CALIFORNIA OCEAN PROTECTION COUNCIL

Staff Recommendation
September 13, 2012

Ocean Acidification
(Revised per Council Vote)

RECOMMENDED ACTION: Consideration and possible Council direction to the OPC Science Advisor to assess the current the scientific understanding of ocean acidification, work with state resource managers to identify key management questions and report findings to the Council at a future meeting.

LOCATION: Statewide

STRATEGIC PLAN FOCAL AREA: Science Based Decision-Making

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 directs the OPC Science Advisor to assess the current the scientific understanding of ocean acidification and the related issue of low dissolved oxygen, work with state resource managers to identify key management questions and report findings to the Council at a future meeting."

Staff further recommends that the Ocean Protection Council adopt the following findings:
"Based on the accompanying staff report and attached exhibits, the Ocean Protection Council hereby finds:

1. The proposed action is consistent with the purposes of Division 26.5 of the Public Resources Code, the Ocean Protection Act.
2. The proposed project is consistent with the Ocean Protection Council's strategic plan, adopted February 17, 2012."

PROJECT SUMMARY:
Staff seeks endorsement from the OPC to direct the OPC Science Advisor to assess the current the scientific understanding of ocean acidification, work with state resource managers to identify key management questions related to ocean acidification and report findings to the Council at a future meeting. Ocean acidification refers to the uptake of CO_2 in the ocean which changes seawater chemistry, causing it to be more acidic, or reducing its pH. Assessing changes in pH is challenging due to the spatial and temporal variability of pH—not all water carries the same value of pH—this is affected by natural changes oceanic processes (such as upwelling), and future unknown changes to oceanic currents from climate change. Given the complexity of this issue, staff recommends that the OPC Science Advisor assess the current the scientific

understanding of ocean acidification, work with state resource managers to identify key management questions and report findings to the Council at a future meeting.

BACKGROUND: Ocean Acidification: Understanding the Issue

Since the Industrial Revolution, human activities have resulted in atmospheric carbon dioxide (CO_2) levels rising by nearly 40 percent. The world's oceans absorb approximately 30 percent of the annual human-induced CO_2 output. This oceanic uptake of CO_2 is changing seawater chemistry, causing it to be more acidic, or reducing its pH. This phenomenon is known as ocean acidification. Over the past two centuries ocean surface waters are 25 to 30 percent more acidic than pre-Industrial Revolution levels. Over the next century, surface ocean pH is projected to drop an equivalent amount.

Ocean acidification directly impacts organisms such as coral, plankton and shellfish by inhibiting the shell and skeleton-forming processes. This is because a reduction in pH reduces the availability of carbonate ions—molecules needed for shell and skeleton forming processes. More acidic seawater can, among other things, corrode the calcium carbonate shells of organisms such as corals, oysters, sea urchins, lobsters and abalone. Shell-building organisms are particularly vulnerable to corrosion during their larval and juvenile stages. Ocean acidification impacts to coastal and marine environments could also be compounded by multiple stressors, including pollution (e.g., excess nutrients, nitrogen, sulfur, phosphorous), changes in freshwater input to coastal areas, overfishing and habitat degradation.

Above and beyond the effects of rising carbon dioxide on ocean pH, decomposing organic matter in deep waters also releases carbon dioxide. Because of this, deeper waters off California are more acidic than the rest of the water column. Oceanographic processes along the west coast of North America lead to coastal upwelling: during the summer months, cold and nutrient-rich bottom waters are driven to the surface. While upwelling provides the nutrients that support California's productive fisheries, it also transports more acidified waters to the surface, further exacerbating acidification along the west coast. This natural process, combined with acidification from anthropogenic inputs, puts California's coastal ecosystems and fisheries at risk. While scientists are rapidly advancing our knowledge of this complex system, we still do not have a thorough understanding of the potential impacts of increasingly acidified coastal waters.

Challenges such as future climate change impacts to ocean currents, and difficulties in assessing ocean pH, make ecosystem impacts more difficult to predict. Climate change will have impact on ocean currents and thus a change in upwelling patterns, but these changes, and therefore the impact of the upwelling of more acidic waters, are not well known. Similarly, measurement of water pH is complex and the development of these data sets is not easy. Given these challenges, it will be difficult to predict the full-range of impacts to organisms and ecological responses to ocean acidification.

An OPC project funded through the California Sea Grant in 2008 will provide insights into effects of coastal upwelling and implications for ecosystems along the California coast. In particular, a multi-disciplinary team will conduct field and laboratory experiments to: (1) investigate the extent of ocean acidification at a site in coastal California; (2) examine the effects of elevated carbon dioxide on calcification rates in red sea urchins, mussels and abalone at different life stages; (3) use molecular tools to link calcification rates with gene expression, and (4) document changes in gene expression at elevated seawater carbon dioxide levels. The project

cost $270,000 and final products for this project are expected in the spring of 2013.
West coast researchers, including those supporting the west coast ocean-observing systems, the OPC Science Advisor, and stakeholders from the aquaculture and fishing industries have convened a network – the California Current Acidification Network (C-CAN) – to encourage collaborative, interdisciplinary approaches to our understanding of ocean acidification and its potential impacts. This effort is in response the complexity of the issue, and the recognition that to more effectively support stakeholders we must advance our understanding collectively, using standardized measurements and data-sharing technology.

While C-CAN and various other efforts are critical to a coordinated approach to understanding this issue, California requires a process whereby an interdisciplinary team of expert scientists provide updates on the rapidly evolving science of ocean acidification to state-level decision makers. Staff therefore recommends the OPC direct the OPC Science Advisor, supported by the OPC Science Advisory Team, to assess the current scientific understanding of ocean acidification, work with resource managers to identify management questions and report findings back to the Council at a subsequent OPC meeting.

CONSISTENCY WITH THE CALIFORNIA OCEAN PROTECTION ACT:
The proposed action is consistent with the California Ocean Protection Act (Division 26.5 of the Public Resources Code). Section 35615(a)(1) specifically directs the Council to coordinate activities of state agencies to improve the effectiveness of state efforts to protect ocean resources. In addition, subsection (5) of this section directs the OPC to provide the results of its research and investigations to state agencies to provide information for policy development. The Council may expend funds on projects that are consistent with these responsibilities given to the OPC. Pub. Res. Code § 35650(b)(1).

CONSISTENCY WITH THE OPC'S STRATEGIC PLAN ISSUE(S) & OBJECTIVE(S):
Focal Area A (Science Based Decision Making), Issue 3: Developing Strategies and Building Institutional Capacity to Incorporate Scientific Information into Management Decisions. Objective 3.1: "Promote and encourage the institutional support, capacity, and leadership role of the OPC-SAT and harness the substantial scientific expertise within California and beyond to inform policy and management decisions." The Plan suggests the OPC "[s]upport the OPC-SAT and promote its service to and coordination with other state and local agencies that would benefit from scientific expertise." The proposed action will call upon the Science Advisor and OPC-SAT to provide information to better inform policy and management decisions to address the impacts of Ocean Acidification.

Focal Area B (Climate Change), Issue 5: Ecosystem Impacts of the Changing Climate.
Objective 5.1: "Provide for improved understanding of how changing climate and ocean chemistry will alter California's ocean and coastal ecosystems and the benefits they produce." In order to achieve this objective the Plan proposes the OPC "[p]rovide coordination and support to synthesize current scientific understanding of how our marine and coastal ecosystems and ecological assemblages will change in the coming decades as the climate and ocean chemistry changes." The proposed action will provide California decision-makers a greater understanding of the impacts resulting from ocean acidification—a phenomenon that is known to be a result

from climate change.

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 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.