OPC-SAT Working Group: Exploring Aquatic Vegetation as an Ocean Acidification Management Tool in California

About this document - This document was prepared by Ocean Science Trust in response to the discussions and recommendations of the Ocean Protection Council Science Advisory Team at the April 18, 2016 Science Advisory Team Workshop: *Bracing for Change*. Below we provide an overview of the need and scope, project activities, deliverable, and timeline for the period of November 2016 to May 2017.

I. Overview

California is interested in addressing the global challenge of ocean acidification (OA) and is exploring local and regional management strategies that can reduce exposure and enhance the ability of biota to cope with OA stress. In early 2016, the West Coast Ocean Acidification and Hypoxia Science Panel[1] (Panel), convened by Ocean Science Trust at the request of the California Ocean Protection Council, recommended that West Coast states advance approaches that remove CO_2 from seawater[2], including making use of photosynthesizing plants in shallow coastal environments. In addition, recent legislation in California (Senate Bill No. 1363, Monning, 2016) calls for scientific and evidence-based approaches to protect and restore eelgrass beds as a critical strategy in enhancing California's ability to withstand OA.

Coastal and estuarine plant species, or submerged aquatic vegetation (SAV), have the potential to uptake carbon and modify pH within their canopy and surrounding waters. These habitats may potentially provide natural acidification refugia to surrounding species, as well as many additional ecosystem services (carbon sequestration, essential fish habitat, shoreline buffering, water quality, biodiversity, etc.). On the West Coast, two dominant SAV habitats, seagrasses and kelps, show promise in their capacity to ameliorate acidification on local scales, and are under active investigation in coastal regions of California, Oregon, and Washington.

As California and coastal communities consider nature-based adaptation strategies for OA, the State is challenged with identifying when, where, and conditions under which SAV restoration and protection can most successfully be applied to ameliorate ocean acidification. At their October 17, 2016 meeting,[3] the California Ocean Protection Council approved funding for carbonate chemistry monitoring and research on natural and restored eelgrass beds in Bodega Harbor, Tomales Bay, Elkhorn Slough, Newport backbay, Humboldt Bay and others. The State is also developing an inventory of eelgrass habitat and monitoring assets throughout California, and has funded the California Ocean Science Trust to build out an ocean acidification "hotspots" inventory, which is also in response to a recommendation

[1] Visit www.westcoastOAH.org for Panel products and information
[2] See Panel Recommendation 2, *Major Findings, Recommendations, and Actions*
[3] http://www.opc.ca.gov/2016/09/ocean-protection-council-meeting-monday-october-17-2016/

from the Panel. These projects are important first steps in broadening our understanding of this issue, but there are still many knowledge gaps and unanswered questions, including how these habitats may expand or degrade with future climate change (e.g., sea level rise, rising sea surface temperatures). Further, while these individual projects and case studies provide valuable information, there is a need to coalesce this information into a statewide context – providing technical guidance for investment and policy issues.

II. About the OPC-SAT Working Group

To assist the State with synthesizing knowledge from SAV OA amelioration demonstration projects on the West Coast and prioritizing next steps for California, the Ocean Science Trust will convene a working group of the Ocean Protection Council Science Advisory Team (OPC-SAT)(see Appendix A). The impetus for this working group developed from discussions and recommendations of the OPC-SAT at their April 18, 2016 workshop "*Bracing for Change*," where OPC-SAT members and decision-makers identified areas where OPC-SAT could inform the State in implementing the recommendations of the Panel.

Ultimately, the State is interested in identifying locations of existing SAV habitats and associated monitoring assets, the potential for these habitats to ameliorate acidification and sequester carbon, and optimal locations for habitat restoration and expansion that would maximize OA amelioration in the context of other co-benefits, taking into account future climate change over the next century. Existing efforts are underway which begin to address components of this need, with a particular focus on estuarine ecosystems. The OPC-SAT working group will draw from and synthesize knowledge across these efforts and assess knowledge gaps. They will provide the State with guidance that can inform future funding decisions and natural resource management efforts.

Working Group Scope

The charge to the working group, described below, was informed by conversations with state and federal decision-makers and other thought leaders, and scoped in close consultation with staff from the Ocean Protection Council. The working group will primarily focus on SAV habitats in California state waters (0-3 miles offshore) and estuarine habitats, drawing upon relevant work West Coast wide.

- **Methods Assessment and Guidance:** Provide a high-level summary of the current monitoring approaches to evaluate and quantify the capacity of SAV to ameliorate OA, focusing on monitoring designs to achieve different management goals. Recommend research and monitoring strategies to refine and extend our understanding of how best to quantify OA amelioration and determine whether it has a measurable benefit to species of interest.
- **Scaling Up**: Provide guidance on how existing SAV monitoring efforts can be scaled-up statewide to measure the role of SAV in mitigating OAH and impacts to species of interest, accounting for local and regional differences in the drivers of OAH and other stressors. Conduct a gap analysis and identify "top priority" monitoring investments needed to assess SAV as an OA mitigation strategy,

considering the multiple stressors to these habitats (hypoxia, water quality, etc.) that may affect this ecosystem service. Monitoring guidance will consider metrics and data needed to plan, prioritize, and/or site SAV restoration projects as nature-based adaptation strategies to mitigate climate impacts and optimize ecosystem services (ocean acidification buffering, essential fish habitat, water quality, carbon sequestration etc.). Current demonstrations and efforts focused on ocean and estuarine acidification may be expanded and built upon to provide guidance at the State level on the role of SAV in ameliorating those impacts in California, across the West Coast and nationally (see Appendix B: Building off Existing Efforts).

- **Informing Management:** Explore how data from California's existing monitoring assets in kelp and seagrass habitats can guide management decisions about if, when and where SAV protection and restoration will be most successful and beneficial as an OA management strategy. As part of this analysis, the working group will evaluate and consider the suite of benefits of SAV restoration and conservation projects to key species of interest (e.g., juvenile Dungeness crab) and the potential trade-offs in management outcomes associated with site selection. Additionally, the group will provide guidance on how to ensure current and future monitoring investments are integrated and applied by State Agencies and non-governmental organizations so that they can better align with management objectives and address science gaps.
- **Understand Future Stress:** Provide a high level summary of how sea level rise and warming may impact the various ecosystem services provided by SAV, with a focus on acidification amelioration. Identify future science needs.

III. Project Activities

Task 1. Scope and process development, assemble working group

Timeline: November – December 2016

Ocean Science Trust staff will work closely with Ocean Protection Council staff and OPC-SAT working group co-chairs to develop and formalize a scope, process and timeline (this document). The process will be informed by conversations with experts in the field, as well as with representatives from agencies involved in coastal natural resource management in California.

Ocean Science Trust will determine an appropriate number of working group members (from six to eight individuals) given the nature and complexity this issue. Karina Nielsen, San Francisco State University, and Jay Stachowicz, UC Davis, were identified as working group co-chairs at the April 18, 2016 OPC-SAT workshop and have agreed to serve in this role. Working group members (see Appendix A) will have expertise in the following:

- Biology and ecology of coastal ecosystems, with a focus on aquatic vegetation
- Marine and estuarine biogeochemistry, carbon cycling dynamics and ocean acidification

- Research and monitoring related to coastal and estuarine restoration and protection
- Natural resource management and policy related to SAV

Ocean Science Trust will solicit recommendations for experts from the OPC-SAT, as well as from Ocean Science Trust's and the Ocean Protection Council's professional networks. OST and the Working Group Chairs will select group members to best encompass the required expertise. An honorarium will be provided to working group participants.

Ocean Science Trust will develop necessary collateral materials, including a webpage for the working group on Ocean Science Trust's website, social media and blog posts (e.g., OceanSpaces.org), assemble a key contacts list, and work with the Ocean Protection Council to disseminate materials to appropriate audiences.

Task 2: Conduct work via remote meetings and host an in-person workshop

Timeline: December 2016 – March 2017

Once the working group is assembled, Ocean Science Trust will host a series of remote calls/webinars, as needed, and an in-person workshop to be held in early 2017. Call/webinar and workshop attendees will include working group members and natural resource managers, as appropriate.

In advance of any meetings, participants will be provided with an agenda that outlines the goals of the meeting, identifies supplementary materials, and maps out how time will be spent. Experts will be asked to familiarize themselves any informational materials, and in some cases, conduct advance work to bring to the group (e.g., prepare presentations). A desired outcome of an in-person workshop is a draft outline of the guidance document.

Task 3: Develop and deliver scientific guidance report

Timeline: March – May 2017

Working group members will contribute to developing a final report that will provide the Ocean Protection Council with guidance that can inform next steps for California as it leverages existing monitoring assets and prioritizes new investments to where and how to protect and restore SAV as an acidification management strategy (see IV. Deliverable and Outcomes).

Outreach and Communications

Ocean Science Trust will provide a draft preview with OPC and additional agency staff, as appropriate, before releasing the document publicly on Ocean Science Trust website. Prior to finalization, the working group product will also go through a full OPC-SAT approval process. The final report will be circulated to OAH Panel members, posted on the C-CAN listserv, the OPC website, distributed to key agencies and partners, and posted on Ocean Science Trust social media and in a blog post on OceanSpaces.org.

Ocean Science Trust or a working group member may present findings from this working group at in-person agency meeting(s). Ocean Science Trust will support the Ocean Protection Council in efforts to update and inform the State legislature on progress towards implementing SB 1363.

IV. Deliverable and Outcomes

The working group will develop a scientific guidance report for the California Ocean Protection Council focused on the elements identified in the working group scope outline above. This guidance will help ensure that existing and future investments in SAV research, monitoring, habitat restoration, protection and expansion are cost-effective and informed by the best available science. The recommendations made as a result of this working group can inform future actions in California and beyond, including those of the Ocean Acidification and Hypoxia Reduction Program (Senate Bill No. 1363), and the ocean acidification and hypoxia task force (to be convened per Assembly Bill No. 2139).

Working Group Leads and Staffing

Working Group Co-Chairs

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Timeline

Milestone/Deliverable	2016			2017						
	O	N	D	J	F	M	A	M	J	J
Task 1: Scope and process development, assemble working group										
Develop scope and process with OPC, co-chairs			X							
Convene working group			X	X						
Develop collateral (webpage, 2-pager)			X							
Task 2: Conduct work via remote and in-person meetings										
Kickoff call/webinar 1				X						
Working group call/webinar 2				X						
Workshop agenda development, logistics				X	X					
Host In-Person Workshop, Oakland, CA				X	X					
Develop workshop summary					X	X				
Task 3: Develop scientific guidance										
Develop draft guidance document						X	X			
Working group call/webinar 3							X			
Guidance document external review								X		
Final report to OPC								X		

Appendix A: SAV Demonstration and Other Relevant Projects or Workshops

Project Title: Potential seagrass buffering of Humboldt Bay to ocean acidification and implication for aquaculture industry and hatchery and eelgrass managers

Lead: California State University, Humboldt

Location: Humboldt Bay, Trinidad, California

More information: link

Project Title: Seagrasses' ability to ameliorate estuarine acidification

Lead: University of California, Davis

Location: Bodega Harbor, Tomales Bay, Newport Back Bay, and Elkhorn Slough, California

More information: Link

Project Title: Inventory of ocean acidification and hypoxia hotspots

Lead: Ocean Science Trust

Location: Statewide

More information: Link

Project Title: Seaweed cultivation as a strategy for mitigating ocean acidification

Leads: Puget Sound Restoration Fund in collaboration with NOAA, Pacific Marine Environmental Laboratory, NOAA, Northwest Fisheries Science Center, University of Washington, Applied Physics Laboratory, Washington Ocean Acidification Center, System Science Applications, Washington Department of Natural Resources, Washington Sea Grant and Anchor QEA

Location: Puget Sound, Washington

More information: www.restorationfund.org/projects/kelp

Project Title: Workshop, "Monitoring for Ocean Acidification Threats in West Coast Estuaries: A San Francisco Bay Case Study"

Leads: San Francisco Estuary Institute (SFEI), Romberg Tiburon Center for Environmental Studies, San Francisco State University (RTC), Coastal and Marine Sciences Institute, University of California Davis, Southern California Coastal Water Research Project Authority (SCCWRP), U.S. Environmental Protection Agency (EPA), San Francisco Estuary Partnership (SFEP), California Ocean Science Trust (OST)

Location: Richmond, California

More information: The workshop summary will be publically available January 2017 at www.sfei.org.

Project Title: Workshop, "Eelgrass and acidification"

Lead: University of California, Davis

Location: Bodega Marine Laboratory, Bodega Bay, California

More information: The workshop products will be publically available in 2017 or when completed.

Project Title: Sea Grass as Possible Ocean Acidification Refugia for Shellfish in a High CO2 World

Lead: George Waldbusser, Oregon State University

Location: various locations and hatcheries, Oregon

More information: link