 DIGIT ZIP CODE **California State University-Long Beach** **1250 Bellflower Blvd** **Long Beach ,CA ,908400004 ,US.**

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

TITLE OF PROPOSED PROJECT **Preliminary Proposal: Sea-level rise alters salt marsh ecosystem function via changes in food web structure**

REQUESTED AMOUNT	PROPOSED DURATION (1-60 MONTHS)	REQUESTED STARTING DATE	SHOW RELATED PRELIMINARY PROPOSAL NO. IF APPLICABLE
$ **0**	**0** months		

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)

☐ VERTEBRATE ANIMALS (GPG II.D.6) IACUC App. Date _____

PHS Animal Welfare Assurance Number _____

☒ FUNDING MECHANISM **Research - other than RAPID or EAGER**

☐ HUMAN SUBJECTS (GPG II.D.7) Human Subjects Assurance Number _____

Exemption Subsection _____ or IRB App. Date _____

☐ INTERNATIONAL ACTIVITIES: COUNTRY/COUNTRIES INVOLVED (GPG II.C.2.j)

_____

☒ COLLABORATIVE STATUS

Not a collaborative proposal

PI/PD DEPARTMENT	PI/PD POSTAL ADDRESS
Biological Sciences	**1250 Bellflower Blvd** **Long Beach, CA 908400004** **United States**
PI/PD FAX NUMBER **562-985-8878**	

NAMES (TYPED)	High Degree	Yr of Degree	Telephone Number	Email Address
PI/PD NAME **Christine R Whitcraft**	**DPhil**	**2007**	**562-985-4820**	**cwhitcra@csulb.edu**
CO-PI/PD **Jarrett Byrnes**	**PhD**	**2008**	**401-529-4104**	**jarrett.byrnes@umb.edu**
CO-PI/PD **Matthew C Ferner**	**PhD**	**2006**	**415-338-3724**	**mferner@sfsu.edu**
CO-PI/PD **David S Johnson**	**PhD**	**2008**	**804-684-7000**	**dsjohnson@vims.edu**
CO-PI/PD **James Nelson**	**ScD**	**2011**	**508-548-3705**	**nelson@louisiana.edu**

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).

Certification Regarding Conflict of Interest

The AOR is required to complete certifications stating that the organization has implemented and is enforcing a written policy on conflicts of interest (COI), consistent with the provisions of AAG Chapter IV.A.; that, to the best of his/her knowledge, all financial disclosures required by the conflict of interest policy were made; and that conflicts of interest, if any, were, or prior to the organization's expenditure of any funds under the award, will be, satisfactorily managed, reduced or eliminated in accordance with the organization's conflict of interest policy. Conflicts that cannot be satisfactorily managed, reduced or eliminated and research that proceeds without the imposition of conditions or restrictions when a conflict of interest exists, must be disclosed to NSF via use of the Notifications and Requests Module in FastLane.

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.

Certification Dual Use Research of Concern

By electronically signing the certification pages, the Authorized Organizational Representative is certifying that the organization will be or is in compliance with all aspects of the United States Government Policy for Institutional Oversight of Life Sciences Dual Use Research of Concern.

AUTHORIZED ORGANIZATIONAL REPRESENTATIVE	SIGNATURE	DATE
NAME		

TELEPHONE NUMBER	EMAIL ADDRESS	FAX NUMBER

Direct for Biological Sciences
Division of Environmental Biology
Ecosystem Studies

Proposal Classification Form
PI: Whitcraft, Christine

CATEGORY I: INVESTIGATOR STATUS (Select ONE)

- ☑ Beginning Investigator - No previous Federal support as PI or Co-PI, excluding fellowships, dissertations, planning grants, etc.
- ☐ Prior Federal support only
- ☐ Current Federal support only
- ☐ Current & prior Federal support

CATEGORY II: FIELDS OF SCIENCE OTHER THAN BIOLOGY INVOLVED IN THIS RESEARCH (Select 1 to 3)

- ☐ Astronomy
- ☐ Chemistry
- ☐ Computer Science
- ☐ Geosciences
- ☐ Engineering
- ☐ Mathematics
- ☐ Physics
- ☐ Psychology
- ☐ Social Sciences
- ☑ None of the Above

CATEGORY III: SUBSTANTIVE AREA (Select 1 to 4)

- ☐ BIOGEOGRAPHY
- ☐ Island Biogeography
- ☐ Historical/ Evolutionary Biogeography
- ☐ Phylogeography
- ☐ Methods/Theory
- ☐ CHROMOSOME STUDIES
- ☐ Chromosome Evolution
- ☐ Chromosome Number
- ☐ Mutation
- ☐ Mitosis and Meiosis
- ☑ COMMUNITY ECOLOGY
- ☐ Community Analysis
- ☐ Community Structure
- ☐ Community Stability
- ☐ Succession
- ☐ Experimental Microcosms/ Mesocosms
- ☐ Disturbance
- ☐ Patch Dynamics
- ☑ Food Webs/ Trophic Structure
- ☐ Keystone Species
- ☐ COMPUTATIONAL BIOLOGY
- ☐ CONSERVATION & RESTORATION BIOLOGY
- ☐ DATABASES
- ☐ ECOSYSTEMS LEVEL
- ☐ Physical Structure
- ☐ Decomposition
- ☐ Biogeochemistry
- ☐ Limnology/Hydrology
- ☑ Climate/Microclimate
- ☐ Whole-System Analysis
- ☐ Productivity/Biomass
- ☐ System Energetics
- ☐ Landscape Dynamics
- ☐ Chemical & Biochemical Control
- ☐ Global Change
- ☐ Climate Change
- ☐ Regional Studies
- ☐ Global Studies
- ☐ Forestry
- ☐ Resource Management (Wildlife, Fisheries, Range, Other)
- ☐ Agricultural Ecology
- ☐ EXTREMOPHILES
- ☐ GENOMICS (Genome sequence, organization, function)
  - ☐ Viral
  - ☐ Microbial
  - ☐ Fungal
  - ☐ Plant
  - ☐ Animal
- ☐ MARINE MAMMALS
- ☐ MOLECULAR APPROACHES
- ☐ Molecular Evolution
- ☐ Methodology/Theory
- ☐ Isozymes/ Electrophoresis
- ☐ Nucleic Acid Analysis (general)
  - ☐ Restriction Enzymes
  - ☐ Nucleotide Sequencing
  - ☐ Nuclear DNA
  - ☐ Mitochondrial DNA
  - ☐ Chloroplast DNA
  - ☐ RNA Analysis
  - ☐ DNA Hybridization
  - ☐ Recombinant DNA
- ☐ Amino Acid Sequencing
- ☐ Gene/Genome Mapping
- ☐ Natural Products
- ☐ Serology/Immunology
- ☐ PALEONTOLOGY
- ☐ Floristic
- ☐ Faunistic
- ☐ Paleoecology
- ☐ Biostratigraphy
- ☐ Palynology
- ☐ Micropaleontology
- ☐ Paleoclimatology
- ☐ Archeozoic
- ☐ Paleozoic
- ☐ Mesozoic

- ☐ Cenozoic
- ☐ POPULATION DYNAMICS & LIFE HISTORY
- ☐ Demography/ Life History
- ☐ Population Cycles
- ☐ Distribution/Patchiness/ Marginal Populations
- ☐ Population Regulation
- ☐ Intraspecific Competition
- ☐ Reproductive Strategies
- ☐ Gender Allocation
- ☐ Metapopulations
- ☐ Extinction
- ☐ POPULATION GENETICS & BREEDING SYSTEMS
- ☐ Variation
- ☐ Microevolution
- ☐ Speciation
- ☐ Hybridization
- ☐ Inbreeding/Outbreeding
- ☐ Gene Flow Measurement
- ☐ Inheritance/Heritability
- ☐ Quantitative Genetics/ QTL Analysis
- ☐ Ecological Genetics
- ☐ Gender Ratios
- ☐ Apomixis/ Parthenogenesis
- ☐ Vegetative Reproduction
- ☐ SPECIES INTERACTIONS
- ☑ Predation
- ☐ Herbivory
- ☐ Omnivory
- ☐ Interspecific Competition
- ☐ Niche Relationships/ Resource Partititioning
- ☐ Pollination/ Seed Dispersal
- ☐ Parasitism
- ☐ Mutualism/ Commensalism
- ☐ Plant/Fungal/ Microbial Interactions
- ☐ Mimicry
- ☐ Animal Pathology
- ☐ Plant Pathology
- ☐ Coevolution
- ☐ Biological Control
- ☐ STATISTICS & MODELING
- ☐ Methods/ Instrumentation/ Software
- ☐ Modeling (general)
- ☐ Statistics (general)
  - ☐ Multivariate Methods
  - ☐ Spatial Statistics & Spatial Modeling
  - ☐ Sampling Design & Analysis
  - ☐ Experimental Design & Analysis
- ☐ SYSTEMATICS
- ☐ Taxonomy/Classification
- ☐ Nomenclature
- ☐ Monograph/Revision
- ☐ Phylogenetics
- ☐ Phenetics/Cladistics/ Numerical Taxonomy
- ☐ Macroevolution
- ☐ NONE OF THE ABOVE

CATEGORY IV: INFRASTRUCTURE (Select 1 to 3)

- ☐ COLLECTIONS/STOCK CULTURES
- ☐ Natural History Collections
- ☐ DATABASES
- ☐ FACILITIES
- ☐ Controlled Environment Facilities
- ☑ Field Stations
  - ☐ Field Facility Structure
  - ☐ Field Facility Equipment
- ☐ LTER Site
- ☐ INDUSTRY PARTICIPATION
- ☐ Technique Development
- ☐ TRACKING SYSTEMS
- ☐ Geographic Information Systems
- ☐ Remote Sensing
- ☐ NONE OF THE ABOVE

CATEGORY V: HABITAT (Select 1 to 2)

TERRESTRIAL HABITATS

- ☐ GENERAL TERRESTRIAL
- ☐ TUNDRA
- ☐ BOREAL FOREST
- ☐ TEMPERATE
  - ☐ Deciduous Forest
  - ☐ Coniferous Forest
  - ☐ Rain Forest
  - ☐ Mixed Forest
  - ☐ Prairie/Grasslands
  - ☐ Desert
- ☐ SUBTROPICAL
  - ☐ Rain Forest
  - ☐ Seasonal Forest
  - ☐ Savanna
  - ☐ Thornwoods
  - ☐ Deciduous Forest
  - ☐ Coniferous Forest
  - ☐ Desert
- ☐ TROPICAL
  - ☐ Rain Forest
  - ☐ Seasonal Forest
  - ☐ Savanna
  - ☐ Thornwoods
  - ☐ Deciduous Forest
  - ☐ Coniferous Forest
  - ☐ Desert
- ☐ CHAPPARAL/ SCLEROPHYLL/ SHRUBLANDS
- ☐ ALPINE
- ☐ MONTANE
- ☐ CLOUD FOREST
- ☐ RIPARIAN ZONES
- ☐ ISLANDS (except Barrier Islands)
- ☐ BEACHES/ DUNES/ SHORES/ BARRIER ISLANDS
- ☐ CAVES/ ROCK OUTCROPS/ CLIFFS
- ☐ CROPLANDS/ FALLOW FIELDS/ PASTURES
- ☐ URBAN/SUBURBAN
- ☐ SUBTERRANEAN/ SOIL/ SEDIMENTS
- ☐ EXTREME TERRESTRIAL ENVIRONMENT
- ☐ AERIAL

AQUATIC HABITATS

- ☐ GENERAL AQUATIC
- ☐ FRESHWATER
  - ☐ Wetlands/Bogs/Swamps
  - ☐ Lakes/Ponds
  - ☐ Rivers/Streams
  - ☐ Reservoirs
- ☐ MARINE
  - ☐ Open Ocean/Continental Shelf
  - ☐ Bathyal
  - ☐ Abyssal
  - ☑ Estuarine
  - ☐ Intertidal/Tidal/Coastal
  - ☐ Coral Reef
  - ☐ HYPERSALINE
- ☐ EXTREME AQUATIC ENVIRONMENT
- ☐ CAVES/ ROCK OUTCROPS/ CLIFFS
- ☐ MANGROVES
- ☐ SUBSURFACE WATERS/ SPRINGS
- ☐ EPHEMERAL POOLS & STREAMS
- ☐ MICROPOOLS (Pitcher Plants, Tree Holes, Other)

MAN-MADE ENVIRONMENTS

- ☐ LABORATORY
- ☐ THEORETICAL SYSTEMS
- ☐ OTHER ARTIFICIAL SYSTEMS

NOT APPLICABLE

- ☐ NOT APPLICABLE

CATEGORY VI: GEOGRAPHIC AREA OF THE RESEARCH (Select 1 to 2)

- ☐ WORLDWIDE
- ☐ NORTH AMERICA
  - ☑ United States
    - ☐ Northeast US (CT, MA, ME, NH, NJ, NY, PA, RI, VT)
    - ☐ Northcentral US (IA, IL, IN, MI, MN, ND, NE, OH, SD, WI)
    - ☐ Northwest US (ID, MT, OR, WA, WY)
    - ☐ Southeast US (DC, DE, FL, GA, MD, NC, SC, WV, VA)
    - ☐ Southcentral US (AL, AR, KS, KY, LA, MO, MS, OK, TN, TX)
    - ☐ Southwest US (AZ, CA, CO, NM, NV, UT)
    - ☐ Alaska
    - ☐ Hawaii
    - ☐ Puerto Rico
  - ☐ Canada
  - ☐ Mexico
- ☐ CENTRAL AMERICA (Mainland)
  - ☐ Caribbean Islands
  - ☐ Bermuda/Bahamas
- ☐ SOUTH AMERICA
  - ☐ Eastern South America (Guyana, Fr. Guiana, Suriname, Brazil)
  - ☐ Northern South America (Colombia, Venezuela)
  - ☐ Southern South America (Chile, Argentina, Uruguay, Paraguay)
  - ☐ Western South America (Ecuador, Peru, Bolivia)
- ☐ EUROPE
  - ☐ Eastern Europe
  - ☐ Russia
  - ☐ Scandinavia
  - ☐ Western Europe
- ☐ ASIA
  - ☐ Central Asia
  - ☐ Far East
  - ☐ Middle East
  - ☐ Siberia
  - ☐ South Asia
  - ☐ Southeast Asia
- ☐ AFRICA
  - ☐ North Africa
  - ☐ African South of the Sahara
    - ☐ East Africa
    - ☐ Madagascar
    - ☐ South Africa
    - ☐ West Africa
- ☐ AUSTRALASIA
  - ☐ Australia
  - ☐ New Zealand
  - ☐ Pacific Islands
- ☐ ANTARCTICA
- ☐ ARCTIC
- ☐ ATLANTIC OCEAN
- ☐ PACIFIC OCEAN
- ☐ INDIAN OCEAN
- ☐ OTHER REGIONS (Not defined)
- ☐ NOT APPLICABLE

CATEGORY VII: CLASSIFICATION OF ORGANISMS (Select 1 to 4)

- ☐ VIRUSES
  - ☐ Bacterial
  - ☐ Plant
  - ☐ Animal
- ☐ PROKARYOTES
  - ☐ Archaea
  - ☐ Cyanobacteria
  - ☐ Bacteria
  - ☐ Noncultured Organisms
- ☐ PROTISTA (PROTOZOA)
  - ☐ Amoebae
  - ☐ Apicomplexa
  - ☐ Ciliophora
  - ☐ Flagellates
  - ☐ Foraminifera
  - ☐ Microspora
  - ☐ Radiolaria
- ☐ FUNGI
  - ☐ Ascomycota
  - ☐ Basidiomycota
  - ☐ Chytridiomycota
  - ☐ Mitosporic Fungi
  - ☐ Oomycota
  - ☐ Zygomycota
- ☐ LICHENS
- ☐ SLIME MOLDS
- ☐ ALGAE
  - ☐ Bacillariophyta (Diatoms)
  - ☐ Charophyta
  - ☐ Chlorophyta
  - ☐ Chrysophyta
  - ☐ Dinoflagellata
  - ☐ Euglenoids
  - ☐ Phaeophyta
  - ☐ Rhodophyta
- ☐ PLANTS
  - ☐ NON-VASCULAR PLANTS
    - ☐ BRYOPHYTA
      - ☐ Anthocerotae (Hornworts)
      - ☐ Hepaticae (Liverworts)
      - ☐ Musci (Mosses)
  - ☐ VASCULAR PLANTS
    - ☐ FERNS & FERN ALLIES
    - ☐ GYMNOSPERMS
      - ☐ Coniferales (Conifers)

- ☐ Cycadales (Cycads)
- ☐ Ginkgoales (Ginkgo)
- ☐ Gnetales (Gnetophytes)
- ☐ ANGIOSPERMS
- ☐ Monocots
- ☐ Arecaceae (Palmae)
- ☐ Cyperaceae
- ☐ Liliaceae
- ☐ Orchidaceae
- ☐ Poaceae (Graminae)
- ☐ Dicots
- ☐ Apiaceae (Umbelliferae)
- ☐ Asteraceae (Compositae)
- ☐ Brassicaceae (Cruciferae)
- ☐ Fabaceae (Leguminosae)
- ☐ Lamiaceae (Labiatae)
- ☐ Rosaceae
- ☐ Solanaceae

☐ ANIMALS

☑ INVERTEBRATES

- ☐ MESOZOA/PLACOZOA
- ☐ PORIFERA (Sponges)
- ☐ CNIDARIA
- ☐ Hydrozoa (Hydra, etc.)
- ☐ Scyphozoa (Jellyfish)
- ☐ Anthozoa (Corals, Sea Anemones)
- ☐ CTENOPHORA (Comb Jellies)
- ☐ PLATYHELMINTHES (Flatworms)
- ☐ Turbellaria (Planarians)
- ☐ Trematoda (Flukes)
- ☐ Cestoda (Tapeworms)
- ☐ Monogenea (Flukes)
- ☐ GNATHOSTOMULIDA
- ☐ NEMERTINEA (Rynchocoela) (Ribbon Worms)
- ☐ ENTOPROCTA (Bryozoa) (Plant-like Animals)
- ☐ ASCHELMINTHES
- ☐ Gastrotricha
- ☐ Kinorhyncha
- ☐ Loricifera
- ☐ Nematoda (Roundworms)
- ☐ Nematomorpha (Horsehair Worms)
- ☐ Rotifera (Rotatoria)
- ☐ ACANTHOCEPHALA (Spiny-headed Worms)
- ☐ PRIAPULOIDEA
- ☐ BRYOZOA (Ectoprocta) (Plant-like Animals)
- ☐ PHORONIDEA (Lophophorates)
- ☐ BRACHIOPODA (Lamp Shells)
- ☐ MOLLUSCA
- ☐ Monoplacophora
- ☐ Aplacophora (Solenogasters)
- ☐ Polyplacophora (Chitons)
- ☐ Scaphopoda (Tooth Shells)
- ☐ Gastropoda (Snails, Slugs, Limpets)
- ☐ Pelecypoda (Bivalvia) (Clams, Mussels, Oysters, Scallops)
- ☐ Cephalopoda (Squid, Octopus, Nautilus)
- ☐ ANNELIDA (Segmented Worms)
- ☐ Polychaeta (Parapodial Worms)
- ☐ Oligochaeta (Earthworms)
- ☐ Hirudinida (Leeches)
- ☐ POGONOPHORA (Beard Worms)
- ☐ SIPUNCULOIDEA (Peanut Worms)
- ☐ ECHIUROIDEA (Spoon Worms)
- ☐ ARTHROPODA
- ☐ Cheliceriformes
- ☐ Merostomata (Horseshoe Crabs)
- ☐ Pycnogonida (Sea Spiders)
- ☐ Scorpionida (Scorpions)
- ☐ Araneae (True Spiders)
- ☐ Pseudoscorpionida (Pseudoscorpions)
- ☐ Acarina (Free-living Mites)
- ☐ Parasitiformes (Parasitic Ticks & Mites)
- ☐ Crustacea
- ☐ Branchiopoda (Fairy Shrimp, Water Flea)
- ☐ Ostracoda (Sea Lice)
- ☐ Copepoda
- ☐ Cirripedia (Barnacles)
- ☐ Amphipoda (Skeleton Shrimp, Whale Lice, Freshwater Shrimp)
- ☐ Isopoda (Wood Lice, Pillbugs)
- ☐ Decapoda (Lobster, Crayfish, Crabs, Shrimp)
- ☐ Hexapoda (Insecta) (Insects)
- ☐ Apterygota (Springtails, Silverfish, etc.)
- ☐ Odonata (Dragonflies, Damselflies)
- ☐ Ephemeroptera (Mayflies)
- ☐ Orthoptera (Grasshoppers, Crickets)
- ☐ Dictyoptera (Cockroaches, Mantids, Phasmids)
- ☐ Isoptera (Termites)
- ☐ Plecoptera (Stoneflies)
- ☐ Phthiraptera (Mallophaga & Anoplura) (Lice)
- ☐ Hemiptera (including Heteroptera) (True Bugs)
- ☐ Homoptera (Cicadas, Scale Insects, Leafhoppers)
- ☐ Thysanoptera (Thrips)
- ☐ Neuroptera (Lacewings, Dobsonflies, Snakeflies)
- ☐ Trichoptera (Caddisflies)
- ☐ Lepidoptera (Moths, Butterflies)
- ☐ Diptera (Flies, Mosquitoes)
- ☐ Siphonaptera (Fleas)
- ☐ Coleoptera (Beetles)
- ☐ Hymenoptera (Ants, Bees, Wasps, Sawflies)
- ☐ Chilopoda (Centipedes)
- ☐ Diplopoda (Millipedes)
- ☐ Pauropoda
- ☐ Symphyta (Symphyla)
- ☐ PENTASTOMIDA (Linguatulida) (Tongue Worms)
- ☐ TARDIGRADA (Tardigrades, Water Bears)
- ☐ ONYCHOPHORA (Peripatus)
- ☐ CHAETOGNATHA (Arrow Worms)
- ☐ ECHINODERMATA
- ☐ Crinoidea (Sea Lilies, Feather Stars)
- ☐ Asteroidea (Starfish, Sea Stars)
- ☐ Ophiuroidea (Brittle Stars, Serpent Stars)
- ☐ Echinoidea (Sea Urchins, Sand Dollars)
- ☐ Holothuroidea (Sea Cucumbers)
- ☐ HEMICHORDATA (Acorn Worms, Pterobranchs)
- ☐ UROCHORDATA (Tunicata) (Tunicates, Sea Squirts, Salps, Ascideans)
- ☐ CEPHALOCHORDATA (Amphioxus/Lancelet)
- ☐ VERTEBRATES
- ☐ AGNATHA (Hagfish, Lamprey)
- ☐ FISHES
- ☐ Chondrichthyes (Cartilaginous Fishes) (Sharks, Rays, Ratfish)
- ☑ Osteichthyes (Bony Fishes)
- ☐ AMPHIBIA
- ☐ Anura (Frogs, Toads)
- ☐ Urodela (Salamanders, Newts)
- ☐ Gymnophiona (Apoda) (Caecilians)
- ☐ REPTILIA
- ☐ Chelonia (Turtles, Tortoises)
- ☐ Serpentes (Snakes)
- ☐ Sauria (Lizards)
- ☐ Crocodylia (Crocodilians)
- ☐ AVES (Birds)
- ☐ Passeriformes (Passerines)
- ☐ MAMMALIA
- ☐ Monotremata (Platypus, Echidna)
- ☐ Marsupalia (Marsupials)
- ☐ Eutheria (Placentals)
- ☐ Insectivora (Hedgehogs, Moles, Shrews, Tenrec, etc.)
- ☐ Chiroptera (Bats)
- ☐ Primates
- ☐ Humans
- ☐ Rodentia
- ☐ Lagomorphs (Rabbits, Hares, Pikas)
- ☐ Carnivora (Bears, Canids, Felids, Mustelids, Viverrids, Hyena, Procyonids)
- ☐ Perissodactyla (Odd-toed Ungulates) (Horses, Rhinos, Tapirs, etc.)

☐ Artiodactyla (Even-toed Ungulates) (Cattle, Sheep, Deer, Pigs, etc.) ☐ Marine Mammals (Seals, Walrus, Whales, Otters, Dolphins, Porpoises)	☐ TRANSGENIC ORGANISMS ☐ FOSSIL OR EXTINCT ORGANISMS	☐ NO ORGANISMS

CATEGORY VIII: MODEL ORGANISM (Select ONE)		
☑ NO MODEL ORGANISM MODEL ORGANISM (Choose from the list)	☐ Escherichia coli ☐ Mouse-Ear Cress (Arabidopsis thaliana)	☐ Fruitfly (Drosophila melanogaster)

PROJECT SUMMARY

Overview:

Coastal wetlands are highly productive systems that provide multiple important ecosystem functions including energy export to coastal food webs, nutrient cycling, and long-term carbon storage. Many of these functions are tied to decomposition rates, macrophyte abundance, microbial and invertebrate community composition, and soil organic matter accumulation rates. Sea level rise (SLR) will alter relative marsh elevation, rates of accretion, inundation regimes, and associated soil properties. These physical changes will have cascading consequences for wetland species and assemblages that may feedback on ecosystem function. However, predictions about how wetland ecosystem function will respond to SLR have focused almost exclusively on plant-sediment interactions rather than corresponding changes in food web processes. Given the coupling between the wetland physical environment, community structure, and ecosystem function, indirect effects of SLR on ecosystem services via changes in food webs could rival those of purely physical forcing. Thus, current models of wetland responses to SLR may provide incomplete predictions by ignoring food web processes. The proposed research will provide a new understanding of specific mechanisms of wetland ecology and food web structure that interact with SLR to control decomposition rates.

This research will evaluate the potential impacts of SLR on wetland ecosystem function: 1) increased decomposition rates due to increased inundation but predators decrease decomposition additively, or 2) decreased detritivore densities due to increased predation could in turn decrease litter decomposition rates. These aims will be addressed through a combination of manipulative field experiments utilizing marsh weirs to simulate SLR and surveys of marshes with different inundation regimes to evaluate processes at large spatial scales using a space-for-time substitution. This study is designed to fit a Structural Equation Model (SEM) testing the hypothesis that inundation time influences marsh functioning via changes in food-web processes. Using different geographic locales on three coasts allows us to model responses among different microclimatic categories of sediment supply, rainfall, and temperature.

Intellectual Merit :

In coastal wetlands, increased inundation has been shown to lead to increased foraging time for small mesopredators with impacts to wetland ecosystem function: 1) decreased herbivore and detritivore densities could decrease litter decomposition as well as 2) altered secondary production and carbon transport to coastal food webs. Current SLR models do not address these concerns leading to less accurate predictions about how coastal wetlands and their functions will respond to SLR. These approaches will transform understanding of SLR impacts. By using novel techniques in different climate regimes, it will be possible to make predictions that are relevant on a regional scale and that allow a better understand the mechanisms behind observed changes in ecosystem processes. There is a surprisingly poor mechanistic understanding of how climate change will influence whole coastal wetland systems, particularly over short and medium time scales. This project will help ensure long-term stability of wetland ecosystems and to describe the potential consequences of climate change.

Broader Impacts :

The proposed research will inform managers, researchers, and the public as well as students. To reach managers and researchers, SEM workshops will be held to share data summaries and reports through individual field site webpages and newsletters. In addition, take home messages from experiments as well as photographs will be shared via existing outreach exhibits or signage at field sites and an existing blog (http://marshlife.org). Web tools that will use SEMs as simulation models will allow users to choose different scenarios of SLR and get an output about changes to ecosystem functions. Finally, funding for several graduate students will increase support for the training of graduate-level biologists

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For font size and page formatting specifications, see GPG section II.B.2.

*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.

Personnel

Lead investigator for each collaborating institution

(1) Christine Whitcraft (PI), California State University, Long Beach
    - Whitcraft will be the lead PI on this proposal, responsible for project coordination with all collaborators and experimental setup and data collection for West Coast field sites.
(2) Jarrett Byrnes (co-PI), University of Massachusetts Boston
    - Byrnes will contribute to project implementation at PIE and conduct the SEM work.
(3) Matt Ferner (co-PI), SF State University - Romberg Tiburon Center for Environmental Studies
    - Ferner will contribute to project planning, interpretation of data and modeling results, project outreach, and data collection for San Francisco Bay field sites.
(4) David Samuel Johnson (co-PI), Virginia Institute of Marine Sciences
    - Johnson will contribute to project planning, interpretation of data and modeling results, and experimental setup and data collection for Chesapeake field sites.
(5) James Nelson (co-PI), University of Louisiana
    - Nelson will contribute to project planning, interpretation of data and modeling results (specifically SIA and network modeling), and field work for Louisiana.

Preliminary proposal: Sea-level rise alters salt marsh ecosystem function via changes in food web structure

Conceptual Framework and Background. Coastal wetlands are highly productive systems that provide multiple key ecosystem functions including energy export to coastal food webs, nutrient cycling, and long-term carbon storage (Minello et al. 2003, Mitsch and Gosselink 2007, Nelson et al. 2013). These functions are driven by decomposition rate, macrophyte abundance, community composition from microbes to mesopredators, and soil organic matter accumulation rates (Newell 1993, Megonigal et al. 2004), all of which will be altered by sea level rise (SLR). Yet current SLR models typically only address changes in marshes from loss of physical area (i.e., "bathtub" models). Only recently have we begun to incorporate the role of vegetation in maintaining marsh elevation (e.g. Kirwan and Megonigal 2013 & references therein). **In order to describe the net effects of SLR on long-term wetland stability, we need a deeper understanding of how ecological interactions (e.g., rates of herbivory and predation) interact with SLR to control decomposition, a function that regulates a marsh's ability to keep up with rising waters.**

We propose to do this by targeting the wide-range of possible climate-change mediated increases in access time by aquatic predators that can have profound effects on tidal ecosystems (Harley 2011) and by examining their cascading effect on marsh plant litter decomposition. In coastal wetlands, increased inundation time from SLR (referred to as "inundation" for the remainder of the proposal) leads to increased foraging time for small mesopredators (i.e., crabs & small fish) (Nelson et al. 2015), which could decrease detritivore densities, lowering litter decomposition rates (Johnson et al. 2009, Whitcraft et al. unpubl. data, Johnson et al. unpubl. data). There is considerable variation in the response of litter decomposition to increased inundation with no effect (Valiela et al. 1985) to increased decomposition (Riece and Stiven 1983). These differences may be due to biotic interactions such as the detritivore density. Thus, increased decomposition rates from inundation (Riece and Stiven 1983) may be offset by decreased decomposition driven by changes in predation (Figs. 1, 2). These relationships might change in magnitude with local climatic factors (e.g. rainfall, temperature, sediment supply) (Osland et al. 2016). Yet current models do not address these concerns, leading to less accurate predictions of the fate of coastal wetlands.

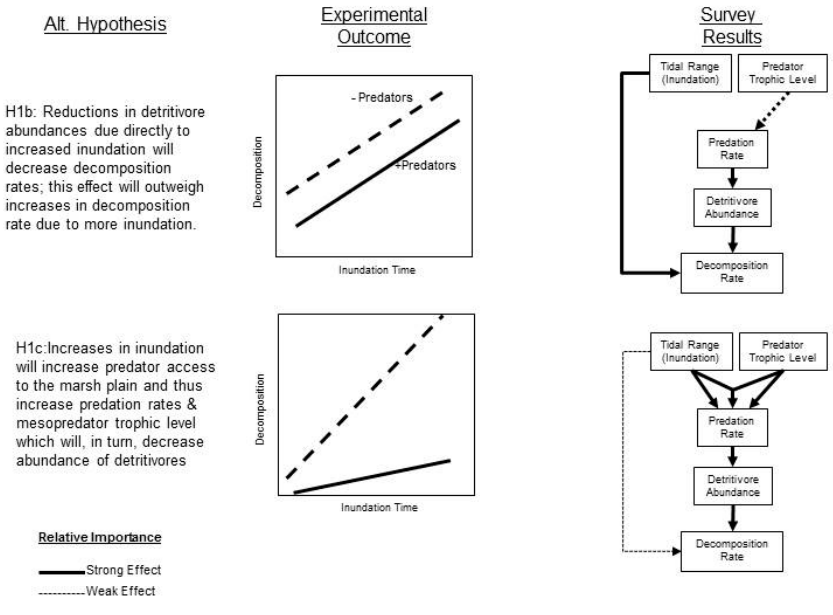

Figure 1. Model illustrating H1: SLR will alter salt marsh ecosystem processes via shifts in food webs.

Specific Aims: **Our primary objective is to improve our understanding of how SLR will affect coastal wetland function via changes in food web structure.** We will evaluate 1) the direct and indirect effects of inundation (as a proxy for future SLR) on wetland decomposition processes as mediated by

predation and 2) the relative importance of local ecology in mediating SLR effects on the dynamics of food web structure and ecosystem function. We will address these aims through a combination of manipulative field experiments, observational surveys, and structural equation modeling. The field experiments will utilize marsh boxes (discussed below) to simulate SLR and observational surveys of marshes with different key climatic parameters to increase our ability to find generalizable effects of changing inundation time on wetland ecosystems.

H1: SLR will alter salt marsh ecosystem processes – predation, decomposition via shifts in food web structure and function (Fig. 1).

H1a: SLR will increase the interaction strength between mesopredators and their prey.

H1b: Reductions in detritivore abundances due to increased inundation will reduce decomposition rates; this effect will outweigh increases in decomposition rate due to increased inundation.

H1c: Increases in inundation will increase predator access to the marsh and increase predation rates and mesopredator trophic level. This will, in turn, decrease detritivore abundance.

H1d: Resistance of decomposer communities to change will vary between geographic locations (within and between regions) as well as between dominant plant types within a marsh.

H2: The relationship between inundation, decomposition and predation will be consistent among sites although the magnitude of decomposition will be affected by environmental covariates as measured across six chosen sites (Fig. 2).

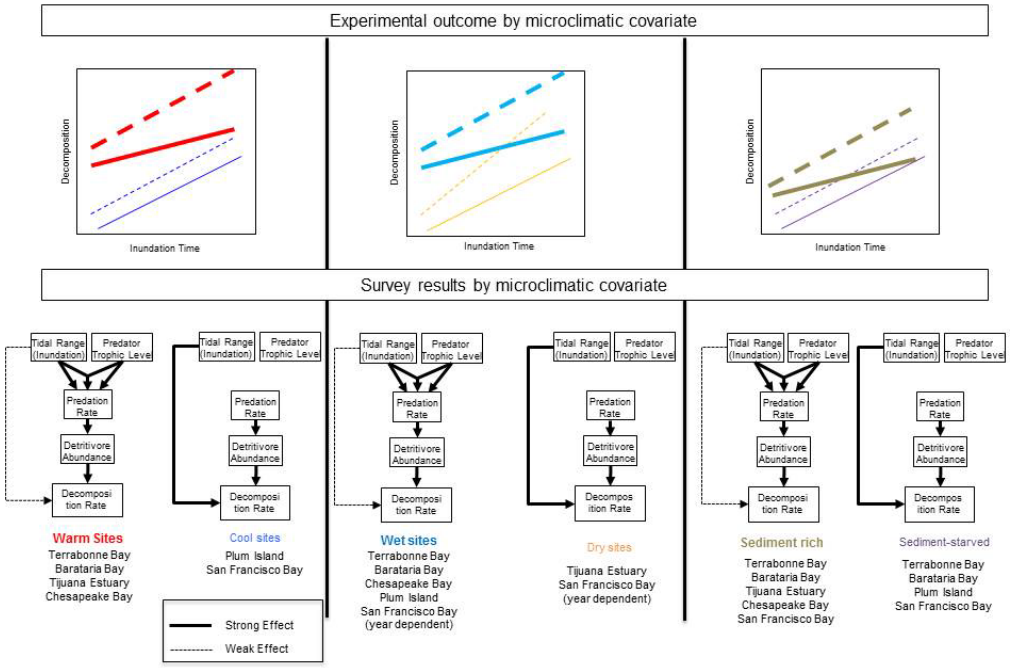

Figure 2. Specific models related to H2 as measured across six chosen sites (listed below each microclimate category).

Research Approach. Site selection (Fall 2017 – Summer 2018): We have chosen marine-dominated sites representing a range of inundation regimes (Plum Island Estuary, Chesapeake Bay, San Francisco Bay, Tijuana Estuary, Barataria Bay, Terrabonne Bay). These six estuaries on three coasts were chosen for differences in sediment supply, rainfall, and temperature (Osland et al. 2016) (Fig. 2). Our experimental design maximizes variation in food web processes, allowing us to investigate the generality of SLR's effect on ecosystem function as mediated by food web structure.

Manipulative Experiments (Summer/Fall 2018): We will use a series of manipulative experiments to test key mechanistic hypotheses from H1 and H2. Experiments will use marsh boxes (Cherry

et al. 2014, Whitcraft et al. unpublished) in combination with other treatments to assess the causal pathways corresponding to our hypotheses. Throughout 2015, we have successfully tested the marsh boxes at two sites. Filled with an intact sediment core and with valves to control flow, these PVC marsh boxes allow us to simulate increased inundation. The experiments below use three drainage times: a control box in which the box drains at the same rate as the receding tide, a ~1.5 hour box, in which the sediment will experience moderately increased inundation, and a 3+ hour box in which the sediment will experience highly increased inundation. We will place these experimental setups on the vegetation transects established in the observational surveys (discussed below) at a subset of sites. While these are the desired treatments, each box will have a low cost open wave height logger developed in Co-PI Byrnes's lab (Miller et al. unpub. data) to enable exact inundation measurements used as a continuous variable.

I) SLR and Predation – To test H1a&b that SLR will increase the interaction strength between predators and their prey, we will place six replicate predator-inclusion or exclusion boxes for each inundation time treatment at all sites. Cages will be stocked with five pieces of dried squid as a standardized predation assay. Inclusions will be stocked with a small fish (e.g., mummichogs). Food will be scored as fraction of samples missing after one tide cycle. We will repeat this experiment for five sequential tide cycles (total n=180/site). Data will be analyzed using logistic regression with inundation time, predator inclusion, environmental covariates, and all interactions as predictors. Depending on whether covariates have an additive or interactive effect on the predator-inundation interaction allows us to test H2. We predict no interaction of covariance with the predator-inundation time effect, although there will be site-level differences in predation.

II) SLR, Detritivory, and Predation - To separate the effects of predation and the direct effects of inundation (i.e., flooding stress) on the detritivore community and thus test the path involved in H1b and H1c, we will conduct a one-month experiment replicated three times using predator inclusion or exclusion boxes (total n=180/site) with mesh tops allowing detritivore access. In each box, we will place large-mesh litterbags, full of plant and algal material. We will model final litter abundance using a generalized linear models (GLM) with a log link and Gamma error and decomposer community using tests of multivariate abundances based on GLMs (Wang et al. 2012). Both analyses will include environmental covariates to evaluate H2.

III) SLR and Decomposition: To look at the direct effect of increased inundation on decomposition and thus whether results in the above trials match H1c&d, or if the entire effect is direct, we will add small-mesh (50 micron) litterbags that exclude detritivores in to the exclusion boxes in experiment II. We will model change in decomposition rate as above.

Observational surveys (Summer/Fall 2019 at peak growth and decomposition time): While our experiments examine causal links between inundation time, rates of predation, and detritivory, they cannot evaluate the relative importance of direct versus indirect effects of SLR on these ecosystem processes, nor test how SLR might affect diet shifts leading to larger higher proportions of detritivores in mesopredator diets. These questions can only be answered by looking at patterns at larger spatio-temporal scales; thus we will use Structural Equation Modeling (SEM) to test our conceptual model of how climate change and SLR affect coastal wetlands.

To parameterize our model, we will survey 50 locations of varying inundation regimes at each site (total n = 300 observations). Each location will involve transects that cross an inundation (and elevation) gradient from low (-0.45 to 0.3 m MLLW), through middle (0.3 -1.5 m) to high (1.5 - 2.1 m) marsh (Ricketts et al. 1992) matching (and at National Estuarine Research Reserves sites utilizing) the existing NERR vegetation sampling protocol (SAV Emergent Biomonitoring Comm. 2009). Transect lines will be placed at least 10m apart and chosen in a stratified random manner within suitable habitat areas. Elevations will be taken with a RTK GPS to normalize sites to local tidal range (e.g. Swanson et al. 2013), enabling accurate comparison among sites and coasts.

Within each transect, we will measure: (1) Inundation regime. Flooding frequency, duration and timing with a HOBO U20 Water Level Data Logger placed in plots in each elevation zone. (2)

Abiotic parameters will include air and soil temperature, humidity, soil water content and pH, and redox. (3) Detritivorous surface invertebrates with passive collectors (pit traps/litterbags) in the same quadrats. (4) Aquatic predators using minnow/crab traps deployed for 24 h. (5) Predation rates using standardized assays of $4cm^2$ pieces of dried squid secured to rods in the marsh along an inundation gradient (Duffy et al. 2015). The bait will be checked and replaced as needed for five days, allowing us to calculate a daily predation rate across marsh elevations. (6) Decomposition rates using 6 litterbags deployed on the sediment surface in the summer seasons and retrieved at 2 weeks, 1, 2, and 6 mos., and 1 year. We will calculate decay constants for each litterbag assuming a simple negative exponential decay (Olson, 1963). (7) Mesopredator Trophic Level - Stable isotope samples and analysis of carbon, nitrogen, and sulfur will be conducted on suitable fish species (i.e., marsh obligates - killifish) and their associated prey to reveal patterns of feeding integrated over weeks to months. We will use hypervolumes (Blonder et al. 2014).calculated from trophic niche areas, production rates, and rates of resource utilization representing the major functions we hypothesize are affected by increased inundation time.

Modeling (ongoing from Winter 2018 – Summer 2019): With our observational data, we will use Structural Equation Modeling (Bollen 1989, Grace et al. 2012) to model the relationship between inundation, ecological process rates (e.g., predation), consumer trophic level, abundance of detritivores, and decomposition rates (Fig. 1,2). **Using SEM, we can simultaneously assess whether each link is different from zero as well as compare alternate models that add or drop paths to explore multiple hypotheses (e.g. exposure time does not alter decomposition rates directly).** SEMs will be fit using equation-level estimation (Grace et al. 2012, Lefcheck in press) with GLMs (mixed) to accommodate the nonlinearity of the model's inundation by predator trophic level interaction non-normality of much of the data, and site-level random effects. We will evaluate generality by assessing whether path coefficients (slopes) or intercepts of pieces of the model vary due to environmental covariates (warm v. cool, wet v. dry, low v. high sediment load) using multigroup analysis (Grace 2006).

Our model tests the direct (physical or microbial processes) versus indirect effects (shifts in predation, predator trophic level and decomposer abundance) of changes in inundation time, a proxy for SLR. We include a moderated nonlinear effect between inundation time and the trophic level of fish, one of the primary consumers of marsh detritivores. If consumers have a higher trophic level AND inundation time is longer, this should have a synergistic effect on predation. We also include a path from inundation time to trophic level as increased exposure time means increased access time for mesoconsumers, likely shifting their diet towards more animal prey.

Broader Impacts. We will integrate the proposed research into education for managers, landowners, researchers, and the public as well as upper-division undergraduates and M.S.- and PhD-level students. To reach managers and researchers, we will conduct a SEM workshop at the two NERR sites (CB and SF). Data summaries, reports and presentations produced from this research will be disseminated through individual field site webpages and a range of publications with varied audiences (e.g. newsletters for friends groups, estuary-wide updates). In addition to utilizing the existing outreach programs at field locations, we will assist with designs of interpretive exhibits that incorporate SLR information. In parallel, photographs and field anecdotes will be shared via an existing blog (http://marshlife.org) and on Twitter using the popular #marshlife, creating an interactive ways to learn about marsh ecology as well as SLR. We will also make use of R-based web applications via the Shiny package. These web tools will use our SEMs as simulation models allowing users to choose different scenarios of SLR, and see projected changes to ecosystem functions (e.g. decomposition rate). Finally, the proposed research will be incorporated into education modules for classroom instruction at all involved institutions. Several of the institutions serve a large percentage of underrepresented groups (e.g, ULL, UMASS-Boston), and CSU Long Beach is designated as Hispanic Serving Institution and NSF-RUI, ensuring that this research reaches a broader scientific audience. In addition, we will solicit interns and graduate students from institutions such as Historically Black Universities (e.g., Hampton University) and list-serves such as the Society for Advancement of Chicanos/Hispanics and Native Americans in Science (www.sacnas.org).

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CHRISTINE WHITCRAFT

PROFESSIONAL PREPARATION

Williams College, Williamstown, MA	Biology	B.A. (Honors), 1999
Scripps Institution of Oceanography, UCSD.	Biological Oceanography	Ph.D., 2007
San Francisco State University, CA	Biology	Postdoc, 2007-2008

APPOINTMENTS

2008- 2014 Assistant professor, Department of Biological Sciences, California State University, Long Beach

2014 – present Associate professor, Department of Biological Sciences, California State University, Long Beach

FIVE RECENT AND RELEVANT PRODUCTS (undergraduate indicated by*, graduate indicated by #)

(1) Nordstrom, M., C.A. Currin, T.S. Talley, **C.R. Whitcraft**, and L.A. Levin. 2014. Trophic succession in a developing salt marsh. *MEPS* 500:43 – 55.

(2) Freedman, R#, **C.R. Whitcraft**, and C. Lowe. 2015. Connectivity and movements of juvenile predatory fishes between discrete restored estuaries in southern CA. *MEPS*

(3) Nordstrom. M.C., A. W. J. Demopoulos, **C. R. Whitcraft**, A. Rismondo, P. McMillan, J. P. Gonzalez and L. A. Levin. 2015. Food web heterogeneity and succession in created saltmarshes. *Journal of Applied Ecology* 52: 1343–1354.

(4) Johnston, K., I. Medel, S. Anderson, E. Stein, **C. Whitcraft**, and J. Crooks. 2015. California Estuarine Wetland Monitoring Manual (Level 3). Prepared by The Bay Foundation for the United States Environmental Protection Agency. 297 pages.

(5) Freedman, R*., E. Holcumbe*, C. R. Whitcraft, B. Allen, C. Espasandin*, and C. Lowe. Accepted pending revision. Using Fish Movements and Habitat Utilization as a Functional Metric of Estuarine Restoration. Marine and Coastal Fisheries

FIVE OTHER RELEVANT PRODUCTS

(1) **Whitcraft, C.R.,** B.J. Grewell, and P. Baye. 2011. Estuarine vegetation at Rush Ranch, San Francisco Bay National Estuarine Research Reserve, California. *San Francisco Estuary and Watershed Science* (Invited article) 20:35-45.

(2) Wigginton, R.#, J. Pearson J*, and **C.R. Whitcraft.** 2014. Invasive plant ecosystem engineer facilitates community and trophic level alteration for brackish marsh invertebrates. *Ecosphere* 5(4): 1-17.

(3) Darjany, L#., **C.R. Whitcraft** and J. Dillon. 2014. Lignocellulose-responsive bacteria in a southern California salt marsh identified by stable isotope probing. *Frontiers in Aquatic Microbiology* 5: 1 – 9.

(4) Jackson, K#., **C.R. Whitcraft** and J. Dillon. 2014. Diversity and activity of sulfate-reducing bacteria in and around a salt pan in a southern California coastal wetland. *Wetlands* 34:969–977.

(5) Barton, M.L#., I. D. Medel, K. K. Johnston, and **C. R. Whitcraft**. in press. Seed Collection and Germination Strategies for Common Wetland and Coastal Sage Scrub Species in Southern California. Bulletin of the Southern California Academy of Sciences

SYNERGISTIC ACTIVITIES

1) grant panels: Oregon State Seagrant Review; National Academy of Sciences

2) reviewer for *Estuaries and Coasts, Marine Ecology, Estuarine, Coastal and Shelf Science, MEPS, Journal of Applied Ecology, Geoderma, Ecology, Plant Ecology, Wetland Ecology and Management, Southern CA Academy of Sciences, PNAS, PLoSOne*

3) Board member and President Friends of Colorado Lagoon (October 2008 – present), Member Sigma Xi Research Society (1999-present), Science Advisory Board member Palos Verde Peninsula Land Conservancy (2009 – present), Board member Bolsa Chica Conservancy (2010 – present), member Technical Advisory Council Los Cerritos Wetlands (2012 – present), advisory board Santa Monica Bay Restoration Council (2012 – present), Chair Southern CA Wetland Recovery Project Science Advisory Panel, President CA Estuarine Research Society (member since 2008, Pres 2015 - 17)

COLLABORATORS & OTHER AFFILIATIONS

Collaborators and Co-editors

Jeff Crooks (Tijuana Estuary NERR), John Gaskin (USDA), Brenda Grewell (UC Davis, USDA), Lisa Levin (UCSD – SIO), Mark Page (UCSB), Steve Schroeter (UCSB), Drew Talley (University of San Diego), Theresa Talley (UC Davis), Bengt Allen (CSULB), Jesse Dillon (CSULB), Tomoko Komada (SFSU), Chris Lowe (CSULB), Jason Keller (Chapman University), Hildie Spautz (CA Department of Fish and Wildlife), Letitia Grainer (SFEI)

Graduate and Postdoctoral Advisors

Lisa Levin, Ph.D., Scripps Institution of Oceanography (graduate)

Drew Talley, Ph.D., SF Bay NERR (postdoctoral)

Thesis Advisor

E. Blair. Winter 2012. "Evaluating Restoration Planting Regimes in a Newly Restored Southern California Salt Marsh"

R. Wigginton. Summer 2012. "Assessing the impacts of *Lepidium latifolium* on food web structure for Suisun song sparrows in a brackish marsh"

T. Asef. Winter 2013. "Associating genetically diverse tamaris invaders with their impacts in a salt marsh ecosystem"

E. Fox. Winter 2013. "Assessing structural and functional recovery in a restored southern California salt marsh: fish community composition and the diet of juvenile halibut"

A. Shippey. Summer 2014. "Effect of Increased Temperature and Altered Precipitation on Structure and Function of a Restored Southern California Salt Marsh"

M. Fitzgerald. Winter 2015. "The relationship between biodiversity and ecosystem function in a coastal wetland"

T. Champieux. Summer 2015. "Impacts of a constructed oyster bed on infaunal invertebrate communities in Jack Dunster Marine Reserve"

S. Sun. Summer 2015. "Determining ecosystem functions of brackish versus salt marsh in the Huntington Beach Wetlands"

Total number of graduate students advised: 13 (8 graduates, 5 currently in M.S. program)
Total number of postgraduate-scholars sponsored: 0
Total number of undergraduate research students advised (last 5 yrs): 32
Total undergraduate presentations at national and regional meetings (last 5 yrs): 7

Jarrett E. K. Byrnes

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Professional Preparation

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.

Appointments

2012 – Present Assistant Professor, University of Massachusetts Boston

List of Five Relevant Products

1. Byrnes, J. E. K., L. Gamfeldt, F. Isbell, J. S. Lefcheck, J. N. Griffin, A. Hector, B. J. Cardinale, D. U. Hooper, L. E. Dee, and J. E. Duffy. 2014. Investigating the relationship between biodiversity and ecosystem multifunctionality: Challenges and solutions. *Methods in Ecology and Evolution* 5: 111-124. [doi][R package]

2. Stewart, J.S**.** Hazen, E.L., Bograd, S.J., **Byrnes, J.E.K.**, Foley, D.G., Gilly, W.F., Robison, B.H., Field, J.C. 2014. Combined climate and prey-mediated range expansion of Humboldt squid (*Dosidicus gigas*), a large marine predator in the California Current System. Global Change Biology. 20:1832-1843. [doi] *This is a product of my SEM class.*

3. O'Connor, M.I. and **Byrnes, J. E.K.** Biodiversity and Ecosystem Function in Marine Ecosystems. 2014. In *Marine Community Ecology and Conservation*, M. Bertness, J. Stachowicz, and B. Silliman, eds. Sinauer. Sunderland, MA. pg.109-130.

4. Fox, J., **Byrnes, J.**, Boker, S., and Neale, M. 2012. Structural equation modeling in R with the **sem** and **OpenMX** packages. In *Handbook of Structural Equation Modeling*. Rick H. Hoyle, David Kaplan, George Marcoulides, and Steve West, eds.

5. 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]

List of Five Additional Products

1. Byrnes J.E., Johnson L.E., Connell S.D. et al. 2014. The sea urchin – the ultimate herbivore and biogeographic variability in its ability to deforest kelp ecosystems. PeerJ PrePrints, 1, e174v1. [doi]

2. Gamfeldt, L., J. S. Lefcheck, **J. E. K. Byrnes**, B. J. Cardinale, J. E. Duffy, and J. N. Griffin. 2014. Marine biodiversity and ecosystem functioning: what's known and what's next? Oikos. [doi]

3. 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]

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

5. Byrnes, J.E., Reynolds, P.L., Stachowicz, J.J. 2007. Invasions and extinctions reshape coastal marine food webs. *PLoS One*. 2: e295. [doi]

List of Five Synergistic Activities

1. Contributing Developer to *lavaan*, *sem*, and *semTools*- Libraries for the analysis of Structural Equation Models in R http://lavaan.org, https://github.com/simsem/semTools/wiki

2. Floating Forests. http://floatingforests.org. A massive citizen science project in collaboration with Zooniverse, the citizen science arm of the Adler Planetarium, to look at change in kelp from satellite records.

3. Marshlife.org http://marshlife.org - A blog part of a MIT SeaGrant on salt marsh food web structure where researchers tell stories of life in the field and current advances in salt marsh research.

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

5. SciFund Challenge, co-founder and board president. SciFund Challenge is a nonprofit organization that empowers scientists to shrink the gap between science and society. We train scientists how to connect to the public, back scientists in their outreach, and crowdfund to support research.

Thesis Advisor: John J. Stachowicz, UC Davis.

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

BIOGRAPHICAL SKETCH

Matthew C. Ferner
Romberg Tiburon Center for Environmental Studies
San Francisco State University
3152 Paradise Drive, Tiburon, CA 94920-1205
Phone: (415) 338-3724
Email: mferner@sfsu.edu

Professional Preparation

University of Louisville	Biology	B. A.	1993
University of Washington	Oceanography	M. Sc.	1996
Georgia Institute of Technology	Applied Biology	Ph. D.	2006
University of California-Davis	Evolution & Ecology	Postdoctoral training	2008

Appointments

2008-present Adjunct Assistant Professor, School of Biology, San Francisco State University
2008-present Research Coordinator, San Francisco Bay National Estuarine Research Reserve

Research Interests

animal behavior; benthic ecology; biomechanics; climate change; hydrodynamics; larval settlement; marsh sustainability; sediment dynamics; sensory ecology; trophic interactions

List of Five Relevant Products

Weissburg MJ, Smee DL, Ferner MC (2014) The sensory ecology of non-consumptive predator effects. *American Naturalist* 184: 141-157.

Ferner MC (2012) Research reserves as a model for conservation science and management of tidal marshes. In *Ecology, conservation and restoration of tidal marshes: the San Francisco Estuary* (A. Palaima, Ed.). Univ. of California Press, Berkeley, California.

Smee DL, Ferner MC, Weissburg MJ (2010) Hydrodynamic sensory stressors produce nonlinear predation patterns. *Ecology* 91: 1391-1400.

Ferner MC, Smee DL, Weissburg MJ (2009) Habitat complexity alters lethal and nonlethal olfactory interactions between predators and prey. *Marine Ecology Progress Series* 374: 13-22.

Smee DL, Ferner MC, Weissburg MJ (2008) Alteration of sensory abilities regulates the spatial scale of nonlethal predator effects. *Oecologia* 156: 399-409.

List of Five Additional Products

Cheng BS, Bible JM, Chang AL, Ferner MC, Wasson K, Zabin CJ, Latta M, Deck AK, Todgham A, Grosholz ED (2015) Testing local and global stressor impacts on a coastal foundation species using an ecologically realistic framework. *Global Change Biology* doi: 10.1111/gcb.12895

Gaylord B, Hodin J, Ferner MC (2013) Turbulent shear spurs settlement in larval sea urchins. *Proceedings of the National Academy of Sciences* 110: 6901-6906.

Ferner MC, Smee DL, Chang YP (2005) Cannibalistic crabs respond to the scent of injured conspecifics: danger or dinner? *Marine Ecology Progress Series* 300: 193-200.

Ferner MC, Weissburg MJ (2005) Slow-moving predatory gastropods track prey odors in fast

and turbulent flow. *Journal of Experimental Biology* 208: 809-819.
Ferner MC, Jumars PA (1999) Responses of spionid polychaetes to dissolved chemical cues. *Journal of Experimental Marine Biology and Ecology* 236: 89-106.

Awards (Last Five Years)

2014 National Aeronautics and Space Administration ($44,455)
Linking satellite and soil data to validate coastal wetland "blue carbon" inventories: upscaled support for developing MRV and REDD+ protocols

2014 National Estuarine Research Reserve System Science Collaborative ($24,100)
Utilizing NERRS Sentinel Site Data For Improved Management of Tidal Marshes

2014 San Francisco Bay Regional Water Quality Control Board ($28,276)
Application of Numeric Nutrient Endpoint Methodology to Evaluate the Potential for Impairment in Tidal Waters of Suisun Marsh

2014 National Science Foundation, Biological Oceanography ($24,034)
Collaborative Research: Turbulence-spurred settlement: Deciphering a newly recognized class of larval response

2014 United States Geological Survey, Menlo Park ($24,402)
Forecasting Coastal Habitat Distributions

2013 National Estuarine Research Reserve System Science Collaborative ($379,793)
Improving management outcomes of sea-level rise modeling through standardized sampling of a key model input: total suspended solids above tidal marshes

2011 National Estuarine Research Reserve System Science Collaborative ($908,006)
Managing for resilience in the face of climate change: a scientific approach to targeted oyster restoration in San Francisco Bay and Elkhorn Slough, California

Synergistic Activities

Summer Session Instructor for *Mechanical Design in Organisms* (EVE106), *Marine Environmental Issues* (EVE111), and *Coastal Marine Research* (BIS124), University of California-Davis, Bodega Marine Laboratory (2010, 2013)

Graduate committee member for students from San Francisco State University (2009-present) and University of California-Berkeley (2010-2012)

Resource scientist for Teacher's Workshop on *Estuary Ecology* run by San Francisco Bay National Estuarine Research Reserve (2006, 2011)

Member of the NERRS' *Habitat Mapping and Change Technical Committee* (2010-2015) and the NERR *System-Wide Monitoring Program Guidance Committee* (2010-present)

Reviewer of proposals for California Sea Grant, CSU-COAST, National Estuarine Research Reserve System Graduate Research Fellowship Program, National Science Foundation

Reviewer of manuscripts for *Aquatic Biology, Journal of Experimental Biology*, *Journal of Experimental Marine Biology & Ecology*, *Marine Ecology & Progress Series*, *Oecologia*

DAVID SAMUEL JOHNSON

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Gloucester Point, VA 23062

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PROFESSIONAL PREPARATION

University of Central Arkansas, Conway, AR.	Environ. Science	B.S, 2003
Louisiana State University, Baton Rouge, LA.	Biological Science	Ph.D., 2008
The Ecosystems Center, MBL, Woods Hole, MA.	Post-doc	2009-2010

APPOINTMENTS

Department of Biology, VIMS, Gloucester, VA	Asst. Professor	2015 – present
The Ecosystems Center, MBL, Woods Hole, MA.	Asst. Res. Scientist	2013 – present
Department of Biology, Sewanee, TN	Visiting Asst. Prof	2012
The Ecosystems Center, MBL, Woods Hole, MA.	Research Associate	2010-2013

FIVE RECENT AND RELEVANT PRODUCTS

1. Deegan, L. A. **D. S. Johnson**, R. S. Warren, B. J. Peterson, J. W. Fleeger, S. Fagherazzi, W. Wollheim. 2012. Coastal eutrophication as a driver of salt marsh loss. *Nature* 490:388-392. Selected as an outstanding paper by the Faculty of 1000 and featured in NSF News (http://www.nsf.gov/news/news_summ.jsp?cntn_id=125739).

2. **Johnson, D.S.**, R.S. Warren, L.A. Deegan, T. Mozdzer. *In press*. Salt marsh plant responses to tidally delivered nutrients. *Ecological Applications*.

3. **Johnson, D.S.** and M. I. Short. 2013. Chronic nutrient enrichment increases the density and biomass of the eastern mudsnail, *Nassarius obsoletus*. *Estuaries and Coasts* 36: 28-35.

4. **Johnson, D.S.** 2011. High-marsh invertebrate communities are susceptible to eutrophication. *Marine Ecology Progress Series* 438:143-152.

5. **Johnson, D.S.**, J.W. Fleeger, and L.A. Deegan. 2009. Large-scale manipulations reveal top-down and bottom-up controls interact to alter habitat utilization by saltmarsh fauna. *Marine Ecology Progress Series* 377: 33-41.

FIVE OTHER RELEVANT PRODUCTS

1. Fagherazzi S., D.M. FitzGerald D.M., R.W Fulweiler, Z. Hughes, P.L. Wiberg, K.J. McGlathery, J.T. Morris, T.J. Tolhurst, L.A. Deegan, and **D.S. Johnson**. 2013. Ecogeomorphology of Tidal Flats. In: John F. Shroder (ed.) *Treatise on Geomorphology*, Volume 12: 201-220.

2. Fleeger, J.W., **D.S. Johnson**, K. A. Galván, and L. A. Deegan. 2008. Top-down and bottom-up control of infauna varies across the saltmarsh landscape. *Journal of Experimental Marine Biology and Ecology* 357:20-34.

3. **Johnson, D.S**., and J.W. Fleeger. 2009. The effect of large-scale nutrient enrichment and predator reduction on macroinfauna in a Massachusetts salt marsh: a four-year study. *Journal of Experimental Marine Biology and Ecology* 373:35-44.

4. **Johnson, D.S**., and B. J. Jessen. 2008. Do spur-throated grasshoppers, *Melanoplus* spp. (Orthoptera: Acrididae), exert top-down control on smooth cordgrass *Spartina alterniflora* in northern New England? *Estuaries and Coasts* 31:912-919.

5. Fagherazzi S., D.M. FitzGerald D.M., R.W Fulweiler, Z. Hughes, P.L. Wiberg, K.J. McGlathery, J.T. Morris, T.J. Tolhurst, L.A. Deegan, and **D.S. Johnson**. 2013. Ecogeomorphology of Tidal Flats. In: John F. Shroder (ed.) *Treatise on Geomorphology*, Volume 12: 201-220.

SYNERGISTIC ACTIVITIES

Workshops and sessions:

1. Session organizer for Enriching our coasts: The past, present, and future of fertilization studies as a management guide, Coastal and Estuarine Research Federation, San Diego, CA.

2. Session organizer for, Special Session on Estuarine Ecology, North American Benthological Society meeting, Providence, RI.

3. Participant to the Climate Ready Estuaries working group, Sponsored by the Massachusetts Bay Program and Environmental Protection Agency.

Outreach activities:
Social Media:
1. Personal blog on science and writing, www.manayunkia.com
2. Project blog on nutrient loading on salt marshes including invertebrate and geomorphic responses, www.tideproject.wordpress.com.

Traditional media:
1. Interviews in newspapers (*Daily News*, *Boston Globe*, *Cape Cod Times*).
2. Popular science essays/articles (*Daily News*, *Science*).
2. Invited lecturer at Environmental Protection Agency, U. of Rhode Island, Sewanee: University of the South, Roanoke College, U. of North Carolina Wilmington, Chesapeake Biological Laboratory, U. of South Carolina, and Amherst College

Mentoring: 28 Undergraduate and graduate students (including 7 undergraduate theses). Five undergraduate mentees are co-authors on publications (e.g., Johnson and Short 2013 from above)

Reviewing activities: Proposals: NSF Science, Engineering and Education for Sustainability (SEES), NSF Graduate Research Fellowship Program, Maine Sea Grant, Maryland Sea Grant. Manuscripts (40+): Including *Global Change Biology; Ecology; Ecology Letters; Ecological Applications; Ecological Monographs; Marine Ecology Progress Series; Journal of Experimental Marine Biology and Ecology; Estuaries and Coasts; Journal of Sea Research; Estuarine, Coastal and Shelf Science*

James A. Nelson

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PROFESSIONAL PREPARATION

Florida State University, Tallahassee, FL	B.S., Biology Honors: Certificate in Marine Resource Ecology	2004
Florida State University, Tallahassee, FL	Ph.D., Chemical Oceanography	2011

PROFESSIONAL APPOINTMENTS

Assistant Professor, Department of Biology 2015-present
University of Louisiana, Lafayette, LA

Assistant Research Scientist, Ecosystems Center 2013-2015
Marine Biological Laboratory, Woods Hole, MA

Postdoctoral Fellow, Ecosystems Center 2011-2013
Marine Biological Laboratory, Woods Hole, MA

PUBLICATIONS

Five Publications Most Closely Related to the Proposed Project

Nelson, J.A., Garritt, H., and Deegan, L. 2015. Physical controls on estuarine food webs and implications of climate change. Marine Ecology Progress Series- *In press.*

Stallings, C.D.; Mickle, A., Nelson, J.A., McManus, M., Koenig, C. 2015. Faunal communities and habitat characteristics of the Big Bend seagrass meadows, 2009-2010. Ecology 96:1 304-304.

Wilson, R.M., Nelson, J., Balmer, B.C., Wells, R.C., Nowacek, D.P., and Chanton, J. 2013. Stable isotope variation in the northern Gulf of Mexico constrains bottlenose dolphin (*Tursiops truncatus*) foraging ranges. Marine Biology 160: 2967-2980.

Nelson, J.A., Stallings, C.D., Landing, W., and J. Chanton, J. 2013. Biomass transfer subsidizes nitrogen to offshore food webs. Ecosystems 16: 1130-1138.

Nelson, J.A., Wilson, R.M., Coleman, F.C., Koenig, C.C., DeVries, D., Gardner, C., and Chanton, J. 2012. Flux by fin: fish mediated carbon and nutrient flux in the northeastern Gulf of Mexico. Marine Biology 159: 365-372.

Five Other Significant Publications

Nelson, J.A., Chanton, J.P., Coleman, F.C., and Koenig, C.C. 2010. Patterns of stable carbon isotope turnover in gag, *Mycteroperca microlepis*, an economically important marine piscivore determined with a non-lethal surgical biopsy procedure. Environmental Biology of Fishes. 90: 243-252.

Stallings, C.D., Nelson, J.A., Rozar, K.L., Adams, C.S., Wall, K.R., Switzer, T.S., Winner, B.L., and Hollander, D.J. 2015. Effects of preservation methods of muscle tissue from upper-

trophic level reef fishes on stable isotope values (δ13C and δ15N). PeerJ 3: e874 https://dx.doi.org/10.7717/peerj.874.

Erhard, E. B., Wilson, R.M., Nelson, J.A., and Chanton, J.P. An extended Bayesian stable isotope mixing model for full-foodweb diet and trophic level inference. The American Statistician- *In Review.*

Nelson, J.A., Hanson, C.W., Koenig, C.C., and Chanton, J. 2011. Influence of diet on stable carbon isotope composition in otoliths of juvenile red drum, *Sciaenops ocellatus*. Aquatic Biology 13: 89-95.

SYNERGISTIC ACTIVITIES

Session Developer, SCI-031 Trophic subsidies in Coastal Ecosystems: implications for coastal management. International Coastal and Estuarine Research Federation (Nov, 2013, San Diego, CA).

Mentor of NSF REU students and MBL Semester in Environmental Science Students.

Invited speaker at "Slow the Flow" workshop sponsored by Parker River National Wildlife Refuge targeted at 5-12th grade (Sept. 2012). Saturday at the Sea Instructor, Florida State Coastal and Marine Lab**,**a hands-on learning marine science learning experience for middle and high school students held at the Florida State Coastal and Marine Lab.

Reviewer for *Limnology and Oceanography, Aquatic Biology, Environmental Biology of Fishes, Marine Biology, Marine and Freshwater Research, Journal of Fish Biology, Wetland Ecology and Management.*