Item 4c

CALIFORNIA OCEAN PROTECTION COUNCIL

Staff Recommendation
October 17, 2016

Seagrasses' ability to ameliorate estuarine acidification

Jenn Phillips, Program Manager

RECOMMENDED ACTION: Authorization to disburse up to $650,000 to the Regents of the University of California, Davis to quantify seagrass effects on estuarine acidification in natural and restored seagrass beds across California; and to assess where seagrass restoration and conservation can be applied to ameliorate local ocean acidification

LOCATION: Statewide

STRATEGIC PLAN OBJECTIVE(S): Climate change and science-based decision-making

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EXHIBITS

Exhibit A: Support Letters

Exhibit B: Site Locations

FINDINGS AND RESOLUTION:

Staff recommends that the Ocean Protection Council (OPC) adopt the following findings:
"Based on the accompanying staff report and attached exhibit(s), the Ocean Protection Council hereby finds that:

1) The proposed projects are consistent with the purposes of Division 26.5 of the Public Resources Code, the Ocean Protection Act.
2) The proposed projects are consistent with the Ocean Protection Council's grant program funding guidelines (Interim Standards and Protocols, August 2013).
3) The proposed project is not a 'legal project' that triggers the California Environmental Quality Act (CEQA) pursuant to Public Resources Code section 21068 and Title 14 of the California Code of Regulations, section 15378. If it were determined to be a 'legal project' under CEQA, the proposed project is categorically exempt from review under CEQA pursuant to 14 Cal. Code of Regulations Section 15306 because the project

involves information collection, consisting of data collection, research, and resource evaluation activities that will not result in a serious or major disturbance to an environmental resource."

Staff further recommends that the OPC adopt the following resolution pursuant to Sections 35500 *et seq.* of the Public Resources Code:

"The California Ocean Protection Council hereby approves the disbursement of up to $650,000 to the Regents of the University of California, Davis to quantify seagrass effects on estuarine acidification in natural and restored seagrass beds across California; and to assess where seagrass restoration and conservation can be applied to ameliorate local ocean acidification.

This authorization is subject to the condition that prior to disbursement of funds, the Regents of the University of California, Davis shall submit for the review and approval of the Executive Director of the OPC detailed work plans, schedules, staff requirements, budgets, and the names of any contractors intended to be used to complete the projects, as well as discrete deliverables that can be produced in intervals to ensure the projects are on target for successful completion. All projects will be developed under a shared understanding of process, management and delivery."

PROJECT SUMMARY:

The overarching goal of this project is to quantify seagrass effects on estuarine acidification in natural and restored seagrass beds across California, and to assess where seagrass restoration and conservation can be applied to ameliorate local ocean acidification.

Recent scientific studies have focused on the potential consequences of ocean acidification (OA), which is the reduction in the pH of the ocean that results from ongoing influx of anthropogenic carbon dioxide (CO_2) into seawater. The West Coast sits at the forefront of addressing the impacts of OA, in part due to recent, catastrophic recruitment failures at oyster hatcheries which are at least partially attributed to larval exposure to low pH waters. Research along the West Coast has brought into sharp focus the potential local consequences of highly acidified seawater for aquaculture operations and marine ecosystems more broadly. In response, states have mobilized in developing policy and science recommendations (e.g., the Washington Ocean Acidification Blue Ribbon Panel and the West Coast Ocean Acidification and Hypoxia Science Panel).

Many studies have documented impacts of OA on a variety of organisms, and efforts are now shifting to define strategies for coping with the issue. For example, seagrass beds have been highlighted as important possible "OA refugia" for their potential to buffer acidified waters. In

fact, the West Coast Ocean Acidification and Hypoxia Science Panel (Panel) recommendations[1] included investigating the use of seagrass meadows and their potential to buffer seawater in the short term, as well as the restoration of seagrass beds for the long-term sequestration of carbon. These ecosystem services are based upon the assumption that seagrass fix carbon through photosynthesis, thereby effectively reducing the CO_2 load in seawater and attenuating the effects of OA, and that seagrass beds can also 'trap' carbon in below-ground sedimentary reservoirs.

This project seeks to determine the conditions under which seagrass beds in California effectively buffer (short-term) and store (long-term) carbon in estuaries, thereby potentially reducing or mitigating the impacts of ocean acidification. California Sea Grant and researchers at UC Davis began similar investigations in 2015, focused on four seagrass beds in Tomales Bay and Bodega Harbor. Preliminary results indicate that during summer months, seagrass beds may provide a buffering influence on local water chemistry due to high amounts of photosynthesis. California Sea Grant funds have provided support for fieldwork in 2015-2016; however, several major questions remain:

1. To what extent do seagrasses 'buffer' estuaries, mitigating the impacts of OA,
   a. during different seasons when seagrass beds may have lower shoot density, and
   b. across multiple years that exhibit differing oceanographic/environmental conditions?
2. As the chemistry of water is modified by moving through seagrass beds, how does this influence organisms living both within and on the edges of seagrass bed ecosystems?
3. To what extent is carbon being 'trapped' and stored in sediments, and how does this change seasonally and inter-annually?
4. How do natural seagrass beds (of a variety of sizes) compare to recently restored seagrass beds, in their capacity to uptake and store carbon?

This project would continue research on seagrass beds in Bodega Harbor and Tomales Bay (2-3 sites total), while expanding to include greater geographic context and a comparison of natural vs. restored beds. Through the addition of two recently restored seagrass bed sites (Elkhorn Slough and Newport Back Bay), this project will ascertain the differences between *restored* vs. *natural* seagrass ecosystems. This project also includes expansion to central and southern California giving us an initial inventory of successful seagrass habitat for local OA amelioration and carbon storage. Researchers will address the above questions through a series of deployments of high-resolution sensors inside and adjacent to seagrass meadows.

[1] http://westcoastoah.org/wp-content/uploads/2016/04/OAH-Panel-Key-Findings-Recommendations-and-Actions-4.4.16-FINAL.pdf

This work is field intensive, and thus the primary cost is to support a team of researchers that are dive and boat trained to work in the field on a regular basis, followed by extensive data analysis and interpretation. This project will employ a combination of high-precision, high--quality sensors, coupled with regular *in situ* bottle sampling for parameters that can be analyzed in the laboratory. Data can be collected at <30 minute intervals continuously for weeks to months. Sensors will typically be arranged to capture "inside" seagrass and "outside" seagrass chemical conditions, but a suite of different experimental designs may be utilized to determine best practices in seagrass monitoring. Routine bottle samples will be analyzed for dissolved inorganic carbon, total alkalinity and/or spectrophotometric pH in the laboratory to ensure proper instrument calibration and comparison between datasets. For a subset of these deployments, juvenile oysters will be studied to understand the relationship between estuarine chemistry and growth rates of calcifying organisms.

This work will be accomplished through a partnership between UC Davis, UC Santa Cruz and Orange County Coastkeeper. While UC Davis and UC Santa Cruz researchers will continue to provide expertise on northern California seagrass deployments (Tomales, Bodega, Elkhorn), Orange County Coastkeeper will provide local expertise on Newport Back Bay seagrass beds and field support during instrument deployment and sampling. The majority of the field research will take place in the first 18 months of the project, and the final 6 months would be focused on synthesis, integration, and presentation of results.

The proposed work directly addresses West Coast Ocean Acidification and Hypoxia Panel *Recommendation 2: Advance approaches that remove CO_2 from seawater*. Specifically, this work would fulfill the suggested *Action 2.1: Use demonstration projects to evaluate which locations are optimal for implementing CO_2 removal strategies,* to "explicitly evaluate under which conditions protection and restoration of vegetated habitats will sufficiently remove CO_2 to meaningfully mitigate OA". This work will also address *Action 2.3: Consider CO_2 removal during the habitat restoration planning process*, by providing a way to "incorporate the potential benefits of local reductions in OA stress." Researchers on this project will continue to closely coordinate with other seagrass researchers in Oregon and Washington to enable comparisons at broad geographic scales from a variety of estuaries. Further, AB 2139 (Williams) references the West Coast Ocean Acidification and Hypoxia Science Panel's recommendations and action items related to seagrass, and asks the OPC to work on these action items as well as to report back to the Council annually on what has been done to address ocean acidification.

Project Timeline: 2 years

PROJECT FINANCING:

Staff recommends that the Ocean Protection Council (OPC) authorize encumbrance of up to

$650,000 to the Regents of the University of California, Davis to quantify seagrass effects on estuarine acidification in natural and restored seagrass beds across California; and to assess where seagrass restoration and conversation can be applied to ameliorate local ocean acidification.

Ocean Protection Council	$650,000
University of California, Davis	$45,000
University of California, Santa Cruz	$15,000
TOTAL	**$710,000**

The anticipated source of funds will be from the Ocean Protection Council's appropriation of the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 (Proposition 84). Proposition 84 authorizes the use of funds for purposes consistent with Section 35650 of the Public Resources Code, establishing the California Ocean Protection Trust Fund (Pub. Res. Code § 75060(g)). Under Section 35650(b), Ocean Protection Trust Fund monies may be expended for projects authorized by the OPC that are identified as appropriate Trust Fund purposes, as specified. The project is consistent with the Trust Fund purposes as discussed in the following section.

Leverage of OPC funds

This project and funding from OPC would build on funding from California Sea Grant to begin to address these research questions in Bodega Bay and Tomales Bay in 2015-16. Additionally, UC Davis and UC Santa Cruz are providing match funding from faculty salaries.

CONSISTENCY WITH CALIFORNIA OCEAN PROTECTION ACT:

The proposed project is consistent with the Ocean Protection Act, Division 26.5 of the Public Resources Code, because it is consistent with trust-fund allowable projects, defined in Public Resources Code Section 35650(b) as projects which:

- Provide monitoring and scientific data to improve state efforts to protect and conserve ocean resources
- Provide funding for adaptive management, planning, coordination, monitoring, research, and other necessary activities to minimize the adverse impacts of climate change on California's ocean ecosystem, including, but not limited to, the effects of sea level rise, changes in ocean productivity, and ocean acidification on coastal and ocean habitat, wildlife, fisheries, chemistry, and other key attributes of ocean ecosystems and to increase the state's understanding of the ocean's role in carbon sequestration.

> Adaptive management strategies, planning, research, monitoring, or other activities shall be designed to improve the management of coastal and ocean resources or aid the state to adapt to climate change impacts.

This proposed project has the potential to improve the management and promote active conservation and restoration of California's seagrass habitat based on the additional service this habitat provides in storing carbon and locally ameliorating ocean acidification. This information and statewide project will promote coordination between the State Coastal Conservancy and the OPC who are both interested in these questions and local and regional ocean acidification strategies, and it will also promote coordination and knowledge sharing with the federal government, academia and the NGO community. This data will be shared publicly and widely to promote such discussion, coordination, and advancement of this mitigation strategy.

CONSISTENCY WITH THE OPC'S STRATEGIC PLAN:
This project implements Focal Area A: Science-based decision-making and Focal Area B: Climate change. The dominant cause of ocean acidification is atmospheric carbon dioxide emissions; therefore, this is an issue that is global in nature and will require global solutions. At the same time, the pace and magnitude of OA on the West Coast requires that we explore and employ regional and local strategies and actions as we continue to reduce CO_2 emissions. These strategies must acted upon quickly and be informed by the best available science to offer the possibility of forestalling at least some of negative consequences of OA on ecosystems and communities.

CONSISTENCY WITH PROPOSITION 84 (The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006; Public Resources Code §75060(g)
This project is consistent with the purposes outlined in Proposition 84, specifically it includes the development of scientific data needed to adaptively manage the state's marine resources and reserves. OA data of high precision, quality, and frequency that is collected inside and outside of seagrass habitat across the state will allow managers to understand the extent to which seagrass removes CO_2 from seawater so we can understand where restoration and conservation of such habitat will successfully and meaningfully mitigate OA.

CONSISTENCY WITH THE OPC'S GRANT PROGRAM FUNDING GUIDELINES:
The proposed project is consistent with the OPC's Grant Program Funding Guidelines for Proposition 84 funds, in the following respects:

Required Criteria

1. Directly relate to the ocean, coast, associated estuaries, or coastal-draining watersheds: *This project will occur in estuaries and bays from Northern to Southern California.*
2. Support of the public: *See Exhibit A*
3. Greater-than-local interest: *Given that this project stretches the length of the state and is addressing a global challenge like ocean acidification, it will garner attention across the state and findings will be shared broadly with other seagrass researchers and managers working on ocean acidification.*

Additional Criteria

4. Improvements to management approaches or techniques: *This project would not improve management techniques but would help managers discern and consider which habitat should be conserved or restored for OA mitigation in addition to the many other services this habitat provides.*
5. Resolution of more than one issue: *By monitoring and studying seagrass habitat for OA benefits, we will better equipped and informed to smartly manage such habitat which will have benefits for fisheries and aquaculture.*
6. Leverage: *As mentioned in the Project Summary, this funding would build on funding allocated to the researchers from California Sea Grant to begin to address these research questions in Bodega Bay and Tomales Bay.*
7. Timeliness or Urgency: *This project will be completed within 2 years; and should be funded now given the urgency of identifying local solutions to ocean acidification, the Panel's recommendations which must be addressed expediently, and given that we are building on one year of funding from California Sea Grant.*
8. Coordination: *This project includes two academic institutions as well as a local non-profit.*

COMPLIANCE WITH CEQA:

The proposed project is not a 'legal project' that triggers the California Environmental Quality Act (CEQA) pursuant to Public Resources Code section 21068 and Title 14 of the California Code of Regulations, section 15378. If it were determined to be a 'legal project' under CEQA, the proposed project is categorically exempt from review under CEQA pursuant to 14 Cal. Code of Regulations Section 15306 because the project involves information collection, consisting of data collection, research, and resource evaluation activities that will not result in a serious or major disturbance to an environmental resource. Staff will file a Notice of Exemption upon approval by the OPC.