CALIFORNIA OCEAN PROTECTION COUNCIL

Staff Recommendation
November 20-21, 2008

SOUTHERN CALIFORNIA BIGHT NUTRIENT LOADING STUDY

File No.: 08-134
Project Manager: Cina Loarie

RECOMMENDED ACTION: Authorization to disburse up to $440,000 to the Southern California Coastal Water Research Project to quantify and characterize natural and anthropogenic nutrient loading and its effects on the Southern California Bight, including harmful algal blooms.

LOCATION: Southern California Bight

STRATEGIC PLAN OBJECTIVE: Research and Monitoring, Ocean and Coastal Water Quality

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EXHIBITS

Exhibit 1: Map of the Southern California Bight study area

Exhibit 2: Map of the San Pedro Shelf intensive study area

Exhibit 3: Details and maps of the nutrient study sampling plan

Exhibit 4: Letters of Support

RESOLUTION AND FINDINGS:

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

"The Ocean Protection Council hereby approves the disbursement of an amount not to exceed $440,000 to the Southern California Coastal Water Research Project to quantify and characterize natural and anthropogenic nutrient loading and its effects on the Southern California Bight, including harmful algal blooms.

This authorization is subject to the condition that prior to disbursement of funds, the Southern California Coastal Water Research Project shall submit for the review and approval of the Secretary to the Council:

1. A work plan, including schedule and budget.
2. Evidence that all permits and approvals necessary to implement the project have been obtained.

3. Evidence that all matching funds necessary to complete the project have been secured."

Staff further recommends that the Council adopt the following findings:

"Based on the accompanying staff report and attached exhibits, the Council hereby finds that:

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 is consistent with the current Ocean Protection Council's project funding guidelines."

PROJECT SUMMARY

The proposed authorization would support a regional monitoring field program in the Southern California Bight ("SCB") (see Exhibit 1) that will assess the magnitude and effects of anthropogenic and natural nutrient loadings. The major nutrient loadings to the SCB (including wastewater effluent discharge, terrestrial runoff, and atmospheric deposition) will be quantified and characterized through a combination of regular monitoring, ship-based and pier-based sampling, stormwater monitoring, specialized atmospheric deposition sampling, remote sensing, and modeling (details of the monitoring are provided in Exhibit 3). More intensive sampling will take place on the San Pedro Shelf using four Southern California Coastal Ocean Observing System ("SCCOOS") gliders and will serve to more thoroughly evaluate coastal processes that affect nutrient budgets and bloom responses in a particular area (see Exhibit 2). The influence of nutrient sources on the algal bloom events will also be evaluated, with particular emphasis on harmful algal blooms ("HABs"), blooms that negatively impact the environment, human health, marine wildlife and/or coastal economies. The focus of the algal bloom study will be on the most frequently observed HAB in the SCB, *Pseudo-nitzschia*, which produces domoic acid.

The results of this project will contribute to evaluating current regulatory decisions regarding nutrient discharge into the nearshore environment and help to determine whether statewide criteria or regulation of nutrients into the ocean are necessary (such as the numeric nutrient endpoints and total maximum daily loads which currently do not exist for the nearshore environment). The public health department will benefit from this study both in the short-term by locating algal blooms in real time and in the long-term by evaluating the relationship between natural and anthropogenic nutrient sources and algal blooms.

PROJECT DESCRIPTION

Project Background

Eutrophication from increased nutrient loading to coastal waters is one of the top three leading causes of water impairment in California. The magnitude of nutrient loading from both anthropogenic and natural nutrient sources and the effects of this loading are not well documented. No statewide criteria exist for the evaluation or management of these impacts to the coastal ocean despite California's $43 billion "ocean dependent economy"[1].

[1] National Ocean Economics Program, 2005, California's Ocean Economy, Report to the Resources Agency, State of California.

Nutrients enter the ocean through many pathways. Anthropogenic nutrient pathways include wastewater effluent discharge (such as continuous inputs from sewage outfalls and anthropogenically-fed river flows), terrestrial runoff, and atmospheric deposition, while natural pathways include ocean upwelling, advection[2], and wind-driven dust transport.

The coastal zone of Southern California is a highly built-up urban environment. Development in this region has been shown to significantly alter both the timing and rate of runoff releases to coastal waters and can affect water quality through addition of sediment, toxic chemicals, pathogens, and nutrients. These nutrients provide ideal conditions for algal growth, which cause an increase in algal cells or a 'bloom.' Some algae contain harmful toxin which at high concentrations during algal blooms can negatively impact the ecosystem and the coastal economies

The importance of evaluating the relative nutrient contributions from different sources into the SCB has become increasingly evident with the increased occurrences of HABs and eutrophication events. A study investigating the timing and magnitude of nutrient delivery to the coastal ocean will be extremely valuable and can offer important information about how to effectively monitor and combat chronic or sporadic nutrient loads throughout California's waterways. Additionally, the regional information from the SCB will have statewide implications and could be used by state regulators and the U.S. Environmental Protection Agency to determine if and how nutrient discharges to the oceans need to be more tightly controlled.

Project Details and Scope of Work:

The proposed two-year project will take place in the SCB from Point Conception to San Diego, with one additional pier sample from San Luis Obispo (see Exhibit 1). This study can be broken down into three main components:

1. Quantification and Characterization of Nutrient Inputs

The major sources of nutrients to the SCB (upwelling, wastewater discharge, terrestrial runoff and atmospheric deposition) will be quantified and characterized through a combination of regular monitoring, ship-based and pier-based sampling, stormwater monitoring, specialized atmospheric deposition sampling, remote sensing, and modeling (see Exhibit 3 for details). Weekly sampling will be conducted at each of the piers (Exhibit 1) and ship-based sampling during HAB and upwelling events. These data will be used to investigate the timing and magnitude of nutrient delivery to the coastal ocean relative to remotely-sensed and field observations of algal blooms in the SCB (see below).

2. Intensive Nutrient and Bloom Assessment on the San Pedro Shelf

An intensive study of coastal processes that affect nutrient budgets and bloom responses will take place on the San Pedro Shelf (see Exhibit 2). Four SCCOOS gliders will be deployed to map physical, chemical, and biological oceanographic parameters during the four-month field observational period. This area was chosen as the intensive study area for the following reasons: (1) there is a large amount of historical data, (2) two of the four major sewage discharge outfalls are located in this area as well as three major river discharges and an upwelling zone, therefore providing both anthropogenic and natural sources of nutrients to

[2] "Advection" refers to horizontal movement of water, as in an ocean current.

the SCB, and (3) this is an area of high urban influence in the SCB.

By maintaining a continuous presence over the four-month period, it is anticipated that these observations will provide a more accurate evaluation of the relative contribution from both natural and anthropogenic sources, improve the accuracy of numerical modeling, and provide information necessary to design future observational/modeling networks necessary to evaluate and predict processes along the California coast. The results of this intensive study can be applied to other highly urbanized areas.

3. Assessment of Algal Blooms

The occurrence, spatial extent, and duration of algal blooms in the SCB will be monitored using a combination of remote sensing, gliders, pier-based and ship-based sampling, remotely sensed ocean color, and modeling. The historical patterns of algal bloom frequency and biomass will be compared with modeled estimates of historic nutrient loads since 1997 from the four sources to understand trends over time.

The researchers will identify the specific coastal ocean conditions and nutrient sources that contribute to the development and maintenance of algal bloom events, with a particular emphasis on anthropogenic versus natural nutrient sources and HABs. These results will be communicated to other HAB research groups including federal, state and local agencies and academic researchers through the California HAB alert network (called the Harmful Algal Bloom Monitoring and Alert Program ("HABMAP"). These data will also be coordinated with the SCCOOS HAB pier surveillance projects and the two NOAA-funded Monitoring and Event Response for Harmful Algal Blooms (MERHAB) programs. The emphasis of the study will be on a diatom, *Pseudo-nitzchia*, which is a type of phytoplankton that produces domoic acid[3] (the most prevalent HAB in the SCB).

The project will also make information and observations regarding HAB species abundance and toxicity in SCB publicly available on the SCCOOS website in near real-time. This site will be targeted for end users, such as resource managers, public health agencies, and marine wildlife rescue organizations.

Throughout the study, two different models, (1) the physical circulation model (ROMS) currently used by both SCCOOS and Central and Northern California Ocean Observing System ("CeNCOOS"), and (2) a biogeochemical (nutrients, phytoplankton, zooplankton – NPZ) model will be utilized. The models will be used to provide (1) a real time 'nowcast' of current ocean conditions and (2) a 3-5 day forecast of predicted conditions. The nowcasts and forecasts can be utilized to help inform management decisions concerning the anticipated threat to human health and the environment. The study will provide a unique opportunity to evaluate the accuracy of the two models, including their ability to quantify chemical constituents, on a regional scale, and will provide a basis for improving future models.

To ensure that the approach taken by this study will be technically sound and scientifically robust, the workplan and field operations manual, designed by the Bight Regional Monitoring Group, was extensively reviewed and approved by the Bight Steering Committee comprised of high-level managers. The scientific protocols and methods used in the study will conform to

[3] Domoic acid is a chemical that can bioaccumulate in marine organisms, such as shellfish, anchovies, and sardines, that feed on phytoplankton. In mammals, including humans, domoic acid acts as a neurotoxin, causing short-term memory loss, brain damage and, in severe cases, death.

ongoing programs already in place, i.e., the permit monitoring for ocean waters and stormwater, the MERHAB project, and the SCCOOS HAB project, as well as standard protocols that have been peer reviewed and published for each parameter.

Regionwide significance

The proposed study addresses Action 1.3 of the West Coast Governor's Agreement on Ocean Health "Action Harmful Algal Blooms and Hypoxia" by supporting the expansion of ocean observing system monitoring efforts in California. Use of the ocean observing system will help expand the understanding of dynamics of nutrients in our oceans and their resulting effects, including the formation of HABs.

In February 2009, SCCWRP will host a HAB workshop in Portland, OR in conjunction with federal partners to reach consensus on the present state of knowledge on the West Coast. Data from this study could provide valuable insight needed by decision makers to lessen the impacts of the HAB events on humans and marine resources.

Study Collaborators

Given the large-scale regional perspective of the proposed project, existing programs and innovative technologies will be leveraged to significantly increase the level of resulting information. The existing programs include:

1. The Bight 2008 Regional Survey, organized by the Southern California Coastal Water Research Project (SCCWRP), which coordinates many local, county, state, academic and non-profit organizations to address a specific scientific topic
2. The SCCOOS, which provides numerous physical, chemical and biological observations, particularly the HAB surveillance program as well as physical and biogeochemical models
3. The sanitation districts' quarterly ship-based water quality surveys (as required by the National Pollutant Discharge Elimination System (NPDES) permits) that will be used to collect physical, chemical and biological data
4. The NOAA-funded MERHAB program in Southern California
5. The Storm Water Monitoring Coalition (SMC) agencies' storm monitoring as part of its NPDES permits during the period of November 2008 – November 2009.

Several researchers involved in the proposed project are also involved with the California HAB alert network (called HABMAP, Harmful Algal Bloom Monitoring and Alert Program). The HAB alert network consists of a larger coordinated group of researchers, including local, state, federal, academic and non-profit organizations.

Project Timeline

The overall field study period is from November 2008 – November 2009. Ship-based event sampling will occur between January and June 2009. The intensive glider deployment period on the San Pedro Shelf is from mid-February 2009 through mid-June 2009. The data will be analyzed, interpreted and written into the Bight Regional Monitoring Program report and many peer-reviewed published journal papers that should be completed by November 2010.

PROJECT GRANTEE

The Southern California Coastal Water Research Project (SCCWRP) is a research institute focusing on the coastal ecosystems of Southern California, from watersheds to the ocean. SCCWRP was formed in 1969 as a joint powers agency. The common mission of its member agencies is to contribute to the scientific understanding of linkages among human activities, natural events, and the health of the Southern California coastal environment; communicate this understanding to decision makers and other stakeholders; and recommend strategies for protecting the coastal environment for this and future generations. SCCWRP organizes the Bight Regional Monitoring Program and participates in data collection, data analyses and compilation of the results.

SITE DESCRIPTION

The proposed project extends 450 miles along the Pacific coast from Point Conception to San Diego and encompasses the entire Southern California Bight (See Exhibit 2). The SCB is an open embayment made up many different habitats including kelp beds, sandy coastlines, estuaries, lagoons, and deep waters. The geographic and oceanographic conditions support an abundant variety of marine biota formed into rich ecosystems.

PROJECT FINANCING

Funding is requested for currently unfunded items that will significantly enhance the project and the level of information provided for regulatory decision-making.

Ocean Protection Council	$440,000
In-kind funding from Agency Partners*	1,700,000
Total Project Cost	**$2,140,000**

The anticipated source of funds for the grant is the fiscal year 2007-2008 appropriation from the "Safe Drinking Waters, Water Quality and Supply, Flood Control, River and Coastal Protection bond Act of 2006" (Proposition 84). Proposition 84 (Public Resources Code Section 75060) authorizes the use of these funds for expenditure on projects that protect beaches, bays and coastal waters and watershed consistent with 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. The project is consistent with the Trust Fund purposes as discussed in the following section.

The proposed project is also appropriate for prioritization under the selection criteria set forth in Section 75060(g). Section 75060(g) provides that the Council will give priority to projects which develop scientific data needed to adaptively manage the state's marine resources and reserves.

* Many collaborating organizations are providing matching funds through the services or funding provided as part of their participation. The following entities are providing matching in-

kind funding: Aquatic Bioassay and Consulting Laboratories, Inc., California Department of Public Health, California State Polytechnic University, City of Long Beach, City of Los Angeles, City of Oceanside, City of Oxnard, City of San Diego, Jet Propulsion Laboratory, Los Angeles County Sanitation Districts, Los Angeles County Department of Public Works, Los Angeles Regional Water Quality Board, National Oceanic and Atmospheric Administration, Orange County Sanitation District, Orange County Resources and Development Management Department, Riverside County Flood Control District, San Bernardino Flood Control District, San Diego County Department of Environmental Health, San Diego Regional Water Quality Control Board, Santa Ana Regional Water Quality Control Board, Scripps Institution of Oceanography, State Water Resources Control Board, Southern California Coastal Water Research Project, University of Southern California, University of California at Santa Barbara, University of California at Los Angeles, Ventura County Watershed Protection Division.

CONSISTENCY WITH CALIFORNIA OCEAN PROTECTION ACT

This project is consistent the Ocean Protection Act (Division 26.5 of the Public Resources Code). Section 35615 specifically directs the Council to coordinate activities of state agencies, establishing policies to coordinate the collection of scientific data related to the ocean. This is a highly collaborative project that combines over 30 federal, state, county and local agencies and multiple academic institutions (including NOAA, the State Water Resources Control Board, the southern California Regional Water Boards, Orange County Sanitation District, Los Angeles County Sanitation District, City of Los Angeles, City of San Diego, University of Southern California, University of California, Santa Barbara, San Diego and Los Angeles, California Institute of Technology, California State Polytechnic University).

This study will also identify management actions that could help monitor, mitigate, or prevent the increased occurrence of HABs and could lead to new legislation to improve management pertaining to natural and anthropogenic nutrient loadings in the coastal ocean.

The Ocean Protection Act identifies trust fund allowable projects in PRC Section 35650 (b)(2), as including projects that:

> (D) Improve coastal water quality
>
> (G) Provide monitoring and scientific data to improve state efforts to protect and conserve ocean resources

The proposed project is consistent with the trust fund allowable projects listed above in that the study will: (1) provide information about the cause and maintenance of nutrient loading and HABs; (2) make recommendations for improving management and protection of coastal waters and ocean ecosystems from nutrient loading; (3) provide monitoring and scientific data on nutrient loading to improve the state's efforts to protect and conserve ocean resources threatened by nutrient loading in Southern California; and (4) support the protection of coastal waters and ocean ecosystems through the recommendation of management actions to prevent or mitigate nutrient loading and the proliferation of HABs.

CONSISTENCY WITH OPC'S STRATEGIC PLAN GOAL(S) & OBJECTIVE(S)

The proposed project is consistent with the Council's Five Year Strategic Plan by furthering the

following goals and objectives:

Goal B (Research and Monitoring) Objective 1b: "Support programs that seek to provide a better scientific understanding of impacts to ocean and coastal ecosystems." The nutrient loading study will result in comprehensive evaluation on the cause and effect of natural and anthropogenic induced nutrient loading in the Southern California Bight.

Goal B (Research and Monitoring) Objective 2c: "Support and expand existing ocean observing and monitoring programs." The nutrient loading study will provide valuable support for collection of data that will document the magnitude of nutrient loading from both anthropogenic and natural nutrient sources. The study will result in a more comprehensive understanding of nutrient discharge on the ecosystem.

Goal C (Ocean and Coastal Water Quality) Objective 4c: "Promote improved monitoring and forecasting of harmful algal blooms." The nutrient loading study will gather critical data on natural and anthropogenic nutrient inputs and serve to more effectively predict and prevent associated algal blooms.

CONSISTENCY WITH OPC'S PROJECT FUNDING GUIDELINES

The proposed project is consistent with the OPC's Project Funding Guidelines adopted June 14, 2007, in the following respects:

Required Criteria

1. **Directly relate to the ocean and coast**: The area of study is the coastal ocean from Point Conception to San Diego (with an additional point in San Luis Obispo).
2. **Support of the Public:** This study's supporters include the Division of Water Quality at the State Water Resources Control Board and the California Department of Public Health (see Exhibit 4).
3. **Greater-than-local interest:** This regional scale monitoring program encompasses 450 miles of California's 1,100 mile coastline. The findings will enhance scientific research and have state-wide implications for management of the ecosystem.

Additional Criteria

4. **Resolution of more than one issue:** This project focuses on both chemical issues of nutrient loading and the resulting biological issues of algal blooms.
5. **Leverage:** See the "Project Financing" section above.
7. **Innovation:** The modeling and glider components are both innovative methods to evaluate oceanographic conditions.
8. **Coordination:** This is a highly collaborative project that combines over 30 federal, state, county and local agencies and multiple academic institutions (including NOAA, the State Water Resources Control Board, the southern California Regional Water Boards, Orange County Sanitation District, Los Angeles County Sanitation District, City of Los Angeles, City of San Diego, University of Southern California, University of California, Santa Barbara, San Diego and Los Angeles, California Institute of Technology, California State

Polytechnic University). SCCWRP will coordinate these organizations to complete the project and disseminate the findings.

CONSISTENCY WITH OPC'S 2007/2008 FUNDING PRIORITIES

The proposed nutrient loading study fulfills two issues identified in the 2007/2008 Funding Priorities: (1) "Research and Monitoring: Focus on High Priority State Needs" in that this study integrates a wide range of valuable ocean monitoring techniques and (2) "Ocean and Coastal Water Quality: Focus on Polluted Runoff" in that this study will provide crucial research that can be used to better address the effects of nutrient loading coastal sources including non-point source pollution.

COMPLIANCE WITH CEQA

The proposed project is categorically exempt from review under the California Environmental Quality Act ("CEQA") pursuant to 14 Cal. Code of Regulations Section 15306 because the project involves only data collection, research and resource evaluation activities that will not result in a serious or major disturbance to an environmental resource. While the study may result in action by a public agency, that action, if any has not yet be approved, adopted or funded. Staff will file a Notice of Exemption upon approval by the Council.