

Bay-Delta Bioinvasions Information, Coordination, and Outreach Project (ICOP)

Project Information

1. Proposal Title:

Bay-Delta Bioinvasions Information, Coordination, and Outreach Project (ICOP)

2. Proposal applicants:

Jodi Cassell, University of California Sea Grant Extension Program

3. Corresponding Contact Person:

Carol Berman
The Regents of the University of California
Agriculture and Natural Resources 1111 Franklin St, 6th Floor Oakland, CA 94607-5200
510 987-0050
Carol.Berman@ucop.edu

4. Project Keywords:

Environmental Education
Natural Resource Management
Nonnative Invasive Species

5. Type of project:

Education

6. Does the project involve land acquisition, either in fee or through a conservation easement?

No

7. Topic Area:

Non-Native Invasive Species

8. Type of applicant:

University

9. Location - GIS coordinates:

Latitude:

Longitude:

Datum:

Describe project location using information such as water bodies, river miles, road intersections, landmarks, and size in acres.

This project is an education, outreach, and coordination project focusing on nonnative invasive species management. Invasive species are a major concern throughout the Bay-Delta, and we will provide outreach, information, and coordination focusing on issues throughout the entire region. Because there inter-region and inter-state transport is a major concern with exotics, we will also monitor and provide information on relevant nonnative species issues outside of the Bay-Delta and coordination with neighboring programs and agencies.

10. Location - Ecozone:

Code 15: Landscape

11. Location - County:

Alameda, Contra Costa, Marin, Sacramento, San Francisco, San Mateo, Solano, Yolo

12. Location - City:

Does your project fall within a city jurisdiction?

No

13. Location - Tribal Lands:

Does your project fall on or adjacent to tribal lands?

No

14. Location - Congressional District:

12th

15. Location:

California State Senate District Number: 8

California Assembly District Number: 19

16. How many years of funding are you requesting?

2

17. Requested Funds:

a) Are your overhead rates different depending on whether funds are state or federal?

Yes

If yes, list the different overhead rates and total requested funds:

State Overhead Rate: 10
Total State Funds: 163,642
Federal Overhead Rate: 21.3
Total Federal Funds: 180453

b) Do you have cost share partners already identified?

Yes

If yes, list partners and amount contributed by each:

University of California Sea Grant \$15,030

University of California Cooperative Extension \$8000 (rent costs/office space)

c) Do you have potential cost share partners?

Yes

If yes, list partners and amount contributed by each:

Misc. Advisory Committee Members \$30,000

d) Are you specifically seeking non-federal cost share funds through this solicitation?

No

If the total non-federal cost share funds requested above does not match the total state funds requested in 17a, please explain the difference:

18. **Is this proposal for next-phase funding of an ongoing project funded by CALFED?**

No

Have you previously received funding from CALFED for other projects not listed above?

Yes

If yes, identify project number(s), title(s) and CALFED program.

19. **Is this proposal for next-phase funding of an ongoing project funded by CVPIA?**

No

Have you previously received funding from CVPIA for other projects not listed above?

No

20. **Is this proposal for next-phase funding of an ongoing project funded by an entity other than CALFED or CVPIA?**

No

Please list suggested reviewers for your proposal. (optional)

Dr. Ted Grosholz	UC Davis - Dept. of Env. Science & Policy	(530) 752-9151	tedgrosholz@ucdavis.edu
-------------------------	--	-----------------------	--------------------------------

Paul Heimowitz	Oregon Sea Grant	(503) 722-6718	paul.heimowitz@orst.edu
-----------------------	-------------------------	-----------------------	--------------------------------

Marilyn Barrett O'Leary	Louisiana Sea Grant	(225) 578-6349	moleary@lsuvm.sncc.lsu.edu
--------------------------------	----------------------------	-----------------------	-----------------------------------

21. **Comments:**

Environmental Compliance Checklist

Bay-Delta Bioinvasions Information, Coordination, and Outreach Project (ICOP)

1. CEQA or NEPA Compliance

a) Will this project require compliance with CEQA?

No

b) Will this project require compliance with NEPA?

No

c) If neither CEQA or NEPA compliance is required, please explain why compliance is not required for the actions in this proposal.

The proposed project is an education, outreach and coordination project.

2. **If the project will require CEQA and/or NEPA compliance, identify the lead agency(ies). If not applicable, put "None".**

CEQA Lead Agency:

NEPA Lead Agency (or co-lead:)

NEPA Co-Lead Agency (if applicable):

3. **Please check which type of CEQA/NEPA documentation is anticipated.**

CEQA

-Categorical Exemption

-Negative Declaration or Mitigated Negative Declaration

-EIR

Xnone

NEPA

-Categorical Exclusion

-Environmental Assessment/FONSI

-EIS

Xnone

If you anticipate relying on either the Categorical Exemption or Categorical Exclusion for this project, please specifically identify the exemption and/or exclusion that you believe covers this project.

4. **CEQA/NEPA Process**

a) Is the CEQA/NEPA process complete?

Not Applicable

b) If the CEQA/NEPA document has been completed, please list document name(s):

5. **Environmental Permitting and Approvals** (If a permit is not required, leave both Required? and Obtained? check boxes blank.)

LOCAL PERMITS AND APPROVALS

Conditional use permit

Variance

Subdivision Map Act

Grading Permit

General Plan Amendment

Specific Plan Approval

Rezone

Williamson Act Contract Cancellation

Other

STATE PERMITS AND APPROVALS

Scientific Collecting Permit

CESA Compliance: 2081

CESA Compliance: NCCP

1601/03

CWA 401 certification

Coastal Development Permit

Reclamation Board Approval

Notification of DPC or BCDC

Other

FEDERAL PERMITS AND APPROVALS

ESA Compliance Section 7 Consultation

ESA Compliance Section 10 Permit

Rivers and Harbors Act

CWA 404

Other

PERMISSION TO ACCESS PROPERTY

Permission to access city, county or other local agency land.

Agency Name:

Permission to access state land.

Agency Name:

Permission to access federal land.

Agency Name:

Permission to access private land.

Landowner Name:

6. Comments.

Land Use Checklist

Bay-Delta Bioinvasions Information, Coordination, and Outreach Project (ICOP)

1. **Does the project involve land acquisition, either in fee or through a conservation easement?**

No

2. **Will the applicant require access across public or private property that the applicant does not own to accomplish the activities in the proposal?**

No

3. **Do the actions in the proposal involve physical changes in the land use?**

No

If you answered no to #3, explain what type of actions are involved in the proposal (i.e., research only, planning only).

The proposed project involves education, outreach, and coordination of programs.

4. **Comments.**

Conflict of Interest Checklist

Bay-Delta Bioinvasions Information, Coordination, and Outreach Project (ICOP)

Please list below the full names and organizations of all individuals in the following categories:

- Applicants listed in the proposal who wrote the proposal, will be performing the tasks listed in the proposal or who will benefit financially if the proposal is funded.
- Subcontractors listed in the proposal who will perform some tasks listed in the proposal and will benefit financially if the proposal is funded.
- Individuals not listed in the proposal who helped with proposal development, for example by reviewing drafts, or by providing critical suggestions or ideas contained within the proposal.

The information provided on this form will be used to select appropriate and unbiased reviewers for your proposal.

Applicant(s):

Jodi Cassell, University of California Sea Grant Extension Program

Subcontractor(s):

Are specific subcontractors identified in this proposal? No

Helped with proposal development:

Are there persons who helped with proposal development?

No

Comments:

Budget Summary

Bay-Delta Bioinvasions Information, Coordination, and Outreach Project (ICOP)

Please provide a detailed budget for each year of requested funds, indicating on the form whether the indirect costs are based on the Federal overhead rate, State overhead rate, or are independent of fund source.

State Funds

Year 1												
Task No.	Task Description	Direct Labor Hours	Salary (per year)	Benefits (per year)	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
1	Evaluation	40%	14,640	4392	828	5000			3000	27860.0	2786	30646.00
2	Info Tracking and Streaming	40%	14,640	4392	6928	2000	8300			36260.0	3626	39886.00
3	Targeted Outreach	20%	7,320	2196	828					10344.0	1034	11378.00
		0	36600.00	10980.00	8584.00	7000.00	8300.00	0.00	3000.00	74464.00	7446.00	81910.00

Year 2												
Task No.	Task Description	Direct Labor Hours	Salary (per year)	Benefits (per year)	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
1	Evaluation	10%	3733	1120					3000	7853.0	785	8638.00
2	Info Tracking and Streaming	50%	18,666	5600	6928	2000	12,600			45794.0	4579	50373.00
3	Targeted Outreach	40%	14,933	4480	1242					20655.0	2066	22721.00
		0	37332.00	11200.00	8170.00	2000.00	12600.00	0.00	3000.00	74302.00	7430.00	81732.00

Year 3												
Task No.	Task Description	Direct Labor Hours	Salary (per year)	Benefits (per year)	Travel	Supplies & Expendables	Services or Consultants	Equipment	Other Direct Costs	Total Direct Costs	Indirect Costs	Total Cost
		0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Grand Total=163642.00

Comments.

Budget Justification

Bay-Delta Bioinvasions Information, Coordination, and Outreach Project (ICOP)

Direct Labor Hours. Provide estimated hours proposed for each individual.

One staff at Project Representative I (mid-point, non-union) for two years (Tasks 1, 2, and 3). Cost of living adjustment for second.

Salary. Provide estimated rate of compensation proposed for each individual.

One staff at Project Representative I (mid-point, non-union) for two years (Tasks 1, 2, and 3) Year 1: \$36,600 Year 2: \$37,332

Benefits. Provide the overall benefit rate applicable to each category of employee proposed in the project.

One staff at Project Representative I (mid-point, non-union) for two years (Tasks 1, 2, and 3)(30% of salary) Year 1: \$10,980 Year 2: \$11,200

Travel. Provide purpose and estimate costs for all non-local travel.

Local Travel Year 1 (Task 1,2,3): Local travel funding is budgeted to support 200 miles per month per task to attend relevant local meetings, travel to workshops, and make site visits for the first year of the project. The University of California mileage reimbursement rate is \$0.345/mile. Expenses are as follows: Task 1 - \$828 Task 2 - \$828 Task 3 - \$828 Total local travel expenses for Year 1 = \$2484
Year 2 (Task 2,3): Local travel funding is budgeted to support 200 miles per month for task 2 and 300 miles per month for task 3 to attend relevant local meetings, travel to workshops, and make site visits for the first second year of the project. The University of California mileage reimbursement rate is \$0.345/mile. Task 2 = \$828 Task 3 = \$1242 Total local travel expenses for Year 2 = \$2070
Regional and National Travel Year 1 and 2 (Task 2): Funds are provided to allow project staff to attend pertinent meetings throughout the year for the purpose of gathering information on ANS issues relevant to the Bay-Delta, and to present information and develop contacts for the ICOP project. Meetings will include the International Conference on Aquatic Nuisance Species, the Marine Bioinvasions Conference, the Aquatic Nuisance Species Task Force, and the Western Regional Panel on Aquatic Nuisance Species.
Year 1: 3 National Meetings/Conferences @ \$1500/meeting = \$4500 4 West Coast/Regional Meetings @ \$400/meeting = \$1600 Total R & N Travel (Task 2, Year 1) = \$6100
Year 2: 3 National Meetings/Conferences @ \$1500/meeting = \$4500 4 West Coast/Regional Meetings @ \$400/meeting = \$1600 Total R & N Travel (Task 2, Year 2) = \$6100

Supplies & Expendables. Indicate separately the amounts proposed for office, laboratory, computing, and field supplies.

Computer (Task 1, Year 1): A computer will be needed for the duration of the project. The computer will be used for project correspondence, evaluations, reports, products, and to maintain a project mailing/contact database and website. A total of \$3000 is allocated for the computer purchase.

Computer Accessories (Task 1, Year 2): Computer printers, scanners and new software will be needed to complete project tasks. This is budgeted at \$2000 for the first year of the program. Office Supplies, General Postage, Phones, Internet, Copying, and Computer Maintenance (Task 2, Years 1 & 2): Performance of the proposed activities will require a high amount of communications. Estimated costs for this category have been budgeted at \$2000/year.

Services or Consultants. Identify the specific tasks for which these services would be used. Estimate amount of time required and the hourly or daily rate.

Graphics for Outreach Materials: (Task 2, Year 1 & 2): A total of \$4000/year is allocated to provide any necessary graphics services for production of project materials including the monthly rap sheet and fact sheets. Printing (Task 2, Year 1 & 2): Printing costs are provided for proposed project fact sheets and monthly rap sheets as described below: Year 1: Rap Sheet 2 pages/month @ .15/copy x 1000 copies x 6 months = \$1800 Color Fact Sheets (2) 1 page @ .25/copy x 5000 copies x 2 = \$2500 Year 2: Rap Sheet - 2 pages/month @ .15/copy x 1000 copies x 12 months = \$3600 Color Fact Sheets (4) 1 page @ .25/copy x 5000 copies x 4 = \$5000

Equipment. Identify non-expendable personal property having a useful life of more than one (1) year and an acquisition cost of more than \$5,000 per unit. If fabrication of equipment is proposed, list parts and materials required for each, and show costs separately from the other items.

No equipment over \$5000 will be acquired for the project

Project Management. Describe the specific costs associated with insuring accomplishment of a specific project, such as inspection of work in progress, validation of costs, report preparation, giving presentations, response to project specific questions and necessary costs directly associated with specific project oversight.

The project will be overseen by the project director: Jodi Cassell, Marine Advisor, University of California Sea Grant Extension Program. Her salary is covered by the California Sea Grant Program, so there is no money budgeted for project management costs.

Other Direct Costs. Provide any other direct costs not already covered.

Office Space (Task 1, Years 1 & 2): \$3000 has been budgeted for office rental for each year of the project. Project staff will be housed in the San Francisco County Cooperative Extension Office.

Indirect Costs. Explain what is encompassed in the overhead rate (indirect costs). Overhead should include costs associated with general office requirements such as rent, phones, furniture, general office staff, etc., generally distributed by a predetermined percentage (or surcharge) of specific costs.

The overhead rate for state funding is 10% on all direct costs. The overhead rate for federal funding is 21.3% on all direct costs, except for rent and equipment over \$1500.

Executive Summary

Bay-Delta Bioinvasions Information, Coordination, and Outreach Project (ICOP)

During the last decade, the field of bioinvasions emerged as a prominent new area of emphasis in marine and estuarine science and management. Throughout the world, introduced aquatic nuisance species (ANS) are now viewed as a major threat to the health of marine and estuarine ecosystems. Due to current, trade patterns, and other factors, the San Francisco Bay-Delta has been particularly impacted by introduced species, and has been dubbed the most invaded estuary in the world (Cohen and Carlton, 1995, 1998). While recognition of ANS issues has grown, the capacity to proactively manage and deal with the continuing flux of new information about invasives has been slower to develop. Particularly at the state level, many agencies have not been granted any significant resources to deal with this new issue. This proposal details a two-year outreach and education program, Bay-Delta Bioinvasions Information, Coordination, and Outreach Project (ICOP), developed to provide specific resources and information flow to agencies dealing with ANS issues in the Bay-Delta. The current ecological situation and continued threats of new ANS invasions in the Bay-Delta merits such approaches to bolster agency capacities. The presence of large-scale on-going restoration efforts, such as CALFED, also provides a window of opportunity where improving information flow could significantly impact the ANS situation in the Bay-Delta. The specific components of ICOP include: an initial California ANS management evaluation (which will highlight management and information gaps), development of an information tracking and streaming/reporting program on relevant ANS issues to assure that agencies and regional efforts are provided with the most up-to-date information on ANS (including monthly presentations and rap sheets, color fact sheets, and a web site), and targeted outreach focused on special needs areas for the Bay-Delta (including ANS curriculum development for middle and high schools and targeted outreach on zebra mussel monitoring and prevention). We will randomly evaluate all program activities and will disseminate summative evaluations via meetings, reports, and a page on the project website. A project advisory committee will also provide feedback on project goals, workplans, and specific outreach products via meetings and informal communications. The University of California Sea Grant Extension Program, which will oversee this project, has extensive experience designing and implementing large-scale outreach efforts on a variety of marine and coastal resource topics. We are well networked within the field of ANS management, and we currently oversee one of the largest outreach efforts focused on ballast water nationwide. We are the ideal candidate to undertake this endeavor, which will be a critical step in improving ANS management in the Bay-Delta.

Proposal

University of California Sea Grant Extension Program

**Bay-Delta Bioinvasions Information, Coordination, and Outreach Project
(ICOP)**

Jodi Cassell, University of California Sea Grant Extension Program

BAY-DELTA BIOINVASIONS INFORMATION, COORDINATION, AND OUTREACH PROJECT (ICOP)

PROJECT DESCRIPTION: Project Goals and Scope of Work

PROBLEM/BACKGROUND

During the last decade, the field of bioinvasions has emerged as a prominent new area of emphasis in marine and estuarine science and management. This field has come to the fore for a number of reasons. First, liberalization of trade and transportation technologies have significantly increased the “inoculation” of viable non-native species to coastal waters through vectors such as ballast water, aquaria trade, and intentional introductions. Historical analysis by Cohen (1998), shows that the rate of introduction of new species to San Francisco Bay has increased fourfold over the past thirty years. Documented impacts of aquatic nuisance species (ANS) introductions include: 1) ecological changes, such as alterations to food webs and displacement of native species, 2) economic costs of removal and management of ANS, and 3) public and ecosystem health concerns from exposure to exotic pathogens (National Research Council, 1996).

Second, and related to the above situation, a number of “high profile” introductions have occurred in recent years, highlighting the potentially dramatic impacts of bioinvasions in aquatic systems. Most notably, the zebra mussel (*Dreissena polymorpha*) was introduced to the Great Lakes region in 1986, and has since expanded its range spread to include 19 states and 2 provinces (Freshwater Foundation, 1995). Zebra mussels are highly prolific, and have an affinity for attaching to man made hard surfaces. A major impact to infested states has been the clogging of water intakes at power plants and municipal water facilities, which has caused facility shutdowns and significant financial investment for removal and control strategies. Zebra mussel control is expected to cost the Great Lakes region an estimated \$300 million per year in control costs (Weathers and Reeves, 1996)

As national attention has focused on marine bioinvasions and scientists have catalogued growing lists of introductions and their impacts, government agencies have scrambled to design programs and policies to respond to this newly recognized threat. In many cases, state resource management agencies, already challenged in terms of staff and budget constraints in this era of government down-sizing, have been charged with developing aquatic nuisance species management programs, often from ground zero and without any significant new fiscal resources. Hence, particularly at the state level, aquatic nuisance species policy has proceeded in a very piecemeal and uncoordinated fashion, and often without the best available information. Regional coordination, in particular, is often lacking in ANS management approaches, and it will most likely be a number of years before agencies priorities and organizational structures evolve to adequately deal with these issues.

Project Goals and Objectives

The overall goal of this project is to provide a resource, the Bay-Delta Bioinvasions Information Coordination and Outreach Program (ICOP), to facilitate development of

efficient, coordinated, and proactive approaches to management of ANS in the San Francisco Bay Delta. The specific objectives of ICOP are as follows:

- 1) Serve as a clearinghouse and conduit for critical information on ANS management issues to resource management agencies in California.
- 2) Enhance awareness of regional issues and opportunities for regional coordination among agency staff.
- 3) Improve public and agency staff awareness of specific Bay Delta ANS issues through development of local and regional outreach products and programs.

JUSTIFICATION

Bioinvasion Management in the San Francisco Bay Delta

The San Francisco Bay-Delta has been profoundly impacted by ANS, and there is a significant need for programs to assist resource managers dealing with ANS introductions in this system. The following sections provide an overview of the situation with respect to ANS introductions and management in the Bay-Delta region, and of the particular need for programs such as ICOP in the region.

Physical and Demographic Setting of the Bay-Delta. The watershed of the Bay-Delta, and hence the physical area which must be managed and monitored and is “open” to introductions, is a huge area. The San Francisco Bay Delta is the largest estuarine system on the west coast of North and South America and has a watershed that encompasses 40 percent of the area of California. Much of the Bay-Delta system also exists in an urban highly populated setting. Competing uses of the Bay-Delta include international shipping, recreation, and commercial fishing, each representing a possible significant avenue for ANS introductions. The San Francisco Bay-Delta and other West Coast estuaries may also be particularly susceptible to introduction of new species due to their relative geologic youth and low species diversity (Herbold and Moyle, 1989).

ANS Introductions in the Bay-Delta. The Bay-Delta has indeed been particularly and profoundly affected by ANS introductions. One recent study found that the San Francisco Bay-Delta is dominated by more than 200 ANS, and dubbed the system the “most invaded estuary in the world” (Cohen and Carlton, 1995, 1998).

Examples of problematic invaders introduced to the Bay-Delta include the Asian clam (*Potamocorbula amurensisi*), Atlantic smooth cordgrass (*Spartina alterniflora*), and the European green crab (*Carcinus maenas*), all of which have altered the ecology of the system. First found in the Bay-Delta in 1986, the Asian clam now sustains average densities of 2,000/m² and can filter the volume of the northern section of the estuary over once per day. Through this filtration, the clam reduces or completely depletes the bacterioplankton, phytoplankton, and zooplankton (copepods), which serve as the basis of the estuary’s food web (Cohen and Carlton, 1995). The European green crab, also introduced to the Bay-Delta in the 1980’s, is a voracious predator that feeds on and may impact populations of native clams and shore crabs (Grosholz et al., 2000). Atlantic cordgrass was intentionally introduced into San Francisco Bay for a marsh restoration

project. It overgrows mudflat habitats needed by wintering shorebirds, and competes for space and hybridizes with native cordgrass (Strong, DR, 1999)

The Chinese mitten crab (*Eriocheir sinensis*) provides an example of a Bay-Delta ANS that has created direct economic impacts and potential human health concerns. First found in the system in 1992, the species has rapidly expanded in number and range. A major impact is that the mitten crab can clog water and fish diversions and industrial water intakes during its fall spawning migration. In 1998, nearly 1 million adult crabs were entrained by the Tracy Fish Collection Facility, causing major problems with removal and disposal, as well as potential impacts to passage and survival of fish species at the facility. The mitten crab also burrows into riverbanks and levees, which may contribute to erosion and costly restoration. Finally, the mitten crab also poses a significant potential public health concern because it serves as a secondary host to the Oriental lung fluke, which causes tuberculosis or influenza-like symptoms in humans (Veldhuizen, TC and S. Stanish, 1999).

The examples above represent only a sampling of the ANS issues that are present or an imminent threat to the Bay-Delta system. Tracking the flow of information on ANS issues, in terms of new scientific findings, policy developments, and species sightings, is, in itself, a huge task. At the same time a seemingly continual flow of aggressive new invaders, such as *Caulerpa taxifolia*, a marine algae nicknamed the “killer weed” and found in Southern California nearshore waters in 2000, requires immediate attention and diverts resources from existing tasks. The Bay-Delta is clearly in a state of crisis in terms of ANS introductions and management.

Regional Movement of ANS. Due to both current and trade patterns, non-native species introduced to any West Coast estuary stand a stronger chance of expanding their range throughout the region. For instance, one study of ballast water issues in Alaska found that, in 1998, tankers from Puget Sound, San Francisco, and Long Beach comprised approximately 82.7% of all tanker traffic to Prince William Sound in Alaska, creating an increased risk for transfer of species from these ports due to repeat “inoculations” (Hines and Ruiz, 2000).

A number of species have followed a pattern of dispersion throughout the West Coast after being introduced to the San Francisco Bay-Delta. For instance, the European green crab (*Carcinus maenas*), most likely introduced to the Bay-Delta via bait shipments from the East Coast, was first seen in San Francisco Bay in 1989 (Cohen and Carlton, 1995). By 1993, this crab had established itself in Bodega Bay, CA, and by 2000, it had been found in Morro Bay, CA and Grays Harbor, WA (Grosholz et al., 2000). It is thought that this unprecedented movement of the green crab (typical non-native species have been found to expand their range by a maximum of 50 miles in 40 years) was facilitated by seven to eight months of northward currents created by an El Nino pattern in 1999, which allowed large numbers of crab larvae to be transported. The Chinese mitten crab (*Eriocheir sinensis*), introduced to the Bay-Delta in 1992 has been spotted twice in the Columbia River and may very well be establishing a population in that system (Stewart, 2000). Movement of the mitten crab has most likely been via ballast water or intentionally by individuals interested in creating a fishery.

West Coast systems also appear to be facing other similar threats, in terms of introduction of species from outside the region. A 1994 study by the U.S. Fish &

Wildlife Service found that, the high level of boat transport throughout the U.S. for fishing tournaments, recreational fishing, and pleasure boating, creates a major potential route for introducing zebra mussels (generally attached to motors or water intake systems) to the west via recreational vessels (Freshwater Foundation, 1995). Since 1993 when border Agricultural Inspection Stations in California began a program of inspecting recreational vessels, 24 boats entering California have been found carrying adult zebra mussels (Kim Webb, US Fish & Wildlife Service, Bay-Delta Office, Stockton, email communication, 2000). Although other West Coast states do not have similar monitoring programs, in June 2001 a boat entering Washington State through the Spokane Port of Entry Saturday was inspected and found to be carrying live zebra mussels (Pamala Meacham, Asst. Aquatic Nuisance Species Coordinator, WA Dept. of Fish & Wildlife, Olympia, WA, email communication, 2001).

This strong linkage within the West Coast region created by trade, current patterns, and similar external vectors of ANS makes cooperation and information sharing vital to minimizing the growing threat of marine bioinvasions. In that the Bay-Delta, due to its heavily invaded state and current and trade patterns, may be a major source for introductions to other West Coast estuaries, it is important that California take a leadership role in promoting coordination on West Coast ANS issues. The staffing and resources provided via the ICOP will serve to facilitate this coordination, and to enable California to take a stronger leadership and participatory role in on-going and new regional management efforts.

State of Management. As noted above, aquatic and marine bioinvasions represents a new field from both a scientific and management perspective. Although terrestrial invaders have been a focus of federal policy and management throughout the past century, the issue of invasions in aquatic and marine environments did not receive much focused attention until passage of the Aquatic Nuisance Species Prevention and Control Act (ANSPCA) of 1990 (cite). The ANSPCA and the reauthorized version of this law, the National Invasive Species Act (NISA) of 1996, emphasized ballast water as a major vector for ANS introduction and mandated development of national ballast management programs. Although less directed in terms of dealing with other vectors, ANSPCA and NISA did establish a federal and several regional task forces to facilitate coordination of ANS policy development for all vectors at the national and state levels. NISA also called for the development of State or Interstate Invasive Species Management Plans, with potential funds available for states with approved plans.

Likewise, states are in the very beginning stages of developing management programs and policies for ANS. Only seven states have approved ANS management plans (<http://www.anstaskforce.gov/mgtplans.htm>). Many states have been affected by serious deficiencies in both financial resources and staff expertise in this process. Coordination between states and development of proactive management programs has been severely limited by such resource deficiencies. Similar to the Federal situation, however, one front where there has been significant movement is on the ballast water issue. To date, nine states have passed laws focusing on ballast management in state waters.

It is a particularly opportune time to provide resources to augment ANS management in the state of California for a number of reasons. First, as is true of many states, California is currently in the process of developing a state management plan for ANS. Implementation of a program such as ICOP at this stage in policy development will insure that the best available information is available to guide policy development and also will enable better coordination with neighboring states. As with most other states, staff time has been a limiting factor for development and implementation of ANS policy in California, as few new staff or resources have been granted to agencies for dealing with ANS. This factor, in combination with the overall complexity and breadth of ANS issues throughout California discussed above, makes it imperative that additional resources, such as ICOP, be made available to assist and speed policy development and implementation in the state.

Second, several regional management initiatives are providing a “window of opportunity” to facilitate improved ANS management in California. First, the CALFED Bay-Delta Program is devoting unprecedented resources to the restoration of the Bay-Delta system. One of the six current multi-regional priorities of this program is to “prevent the establishment of additional non-native species and reduce the negative, biological, economic, and social impacts of established nonnative species in the Bay-Delta estuary and its watersheds”. Given CALFED’s resources and the resultant potential to significantly impact the ANS situation in the Bay-Delta, it is vital the most current and accurate ANS information be fed into the CALFED process to facilitate the best possible use of resources. Again, the sheer enormity and continually changing complexion of ANS issues being encountered in the Bay-Delta and throughout California dictates that specific additional resources, such as ICOP, are necessary to track and coordinate information flow on these issues.

The Western Regional Panel on Aquatic Nuisance Species (WRP) presents another opportunity for improved ANS management in California and greater regional cooperation. The WRP, mandated by NISA 1996 and established in 1998, is an inter-governmental taskforce developed to facilitate coordination of ANS management efforts in the Western states. The information coordination and tracking provided by ICOP will allow California to play a stronger role in this forum and will provide for greater opportunities for coordination with other West Coast states. This will, in turn, benefit California by ultimately decreasing ANS flows within the region.

The Need for Education. Given the high social and fiscal costs of dealing with established ANS, sound management necessitates that a heavy emphasis be placed on preventing introductions. Along these lines, there is a significant need for both general public outreach and specific targeted programs that emphasize looming invasion threats. As an information clearinghouse, ICOP will be well situated to develop and implement education and outreach programs. We are aware of and will work collaboratively with existing ANS education and outreach programs, including the Reducing the Introduction and Damage of Aquatic Nonindigenous Species through Outreach and Education program (RIDNIS) funded by CALFED and the West Coast Ballast Outreach Project, funded by CALFED and the National Sea Grant College

Program. We have identified two specific areas of outreach need that are not being covered by the above two programs, school ANS curriculum development and public utility outreach on zebra mussels. In addition to being identified needs within the state, these two areas of emphasis are currently or have been addressed via teams from other West coast states. Thus, there are opportunities to participate in regional program development or to utilize existing materials, which probably would not be taken advantage of without a program such as ICOP. In that there is a strong Sea Grant presence in these regional outreach efforts, the situating of ICOP within the UC Sea Grant Extension Program will also be highly beneficial to this work.

Sea Grant Extension Model

In summary, the novelty and the context of the ANS issue in the Bay-Delta necessitates that additional resources be provided to agency staff to facilitate development of successful ANS management systems. A number of management frameworks and opportunities for coordination, such as the CALFED Process and the WRP, exist. Currently, however, there are inadequate resources to provide a coordinated flow of information to address complex and rapidly shifting ANS issues to these processes. It is vital that a program, such as ICOP, be developed to promote management based on the best possible information and with a view towards coordination of efforts among regions and states.

The University of California Sea Grant Program is the logical location to house the ICOP project. A major role of Sea Grant Extension is to provide objective technical information to marine and coastal resource users and managers. Sea Grant Extension has been in existence nationwide since 1968, and, among other things, conducts workshops and training seminars, produces targeted publications and videos, and develops websites and other media. UC Sea Grant Extension in the San Francisco Bay region currently places a major emphasis on developing outreach and information on ANS issues in the marine environment and Bay-Delta. We will utilize this expertise, as well as the Sea Grant model of outreach and communication, to develop the ICOP program.

APPROACH

There is clearly a strong need for programs to coordinate and disseminate information in the rapidly evolving field of ANS management. This proposal describes a program developed to meet these needs, ICOP, the Bay-Delta ANS Information, Coordination, and Outreach Project. ICOP will be based in the San Francisco County Office of the University of California Sea Grant Extension Program, and will be overseen by Sea Grant Advisor, Jodi Cassell, who has expertise in ANS, outreach, and natural resource management issues. ICOP staff will emphasize tracking and collection of information on ANS issues pertinent to the Bay-Delta. Information will be assessed and transferred to relevant resource management programs dealing with ANS, such as CALFED and the California Department of Fish and Game (DFG) via meetings and outreach materials. We will also utilize information to develop targeted education programs for the general public and specific constituencies. Development and implementation of the specific programs of ICOP will proceed through the three task

pathways described below that will be pursued concurrently during the course of the project.

Task 1: Evaluation. In some sense, this task will drive all other aspects of our project work because we will continually evaluate project plans and outcomes, and will seek to refine project approaches according to the input received. The following sections describe the major components of the on-going evaluation efforts and processes that will occur during the course of the project.

a) Advisory Committee. At the outset of the project, an advisory committee will be established with approximately 10 members including representatives from government agencies, the research community, non-governmental organizations, and the public. Through formal meetings and informal communications, the advisory committee will be asked to provide feedback on project goals, workplans, and specific outreach products. At least four formal meetings of the advisory committee will be held during the course of the project.

b) Initial California ANS Management Evaluation. The first sub-task of the project will be to undertake a comprehensive evaluation of ANS issues and management activities in California. This evaluation will serve two major purposes. First, it will provide a “big picture” of the agencies and specific personnel who are involved in ANS management in California, current issues being addressed, and information flows between people and agencies. In this sense, gaps and disconnects in management, as well as information needs, will also be assessed. Second, this initial evaluation will also provide a mechanism for agency staff to provide direct input and to shape the project according to their information needs. The evaluation will include examination of agency reports and literature, scientific literature, interviews with key informants (agency staff, scientists, and other). The evaluation will place a strong focus on CALFED, DFG, and US FWS as the major agencies involved with ANS management in the California Bay-Delta, but will not exclude other agencies that are in any way involved with ANS.

Utilizing a less detailed, but similar approach, we will also generate a summary assessment of issues and management frameworks in the neighboring Pacific Coast states of Washington and Oregon. Two outcomes will be produced from this subtask. First, a white paper/report will be produced which details the current ANS management framework for California (and to a lesser extent, other Pacific Coast states) and provides a discussion of information needs or problems with the framework for California. The white paper will also discuss opportunities for expanded collaboration with other West Coast states. This report will serve as the basis for our first advisory committee meeting discussion, and will also provide the template for development of a workplan for the project. Second, a revised version of the report will be developed for publication in a scholarly journal and relevant ANS-focused newsletters.

c) Evaluation of Specific Outreach Components. Success of specific project components will be continuously measured by receiving input from our advisory committee, and by random evaluations of all activities. We will utilize surveys to

evaluate presentations and workshops. We also will establish a feedback page on our website, through which we will solicit input on all project components.

Task 2: Information Tracking and Streaming. Based on the findings of the CA ANS management evaluation, a workplan will be developed which provides a framework for information tracking and reporting on ANS issues relevant to the Bay-Delta. The workplan will include, but will not be limited to, the following components.

a) Information Tracking. Information tracking for the ICOP project will be pursued through the following major categories, which may also be augmented based on the CA ANS evaluation and advisory committee input:

1. **Mass media.** We will research, review, and assess all information relevant to Bay-Delta ANS issues produced through mass media such as video, tv, and internet list-servs.
2. **Scientific Reports and Scholarly Journals.** All relevant scientific journals and reports will be regularly reviewed. Information will also be obtained through attending conferences and regional meetings.
3. **Management Programs.** ICOP will track and research any management and outreach relevant to ANS issues in the Bay-Delta. Legislation being considered and/or implemented in other states will be analyzed and reviewed. ICOP will particularly flag potential models for management of Bay-Delta ANS that are being pursued in other locales, as well as opportunities for CA to collaborate or participate in ANS management programs with other states or groups. This research will be pursued through personal contacts and through attending regional and national meetings focusing on ANS issues, such as the WRP and the ANS Task Force. If requested by agencies, we will serve as a California contact for these forums.
4. **Personal Contacts.** ICOP will serve as a point of contact for parties outside of California with information relevant to ANS issues in the Bay-Delta. We will work to verify introductions in other nearby states. And, in as much as it is requested by agencies, ICOP will serve as a point of contact for the general public in terms of potential sitings of ANS or general ANS questions.

b) Information Streaming/Reporting. CALFED, the California Department of Fish & Game, and the US Fish and Wildlife Service are viewed as the major audience for the ICOP project, therefore, to some extent, the information reporting formats will be determined by input from these agencies. Other agencies/groups may also be targeted as information recipients based on the CA ANS evaluation. The following framework is what we currently visualize as potential outputs for information reporting through the ICOP system.

1. **Meetings and Presentations.** We expect to provide regular (monthly to bi-monthly) in-person updates on ANS issues to CALFED, CA DFG, and USFWS. We expect that these presentations will include both issue summary reports and more detailed presentations on a particular ANS topic provided by ICOP project staff or a speaker organized by the ICOP project. As is requested, we will also provide talks and presentations to other forums. We

will also attend CALFED meetings and roundtables to provide input to Bay-Delta funding and restoration decisions as requested by the agency. We will convene meetings on “emergency” ANS invasions as is necessary during the course of the project.

2. **Rap Sheet.** We will develop a monthly Bay-Delta ANS “rap sheet” which will summarize all major events and information regarding relevant ANS happenings during the month. The rap sheet will be distributed in paper and digital (website and listserv) format. As directed by our project advisory committee, we will develop “fact sheets” for specific ANS of concern for the Bay-Delta. Fact sheets will be developed for both agency representative and public audiences.
3. **Multimedia.** We will develop and manage an NIS listserv and website for the project. The ICOP project website will be linked and coordinated with other relevant websites focusing on ANS in the Bay-Delta, such as the RIDNIS program and agency websites focusing on ANS. We will provide continual updates on ANS information relevant to the Bay-Delta for the project website, and will also work with agencies to manage links and information for agency ANS websites.

Task 3: Targeted Outreach. Throughout the project, we will provide leadership in the development of targeted outreach programs to improve awareness of ANS among the general public. To some extent, program development in this area will be driven by input from our advisory committee and by current events in terms of invasion issues. We will also emphasize working collaboratively with others in the Western region to facilitate the most efficient use of resources and to utilize the wide variety of resources that have already been developed as much as possible. Two specific programs that could benefit from involvement of the ICOP project and that we are currently targeting for involvement are as follows:

a) Zebra Mussel Monitoring and Prevention. As discussed above, potential transport of zebra mussels to the West continues to be a major issue of concern for California and other West Coast states. Experience has shown that early detection and localized control efforts are successful tools for slowing the spread, and reducing the impacts of the zebra mussel. The California Zebra Mussel Training Initiative was developed by the University of California and the University of Southern California in 1998 to provide training and public outreach to the water industry, utilities, and natural resource professionals, about monitoring, preventing, and controlling zebra mussel infestations. Training binders were developed and utilized during several workshops in 1998/99. Additional binders and training resources exist from this program, although no further trainings have occurred due to Sea Grant staff time constraints. The ICOP program will utilize Sea Grant resources to host at least 8 additional trainings on this topic throughout the Bay-Delta watershed of California during the course of the project. We will also work with individual water industry and government entities in California and other states to facilitate prevention and monitoring for zebra mussels.

b) Invader Investigators! Aquatic Nuisance Species Education Kits for the West Coast. Oregon State University Sea Grant recently received funding for a two-year project (beginning 10/1/01) to develop West Coast ANS “learning kits” for use in middle and high school classrooms. Oregon Sea Grant is very interested in taking a regional approach to this project, which presents a unique opportunity to maximize the benefit from this funding to expand this development of quality ANS-focused education materials to California. ICOP staff will participate and provide information for the development of these kits, and will also host at least 4 teacher training workshops in the Bay-Delta region to facilitate use of learning kits in this area of California. ICOP will serve as a lending center for learning kits in the San Francisco Bay region, and we will also work to establish lending centers in other areas of the Bay-Delta.

FEASIBILITY

There are no extenuating circumstances or contingencies that will detract from accomplishment of this project. As described above, there is a great need for a targeted information tracking, coordination, and outreach program focusing on ANS issues in the Bay-Delta. The ICOP strategy described above is an appropriate approach to this dealing with this problem. The University of California Sea Grant Extension Program, which will oversee this project, has extensive experience designing and implementing large-scale outreach efforts on a variety of marine and coastal resource topics. We are well networked within the field of ANS management, and we currently oversee one of the largest outreach efforts focused on ballast water nationwide. We have formulated a realistic workplan for this effort, and we foresee no problems with developing a quality program.

PERFORMANCE MEASURES

Evaluation will drive all other aspects of our project work because we will continually evaluate project plans and outcomes, and will seek to refine project approaches according to the input received. Success of specific project components will be measured by receiving input from our advisory committee, and by random evaluations of all activities. We will utilize surveys to evaluate presentations and workshops. We also will establish a feedback page on our website, through which we will solicit input on all project components. Less directly, we will measure performance by the demand for specific project components, such as the rap sheet and fact sheets, and by the amount of traffic through the project web site. Results of all summative evaluations will be disseminated to peers via meetings, reports, and a page on the project website.

DATA HANDLING AND STORAGE

Since this is an education, outreach, and coordination project, there will be no significant data generated by this project. All project events and materials will be posted on the project web site, and within the project newsletter.

EXPECTED OUTCOMES

Task 1: Evaluation

- a. ICOP Advisory Committee.
 - Develop project advisory committee
 - Host **four advisory committee meetings** during the course of the project to plan and evaluate the course of the project
- b. Bay-Delta ANS Issues and Management Evaluation.
 - Review and production of **Evaluation Report**
 - Development of project **workplan** based on evaluation
- c. Evaluation of specific outreach components. To be conducted randomly and reported on for project activities during the course of the project.

Task 2: Information Tracking and Streaming

- a. Information Tracking. Will occur throughout the course of the project.
- b. Information Streaming/Reporting.
 - Meetings and presentations with CALFED, DFG, and USFWS during the course of the project. We expect to present at least **monthly presentations to CALFED** after the initial ANS evaluation and workplan development (18 reports).
 - **ANS Rap Sheet**. To be **produced monthly** after initial ANS evaluation and workplan development (18 editions).
 - **ANS Fact Sheets**. At least **6 Fact Color Sheets** to be produced during the course of the project.
- c. Multimedia.
 - Develop and maintain project **listserv and website**. Work with agencies on related ANS websites and managing links to relevant websites throughout course of project

Task 3: Targeted Outreach

- a. Zebra Mussel Monitoring and Prevention.
 - **Eight training workshops** during the course of the project.
- b. Invader Investigators.
 - Development of **prototype curriculum** for middle and high school classrooms.
 - **Four teacher-training workshops** during the course of the project.

WORK SCHEDULE

Aspects of all of the identified tasks will be carried out during entire course of the project, which will run from October 1, 2002 through September 30, 2004. Landmarks and an estimated schedule for specific sub-tasks are listed below. As all tasks are linked within this education program, the tasks are inseparable, and it is not feasible to incrementally fund the project.

FALL 2002

- Advisory Committee Meeting #1 (Task 1a)
- Draft CA ANS Management Evaluation (Task 1b)
- Initiate project listserv (Task 1c)
- Host four Zebra Mussel Monitoring and Prevention Workshops (Task 3a)

SPRING 2003

- Advisory Committee Meeting #2 (Task 1a)
- Finalize and publish CA ANS Management Evaluation (Task 1b)
- Six presentations/meetings with CALFED (Task 1b)
- Produce and distribute six versions of CA ANS “Rap Sheet” (Task 1b)
- Produce and distribute two color fact sheets (Task 1b)
- Finalize project web site (Task 1c)
- Work with cooperators to finalize prototype curriculum for Invader Investigators (Task 3b)

FALL 2003

- Advisory Committee Meeting #3 (Task 1a)
- Six presentations/meetings with CALFED (Task 1b)
- Produce and distribute six versions of CA ANS “Rap Sheet” (Task 1b)
- Produce and distribute two color fact sheets (Task 1b)
- Maintain project web site (Task 1c)
- Host four Zebra Mussel Monitoring and Prevention Workshops (Task 3a)

SPRING 2004

- Advisory Committee Meeting #4 (Task 1a)
- Six presentations/meetings with CALFED (Task 1b)
- Produce and distribute six versions of CA ANS “Rap Sheet” (Task 1b)
- Produce and distribute two color fact sheets (Task 1b)
- Maintain project web site (Task 1c)
- Host four Teacher Training Workshops for Invader Investigator Curriculum (Task 3b)

APPLICABILITY TO CALFED ERP AND SCIENCE PROGRAM GOALS AND IMPLEMENTAION PLAN AND CVPIA PRIORITIES

ERP, SCIENCE PROGRAM AND CVPIA PROIORITES

The goals of this project are directly in-line with multi-regional priorities 1 and 3 of the CALFED Ecosystem Restoration Program. Multi-regional priority 1 of this program is to “Prevent the establishment of additional non-native species and reduce the negative biological, economic, and social impacts of established non-native species in the Bay-Delta estuary and its watersheds”. ICOP seeks to reduce the impacts of established invaders through augmenting and improving management efforts. The project also takes a proactive approach of preventing introductions focusing on monitoring and school curriculum development. Through this second are of emphasis, we are also very much in

line with Multi-regional priority 3, which states a need to “Implement environmental education actions throughout the region”.

RELATIONSHIP TO OTHER ECOSYSTEM RESTORATION PROJECTS

A major emphasis of this project will be to serve as a clearinghouse for any and all information related to ANS issues in the Bay-Delta. Along these lines, we expect to become familiar with all CALFED projects focusing on ANS, and to assist with dissemination of the results of ANS research projects. In that we expect our information streaming/reporting to impact CALFED decision-making on future goals and activities, we expect that we will have some impact on future project selection. We are aware of and will work collaboratively with other education and prevention programs funded by CALFED, such as the RIDNIS program, which is run by Dr. Ted Grosholz at UC Davis, and the West Coast Ballast Outreach Project, which is also run through the UC Sea Grant Extension Program.

REQUESTS FOR NEXT PHASE FUNDING

This project is not a request for next phase funding.

PREVIOUS CALFED FUNDING

The West Coast Ballast Outreach Project (Title: Preventing the Introduction of Exotic Species from Ballast Water: the San Francisco Bay-Delta Ballast Management Education Program/ Project Number: 97C07/ Program: ERP) was funded by CALFED Bay-Delta Program from February 1999 through August 2001. The project was completed on August 31, 2001, and a final report is being developed for this phase of the project for the project. Additional funding to support this project has been provided by the National Sea Grant College program from February 1999 through January 2001, and from October 2001 through September 2003. All project accomplishments (including portions funded by the National Sea Grant College Program) are included in the list below.

List of Accomplishments:

Bi-annual Newsletter, “Ballast Exchange” – Over the duration of the project we produced and distributed three issues of the biannual newsletter “Ballast Exchange,” providing the latest information on ballast water treatment technologies, management strategies, and west coast ANS issues. This newsletter has a growing mailing list that includes over 2000 nationwide and international recipients. An additional 3000 copies of each issue have been distributed at conference and workshops.

“Stop Ballast Water Invasions” Poster and Brochure – These educational materials were developed, printed and distributed. These products were designed to tell the ballast water story to a variety of audiences (including ships crews) through an appealing graphics-oriented poster and a more text-focused brochure. These brightly illustrated documents describe the potential impacts of ANS, give examples of ANS that have already caused impacts, and give tips on how to manage ballast water management

and where to get more information. These documents were been well received by the various stakeholders involved in this issue. A total of 15,000 posters and 20,000 brochures were printed. The majority of these copies were distributed to domestic and international shipping companies, ports, and government executives.

Ballast Water Forums – We sponsored nine educational workshops and one video-conference with Australia. The workshops included presentations on ballast water management and technology issues, and opportunities for interaction and discussion of such issues between the various stakeholders.

West Coast Ballast Outreach Web Site: <http://ballast-outreach-ucsgep.ucdavis.edu> - We developed and maintained the project web site to inform people of recent developments in ballast water management in a timely fashion. The web site includes the following sections: Project Background and Information, Educational Poster and Brochure, Newsletter, Articles and Books, Links for Information, Coming Events, Laws and Policies, What's New, and Contact Us. The first four sections provide background and information on ballast water issues. The final five sections allow people to find out what is currently going on by providing information and/or links to coming events, laws and policies, news articles, press releases, and draft reports.

Development of Multi-stakeholder Working Groups – We developed successful partnerships and collaborative programming with the major governmental agencies involved with ballast management including the U.S. Coast Guard and the California State Lands Commission. We also formed a network within the maritime community. Many of the key members of these groups participated in our advisory committee meeting to develop project products.

SYSTEMWIDE ECOSYSTEM BENEFITS

This project has two major goals: 1) to facilitate improved management of ANS in the Bay-Delta and maximize benefits from current management and restoration efforts in the system, and 2) to prevent introductions of ANS via targeted education and outreach. This two-pronged approach addresses ANS management needs on a number of levels, and is an appropriate strategy for dealing with the current scenario in the San Francisco Bay-Delta. The project will also seeks to facilitate California's involvement in regional approaches to dealing with ANS issues, which is necessary given the rapid transport of species within the region. All of these activities will benefit the system in terms of improving California's capacity to effectively manage and prevent ANS introductions.

QUALIFICATIONS

Overall implementation of the project tasks will be managed by the California Sea Grant Extension Program. Jodi Cassell, a Marine Advisor at the California Sea Grant Extension Program, will serve as Project Leader, assuming overall responsibility for all project activities. Her salary support is provided through state Sea Grant funding, therefore is not included in this request. Ms. Cassell will devote approximately 15% effort to project management and project activities. A brief biographical sketches of the Program Director and Project Coordinator is included below:

JODI L. CASSELL

EDUCATION:

B.A. Harvard University, Biology, 1988.

M.S. Oregon State University, Marine Resource Management, 1992.

POSITIONS:

Marine Science Field Instructor, Newfound Harbor Marine Institute/Catalina Island Marine Institute/Jekyll Island Marine and Environmental Education Program, 1988-89; Research Assistant and Teaching Assistant, Oregon State University, 1989-91; Technical Assistant, University of Oregon Micronesia Program, 1991; Dean J. Knauss Sea Grant Marine Policy Fellow, U.S. Senate, 1992-93; Program Officer for Marine Conservation, World Wildlife Fund, 1993-94; Marine Advisor, San Francisco and San Mateo Counties, California Sea Grant Extension Program, 1995 to present.

SELECTED PUBLICATIONS

- 1) Cassell, J., K.H. McDowell, and J. Patton. 2000. *Stop Ballast Water Invasions* (poster). West Coast Ballast Outreach Project, San Bruno, CA.
- 2) Cassell, J., K.H. McDowell, and J. Patton. 2000. *Stop Ballast Water Invasions* (brochure). West Coast Ballast Outreach Project, San Bruno, CA.
- 3) Cassell, J., and K.H. McDowell. 2000. *Ballast Exchange* (newsletter), Volume 3. West Coast Ballast Outreach Project, San Bruno, CA.
- 4) Cassell, J., and K.D. Hart. 2000. *Ballast Exchange* (newsletter), Volume 2. West Coast Ballast Outreach Project, San Bruno, CA.
- 5) Cassell, J., and K.D. Hart. 1999. *Ballast Exchange* (newsletter), Volume 1. West Coast Ballast Outreach Project, San Bruno, CA.
- 6) Cassell, J. 1997. *Keep California Zebra Mussel Free* (brochure). Department of Water Resources, Sacramento, CA.
- 7) Cassell, J. and K. Schroeder, 1997. *Steelhead and Coho Salmon Fact Sheet*. University of California Cooperative Extension/California Sea Grant Extension Program, San Bruno, CA.
- 8) Cassell, J. and C. Carpenter, 1996. *Conflicts of Interest: An Issue for Management of U.S. Marine Fisheries?* World Wildlife Fund: Washington, D.C.
- 9) Cassell, J., Adelbai, and D. Otobed, 1992. *A Comprehensive Conservation Strategy for the Republic of Palau*. South Pacific Regional Environmental Program, Western Samoa.

COST-SHARING

Cost sharing will be provided by the University of California Sea Grant Extension Program, which will provide 15% of the PI's salary toward managing and directing this project (\$15,030 during the course of the project). The University of California Cooperative Extension Service (UCE) will also cost-share by providing office space (funds are allocated to cover half the cost of office space, the remainder of costs will be provided by UCE), equipment usage (copier, fax), and administrative assistance for the

project. Organizations and individuals who agree to serve as advisory committee members will donate their time during meetings and to review project materials, which will amount to an in-kind time donation of up to \$15,000 per year. Finally, we plan to achieve some cost-sharing via partnering with regional efforts to develop our targeted education program. In terms of zebra mussel outreach, there are materials that have been produced and are currently available for use in this educational program. In terms of the Invader Investigator program, funding has been received by Oregon Sea Grant to develop and produce “learning kits”, and our role in this program will be to cooperate in the development stage and to facilitate use of kits in California. As has been our experience with the West Coast Ballast Outreach Project, we also expect some opportunities for cost-sharing to arise during the course of the project.

LOCAL INVOLVEMENT

The University of California Sea Grant Extension Program has played a strong role in ANS management and outreach on the West coast for approximately five years. As such, we have an exceptionally strong network of contacts with local maritime industry representatives, regulators, environmental groups, and the public. We will utilize this network to develop a project advisory committee, which will have a strong presence and role in the project throughout its two years of operation. This network will also be utilized to disseminate information and outreach products, as has been our model of operation in the West Coast Ballast Outreach Project. As a Sea Grant Marine Extension Program, we also have excellent connections with neighboring state Sea Grant programs and with Cooperative Extension Resources and faculty (Ted Grosholz) on campuses that will be employed through this project.

COMPLIANCE WITH STANDARD TERMS AND CONDITIONS

See cover letter faxed with signature page.

LITERATURE CITED

.Cohen, A.N., and J.T. Carlton. 1995. Biological Study. Nonindigenous Aquatic Nuisance *Species in a United States Estuary: A Case Study of the Biological Invasions of the San Francisco Bay and Delta*. Washington, D.C., National Oceanic and Atmospheric Administration for the U.S. Fish and Wildlife Service and the National Sea Grant College Program, Connecticut Sea Grant. NTIS Report Number PB96-166525.

Grosholz et al, 2000. The Impacts of a Nonindigenous Marine Predator in a California Bay. *Ecology*, 81 (5), pp. 1206-1224

Herbold, B. and P.B. Moyle. 1989. *The Ecology of the Sacramento-San Joaquin Delta: a Community Profile*. U.S. Fish and Wildlife Service Biological Report No. 85(7.22), 106 pp. Slidell, Louisiana.

National Research Council. 1996. *Stemming the Tide: Controlling the Introductions of*

Nonindigenous Species by Ship's Ballast Water. Washington, D.C., National Academy Press.

Ruiz, G.M., T.K. Rawlings, F.C. Dobbs, L.A. Drake, T. Mullady, A. Hug, and R.R. Colwell. 2000. *Global Spread of Microorganisms by Ships*. **Nature** 408, pp. 49-50.

Stewart, B., 2000. **The Oregonian**. Green Crab Hitches Ride on Ocean Currents to Arrive in our Backyard by Derek Reiber, Tidepool staff writer.
<http://www.tidepool.org/ctc/greencrab.html>

Strong, DR, 1999. *Extent and degree of hybridization between exotic (*Spartina alterniflora*) and native (*S. foliosa*) cordgrass in California, USA determined by Random Amplified Polymorphic DNA (RAPDs)*. **Molecular Ecology** 8, 1179-1187.

Veldhuizen, TC and S. Stanish, 1999. *Overview of the Life History, Distribution, Abundance, and Impacts of the Chinese Mitten Crab, *Eriocheir sinensis**. California Department of Water Resources, Sacramento, CA

Weathers, K, and E Reeves, 1996. *The Defense of the Great Lakes Against the Invasion of Nonindigenous Species in Ballast Water*. **Marine Technology** 33(2): 92-100.