Item 4b

Staff Recommendation
June 19, 2020

Application of An Integrated Earth System Model to Assess Effects of Anthropogenic Nutrient Inputs on Ocean Acidification and Hypoxia

Justine Kimball, Senior Climate Change Program Manager

RECOMMENDED ACTION: Staff recommends that OPC approve the disbursement of up to $998,600 to Southern California Coastal Water Research Project to conduct application of an integrated earth system model to assess effects of anthropogenic nutrients on ocean acidification and hypoxia.

LOCATION: Statewide

STRATEGIC PLAN OBJECTIVE(S): 1.2.1: By 2022, provide scientific guidance to the State Water Resources Control Board to inform new nutrient loading standards that minimize biological and chemical impacts including ocean acidification, hypoxia, and harmful algal blooms

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EXHIBITS:

Exhibit A: Letters of Support

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), OPC hereby finds that:
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> 1) The proposed project is consistent with the purposes of Division 26.5 of the Public Resources Code, the Ocean Protection Act;
> 2) The proposed projects are consistent with OPC's Proposition 84 grant program funding guidelines and environmental license plate funding guidelines (Interim Standards and Protocols, August 2013); and
> 3) The proposed project is not 'legal projects' that trigger the California Environmental Quality Act (CEQA) pursuant to Public Resources Code section, section 15378."

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

> "OPC hereby approves the disbursement of up to $998,600 to the Southern California Coastal Water Research Project to implement application of an integrated earth system model to assess effects of anthropogenic nutrients on ocean acidification and hypoxia.
>
> This authorization is subject to the condition that prior to disbursement of funds, Southern California Coastal Water Research Project 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 California coast is vulnerable to ocean acidification and hypoxia (OAH), which are driven by global climate change. Decisions on management of local pollution sources, which can exacerbate these stressors, is a key line of inquiry to address OAH in OPC's Strategic Plan (2020). OPC has previously invested substantial resources in the development of a coupled physical-biogeochemical OAH model for the entire West Coast as impacted by the California Current System. The National Oceanic Atmospheric Administration has matched the state in this investment. The model is now considered a state-of-the-art global example and has resulted in numerous peer-reviewed scientific publications. In the Southern California Bight, this effort has demonstrated that coastal anthropogenic nutrients, mainly from wastewater treatment plant effluent, are having a significant impact on OAH in this region.

Building off these initial findings in the Southern California Bight, additional work is proposed to better understand the relative impact of coastal anthropogenic sources and management strategies at different spatial and temporal scales, and to extend this effort to the San Francisco and Monterey Coasts. In the Southern California Bight, more work is needed to fully characterize and document the biogeochemical budgets, causal linkages, and attribution of local pollution sources to OAH. Also, model simulations with various different management scenarios, such as increased water recycling and reduced nutrient loading, are needed to better understand how management decisions impact OAH. In the San Francisco and Monterey Coasts, another region with a large coastal population, preliminary model simulations have been run, but additional higher resolution work is needed to understand system dynamics and attribution of local pollution sources in the same way as the Southern California Bight.

The results of these additional simulations will further be applied to investigate the relative roles of climate change, natural variability, and local anthropogenic pressures in shaping the habitats of key California Current species (e.g. pteropods, crabs, echinoderms and bivalves). This will allow us to better estimate the consequences of management decisions on biological effects. The results of this modeling effort and research project will be extremely useful for the State Water Resources Control Board to consider management or regulatory actions if needed.

Project Tasks:

Task 1. Synthesize OA thresholds for bivalves: This task will synthesize literature and develop acidification thresholds for California Current System bivalves that carry ecological and economic importance. It seeks specifically to answer the question: What is the scientific evidence for thresholds of adverse impacts of acidification on bivalves, specifically with respect to different pathways of organismal impacts (physiological, lethal, behavioral) that indicates deteriorating biological conditions by life stage, duration of treatment and type of habitat exposed?

Task 2. Assess the effects of point versus non-point source anthropogenic nutrient discharges on environmental effects in the Southern California Bight: This task will document the causal linkage of anthropogenic nutrient discharges to environmental effects, including net primary production, acidification, deoxygenation, and their biological consequences. This task will address two major questions: 1) What are the environmental effects of Mexican cross border wastewater inputs and 2) Across the Southern California Bight, what are relative environmental effects of point versus non-point sources of anthropogenic nutrients that are discharged via outfalls and rivers?

Task 3. Investigate how publicly owned treatment works (POTW) water recycling and nutrient management modifies environmental effects of POTW outfall discharges to the SCB: This task will investigate the effects of nutrient management and wastewater recycling scenarios in the Southern California Bight. This task will address two major questions: 1) What is the effect of wastewater recycling on coastal biogeochemistry (net primary productivity, carbon, nitrogen, and oxygen budgets) and biological responses? 2) How does nutrient management modify that effect?

Task 4. Validate and assess the environmental effects of San Francisco Bay versus Monterey coastal terrestrial influences on the San Francisco and Monterey Coasts: This task will document the impacts of San Francisco Bay versus Monterey Coast land-based inputs on OAH and its biological effects. This task will address three major questions: 1) What is the uncertainty in model predictions of Central Coast physics, biogeochemistry, and lower ecosystem responses? 2) What is the effect of San Francisco Bay exchanges (water versus materials), coastal POTW outfalls and coastal riverine and atmospheric sources of nutrients, organic matter and acidity on central coast shelf nutrient mass balance, productivity, carbonate chemistry, and oxygen? And 3) What is the spatial and temporal footprint of this impact over seasons and interannual climate cycles?

Task 5. Apply "biological linkage" tools to coast-wide acidification and deoxygenation status and trends assessment, investigations of causal linkages and management scenarios: This task will quantify the effects of California coastal acidification on potential habitat compression for marine pelagic and epibenthic calcifiers. It addresses the following questions: 1) What are the trends and variability in southern CCS marine calcifier habitat in the past two decades, specifically considering pteropods, echinoderms, decapods, and bivalves as sentinel taxa for pelagic and epibenthic habitats? 2) what are the net effects of point versus non-point sources of nutrients on potential habitat for marine calcifying sentinel taxa in the Southern California Bight, 3) what is the change in impact of wastewater recycling versus nutrient management on potential habitat for marine calcifying sentinel taxa in the Southern California Bight? And 4) What is the relative contribution of San Francisco Bay water and materials, coastal outfalls, and coastal rivers on changes in potential habitat for marine calcifying sentinel taxa in the San Francisco and Monterey Coasts?

About the Grantee

The Southern California Coastal Water Research Project (SCCWRP) is a public research and development agency that develops and applies next-generation science to improve management of aquatic systems in Southern California and beyond. Since its founding in 1969, SCCWRP has been developing strategies, tools and technologies that the region's water-quality management community relies on to more effectively protect and enhance the ecological health of Southern California's coastal ocean and watersheds.

Project Timeline

June 2020 – June 2022

PROJECT FINANCING:

Staff recommends that the Ocean Protection Council authorize encumbrance of up to $998,600 to Southern California Coastal Research Water Project to conduct application of an integrated earth system model to assess effects of anthropogenic nutrients on ocean acidification and hypoxia.

Ocean Protection Council	$998,600
TOTAL	**$998,600**

The anticipated source of funds will be from the Ocean Protection Council's Fiscal Year 2018/2019 appropriation of California Environmental License Plate Funds (ELPF). Using these funds to support this project is consistent with the California Ocean Protection Act, Section 35650(b), as well as OPC's Strategic Plan and Grant Program Funding Guidelines as discussed in more detail in the following section.

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)(2) as projects which:

- Improve management, conservation, and protection of coastal waters and ocean ecosystems
- 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

CONSISTENCY WITH THE OPC'S STRATEGIC PLAN:

This project directly implements Objective 1.2.1: By 2022, provide scientific guidance to the State Water Resources Control Board to inform new nutrient loading standards that minimize biological and chemical impacts including ocean acidification, hypoxia, and harmful algal blooms. Specifically, this project will examine, using an integrated earth system model, the effect of anthropogenic nutrient inputs to ocean acidification and hypoxia, and subsequent biological effects.

CONSISTENCY WITH THE OPC'S GRANT PROGRAM FUNDING GUIDELINES:

The proposed project is consistent with the OPC's Grant Program Funding Guidelines for Environmental License Plate Funds, in the following respects:

Required Criteria

1. Directly relate to the ocean, coast, associated estuaries, or coastal-draining watersheds: *The project directly investigates ocean and coastal processes to support best available science in decision-making and management.*
2. Support of the public: *See Exhibit A.*
3. Greater-than-local interest: *This project is statewide in scope with implications to the health and resilience of fisheries and ecosystems.*

Additional Criteria

4. Improvements to management approaches or techniques: *The findings from this project will provide scientific support and evidence so that the State Water Resources Control Board (SWRCB) may support new nutrient loading standards (regulatory loads) that minimize biological and chemical impacts from ocean acidification and hypoxia.*
6. Timeliness or Urgency: *The SWRCB's 2019 Ocean Plan Review identified "Ocean Acidification, Hypoxia, and Climate Change Impacts" as one its five highest-ranked issues. Further research is needed to evaluate how to develop water quality objectives and improve the resilience of the coastal environment. This project directly supports the priorities of the 2019 Ocean Plan Review.*
7. Coordination: *This project will compliment and coordinate with similar modeling efforts in San Francisco and Monterey Coasts.*

COMPLIANCE WITH THE CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA):

The proposed project is not a 'legal project' that triggers the California Environmental Quality Act pursuant to Public Resources Code section 21068 and Title 14 of the California Code of Regulations, section 15378.