

Ocean Protection Council Science Advisory Team Workshop: Bracing for a changing world

April 18, 2016

10:00AM – 5:00PM

Hosted by California Ocean Science Trust
Elihu M. Harris State Building, Room 1, Oakland, CA

Workshop Participants

SAT Executive Committee: F. Chavez (Co-chair), K. Nielsen (Co-chair), M. Carr (Co-chair Emeritus)

Other SAT Members: R. Ambrose, A. Boehm, D. Cayan, H. Doremus, J. Field, B. Fraley, G. Griggs, M. Hall-Arber, G. Hofmann, S. Johnson, B.W. McCovey, S. Murray, J. Paduan, J. Schubel, J. Stachowicz, C. Striplen, W. Sydeman, S. Weisberg

State Participants: D. Aseltine-Neilson (California Department of Fish and Wildlife), L. Bedsworth (Office of Planning and Research), J. Bishop (State Water Resources Control Board), J. DeLeon (State Lands Commission), D. Halberstadt (Ocean Protection Council, California Natural Resources Agency), B. Ota (California Department of Fish and Wildlife), M. Small (State Coastal Conservancy)

Ocean Science Trust Staff: H. Carter, M. DeLapa, B. Duncan, S. Finstad, E. Knight, D. Liebowitz, E. Meyer, R. Meyer, E. Ramanujam, L. Sievanen, M. Villarreal, S. Wheeler, E. Whiteman

SAT workshops are open to the public.

Workshop Summary

The impact and relevance of the Ocean Protection Council Science Advisory Team (SAT) has grown substantially over the last five years. From ocean acidification and hypoxia (OAH), to sea-level rise and sustainable fisheries, the SAT has advanced science-informed actions on a wide array of state priorities. However, as the threat of climate change looms ever larger over our ocean and coast, the State increasingly recognizes the need to work even more closely with the scientific community. At this workshop, Ocean Science Trust brought the SAT together with decision-makers to:

- reflect upon the SAT's progress as the State's conduit to the scientific community, refine its vision and discuss its working procedures; and
- conduct a deep dive into the final Recommendations and Actions of the West Coast Ocean Acidification and Hypoxia Science Panel (the Panel) – to identify next steps that the SAT can carry forward.



April 18, 2016

Part I: Reflecting on the SAT's Progress and Improving Its Value to the State

The partnership among the Ocean Protection Council (OPC), Ocean Science Trust and the SAT is a unique and innovative model for science advice and integration into ocean management and policy. The impact of the SAT has grown significantly over the last five years, with an increasing demand for working groups over a broader range of topics.

Next Steps: SAT Working Procedures

Ocean Science Trust, the OPC and the SAT will work together to develop a Working Procedures document that will articulate and formalize:

- the role and value of the SAT, including its role in identifying emerging issues on the horizon to help the State recognize and potentially get ahead of issues;
- processes for convening working groups, providing review of products, and identifying what constitutes a SAT product; and
- the pathways for external partners to engage with the SAT, solicit guidance and use it as a resource for independent scientific expertise.

This document will be widely disseminated among ocean and coastal management agencies, and the public.

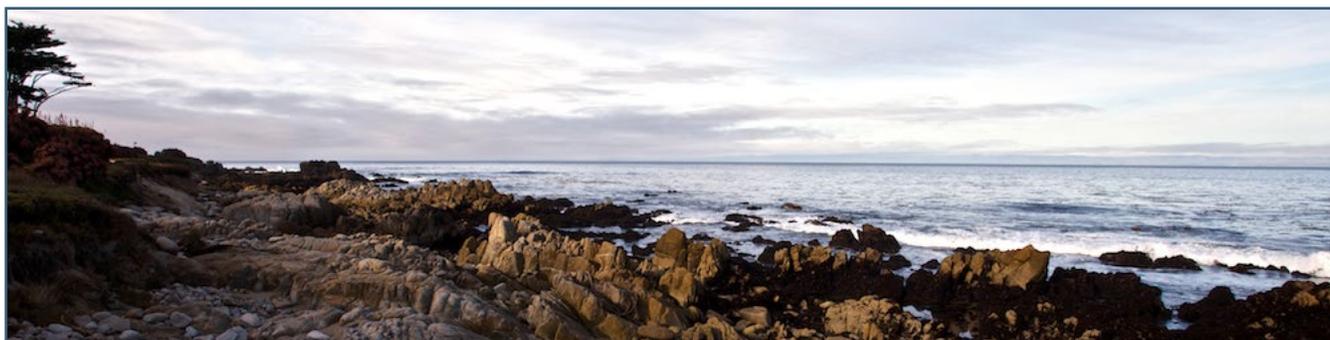
Part II: Carrying Forward the Work of the West Coast Ocean Acidification and Hypoxia Science Panel

On April 4, [the Panel](#) released its [Major Findings, Recommendations, and Actions](#) following three years of scientific synthesis and discussion. At this workshop, the SAT established itself as the successor of the Panel, ready to work with the State and West Coast region to take comprehensive action in the face of changing ocean chemistry.

Next Steps: Taking Action on Multiple Fronts

The Panel urged action on multiple fronts. A strategic approach should balance political opportunity, leverage existing projects, and support new collaborations and research to address knowledge needs. The SAT is already engaged on issues related to changing ocean conditions through the climate change and fisheries working group and the harmful algal blooms working group. At this workshop, the SAT and decision-makers examined the Panel's Recommendations for follow-up work and identified three additional priority areas around which to focus work in the coming year:

- Establish a working group to explore the ability of aquatic vegetated habitats to remove carbon from seawater and ameliorate ocean acidification (Panel Recommendation 2: Advance approaches to remove CO₂ from seawater)
- Address science needs to revise water quality criteria (Panel Recommendation 3: Revise water quality criteria)
- Establish a working group to build OAH considerations into statewide marine protected area (MPA) monitoring and research (Panel Recommendation 5: Advance adaptive capacity of marine species and ecosystems).



Full Proceedings

1. Welcome & Introduction

Welcome Remarks

Michael DeLapa, Interim Executive Director, California Ocean Science Trust

Welcome SAT members and invited decision-makers. In particular, welcome Deborah Halberstadt, the new Executive Director of the OPC, and Deputy Secretary for Oceans and Coastal Policy at the California Natural Resources Agency. On behalf of Ocean Science Trust and the SAT, we look forward to working with you towards a healthy and productive ocean and coast. Over the years, the SAT has worked closely with Ocean Science Trust to support science-informed actions on a wide array of priorities identified by the OPC and their agency partners. It is a unique and innovative model for linking science with action. This workshop is an opportunity to reflect upon our work together, refine our vision, and strengthen our partnership.

Opening Remarks

Deborah Halberstadt, Executive Director, Ocean Protection Council, Deputy Secretary for Oceans and Coastal Policy, California Natural Resources Agency

I am thrilled to work with the SAT to ensure that the best available science is applied to State decision-making, including OPC policy and funding decisions. This workshop is an opportunity to reflect upon the progress and achievements of the SAT, as well as to discuss ways to expand its value to the State. Just this April, the West Coast Ocean Acidification and Hypoxia Science Panel, an effort that proliferated from the SAT, concluded its term. The panelists created an extraordinary, world-class document that not only bridges science and policy, but also serves as a roadmap of concrete actions we can take to address OAH. Their body of work is a tremendous achievement, and equally demonstrates the value of the SAT to the State. I am looking forward to our discussion this afternoon, where we can explore how OAH cuts across such critical issues as MPAs, fisheries and other ocean changing issues.

Today's [Workshop](#): Bracing for a Changing World

Francisco Chavez, Co-chair, Science Advisory Team, Senior Scientist, Monterey Bay Aquarium Research Institute

Change is the new normal. California is moving in so many ways to address the changes that are impacting our ocean and coast, and the SAT is well positioned to support the State in this effort. The SAT was initiated in 2008 and its responsibilities have grown substantially over the last five years. The breadth of issues brought to the SAT has expanded, from OAH, to sea-level rise, sustainable fisheries and mitigation and restoration. Over the last year, we have also welcomed five relatively new members, and now, with new leadership at OPC and Ocean Science Trust, this workshop is an opportunity to refine our vision, broaden our impact, and strengthen our partnership with Ocean Science Trust and the State of California.

Finally, with respect to the SAT Executive Committee election, I would like announce that Dr. Steven Murray, Professor Emeritus at California State University, Fullerton, will join us as co-chair elect. With this new appointment, Mark Carr, Professor at the University of California, Santa Cruz, will end his term on the Executive Committee. We would like to thank him for his service to the group [award presented to Mark Carr by Francisco Chavez].

2. SAT Initiatives: Our Work as a Team and Looking Forward

Presentation: Understanding the SAT: Role, Contributions, and Future Directions

Ryan Meyer, Senior Scientist, Ocean Science Trust

Mark Carr, Co-chair of the Science Advisory Team, Professor at the University of California, Santa Cruz



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An Innovative Model for Providing Science Advice

California has established a unique model for science advice on oceans, founded in the partnership among the OPC, Ocean Science Trust and the SAT. Each body plays a key role in ensuring that science is applied to policy and management decisions in California, recognizing the need for independent science that is grounded in decision-maker needs. The OPC provides broad policy leadership and coordination for ocean health. The SAT serves the OPC and the State by providing broad, deep and independent ocean expertise. Ocean Science Trust is the boundary organization that manages the SAT, providing the thought leadership needed to translate science so that it is relevant to management decisions and addresses state priorities.

California Ocean Protection Council

OPC-SAT
Science Advisory Team



Strong Foundation in Statute

These partnerships are based in [Statute; AB 1056](#) required the establishment of the SAT and Ocean Science Trust to manage it. This broad mandate links across problem areas, disciplines, and geographies on behalf of the State's pressing ocean issues. As the designated manager, the Ocean Science Trust oversees and facilitates effective links across science and policy. As a standing body, the SAT is able to build relationships, familiarity with process, and trust. This structure provides stability and versatility, particularly as working groups bring in needed expertise and preserve SAT institutional knowledge.

An Agile, Effective Team of Experts

The SAT has generally four modes of operation:

1. **Review and input:** Members respond to requests as individuals, with oversight by Ocean Science Trust and the SAT Executive Committee.
2. **Working groups:** SAT members and external experts collaborate to develop products on various topics based on state needs.
3. **Subcommittees:** A subset of SAT members take on initiatives, collaborating with Ocean Science Trust and OPC, as needed.
4. **SAT as a whole:** The SAT works together as a full group to produce or approve a product.

The bulk of work conducted by the SAT has been through its many working groups. Past working groups have primarily formed when an issue is brought to the attention of the OPC, the SAT Executive Committee or the Ocean Science Trust. Issues are raised by a variety of groups including the OPC, the Ocean Science Trust, the SAT, policymakers, or state agencies. They may involve peer review requests, or may also be raised by new science or an event, such as recent harmful algal blooms that have impacted state fisheries.

These issues are subsequently vetted and clarified by OPC and Ocean Science Trust before the SAT Executive Committee decides whether the issue warrants the formation of a SAT working group. If approved, a working group is generally formed by the Executive Committee in collaboration with Ocean Science Trust and specific SAT members identified as working group leads or participants. Often, non-SAT members participate on working groups and the process of formalizing them. Ocean Science Trust manages working groups, including meetings, product development and product delivery.

Looking Ahead: Developing SAT Working Procedures

There is a need to refine the SAT's model and its working procedures to ensure its capacity to meet increasing demand. Formalizing how the SAT, OPC and the Ocean Science Trust work together and tracking our impact will increase efficiency and broaden the audience we are capable of serving together.

Discussion: Building Upon Our Achievements

Ryan Meyer, Senior Scientist, Ocean Science Trust

Mark Carr, Co-chair of the Science Advisory Team, Professor at the University of California, Santa Cruz

The goal of this discussion is to receive feedback on ways that the work of the SAT could be improved, and its working procedures formalized. Broadly, we aim to foster a shared understanding of:

- how issues the SAT works on are raised and vetted, including how the SAT itself participates in ‘horizon-scanning’ and identifying emerging issues;
- mechanisms for the creation of working groups and other processes; and
- processes by which SAT members are informed of, and have input on working group activities and products.

Topics Raised in the Discussion:

- **Transparency of SAT Working Procedures and agency outreach:** Decision-makers voiced a need for clear a process by which they may engage the SAT, its working procedures, areas of expertise, and current projects.
- **The SAT as a body to “scan the horizon” for emerging issues:** The full group expressed interest in creating an avenue for the SAT to identify and communicate emerging issues for the State.
- **SAT involvement and review of working group products:** We need guidance for a process of finalizing SAT working group products that includes sharing draft products with the full SAT. Webinars would be a great opportunity to share draft products, and solicit input from the SAT prior to public release.
- **Improving SAT communications:** A need to better communicate to state partners and the public the role and value of the SAT, as well as a need for a venue to make SAT products, expertise, and working procedures more accessible.

3. Brief Updates from Working Groups

Moderated by Francisco Chavez, Co-chair of the Science Advisory Team, Senior Scientist, Monterey Bay Aquarium Research Institute

Climate Change and Fisheries Working Group

Leila Sievanen, Associate Scientist, Ocean Science Trust

Francisco Chavez, Co-Chair, Science Advisory Team, Senior Scientist, Monterey Bay Aquarium Research Institute

The need for this working group was identified and discussed at the SAT’s last [workshop on February 25, 2015](#). Now convened and supported by the OPC, this group is composed of 11 interdisciplinary scientists (both SAT and non-SAT members) with ecological, socio-economic, and governance expertise, as well as an agency scientist and expert from the California Department of Fish and Wildlife (CDFW). The working group will provide scientific guidance that will be used to inform the Marine Life Management Act Master Plan ammendment on the potential impacts of climate change on fisheries, and suggest options to increase fisheries resilience and adaptability. It will deliver its final product to CDFW in September 2016.

Scientific Collecting Permit Task Force

Mark Carr, Co-chair Emeritus, Science Adivsory Team, Professor, University of California, Santa Cruz

In 2012, CDFW requested the formation of a Scientific Collecting Permit Task Force to create objective, quantitative approaches and tools to evaluate scientific collecting permit requests in MPAs. Over the last four years, the working group has developed methods to:

- estimate cumulative ecological impacts of multiple proposed scientific activities within MPAs; and
- evaluate whether impacts are appropriate relative to the conservation goals of a protected area and the benefits derived from the proposed research.

The working group is in the final stages of producing a report and analytical tools to be delivered to CDFW and the Fish and Game Commission (FGC) in June 2016. Ocean Science Trust will work with task force leads to coordinate a webinar for the full SAT to preview the final products in summer 2016.

Mitigation Working Group

Rich Ambrose, Member, Science Advisory Team, Professor, University of California, Los Angeles

Benét Duncan, Associate Scientist, California Ocean Science Trust

Marisa Villarreal, Project Scientist, California Ocean Science Trust

In the wake of the Refugio oil spill, and recent advancements in mitigation policies regarding once-through cooling, the OPC recognized an opportunity to advance the State's understanding of what can constitute mitigation activities in a dynamic and complex marine environment. Thus, Ocean Science Trust convened a working group in the fall of 2015 to provide a high-level overview of traditional and emerging mitigation approaches, and guiding principles that can be applied across multiple situations – from environmental disasters to planned coastal development activities. The group is now in the final stages of producing a white paper that was planned for release in May 2016. To start, the white paper will inform current conversations about once-through-cooling mitigation policies being led by the State Water Resources Control Board (SWRCB), as well as CDFW's Office of Spill Prevention and Response. Looking ahead, decision-makers have also expressed interest in continuing to work with the SAT to inform mitigation activities in response to the Refugio oil spill.

Harmful Algal Blooms and California Fisheries Working Group

Errin Ramanujam, Associate Scientist, California Ocean Science Trust

Because of the Dungeness crab fishery closure and associated economic losses, the OPC has mobilized an Inter-agency Harmful Algal Bloom Task Force (Task Force), and asked Ocean Science Trust to convene a SAT working group. Among other management activities, the Task Force will develop a list of short- and long-term science needs for the working group to address, including guidance on:

- existing harmful algal bloom (HAB) and seafood toxin monitoring in California;
- sampling protocol for seafood toxin testing, with a focus on domoic acid and California's Dungeness crab fishery; and
- scientific synthesis of existing information and research recommendations for HAB monitoring and toxin sampling into the future.

The [working group](#) will develop initial guidance in mid-summer, but also scope a longer-term working group going forward. Ocean Science Trust is currently developing timelines and a scope. This effort is a critical next step to responding to the West Coast Ocean Acidification and Hypoxia Science Panel's message that we must take action in the face of changing conditions.



4. Managing in the Face of Changing Ocean Conditions

Presentation and Q&A: Advancing the Work of the West Coast Ocean Acidification and Hypoxia Science Panel

Steve Weisberg, Member, Science Advisory Team, Panelist, West Coast Ocean Acidification and Hypoxia Science Panel, Executive Director, Southern California Coastal Water Research Project

In September 2012, the OPC requested Ocean Science Trust to convene a science advisory panel to recommend a long-term management strategy for combatting the effects of OAH. California then joined forces with the States of Oregon and Washington, and the Province of British Columbia to broaden the Panel’s focus to include the entire North American West Coast, a region that is particularly vulnerable to ocean acidification. As a result, Panel membership was expanded to reflect the depth of expertise from across the region. Ocean Science Trust led a science needs assessment at the state, regional, and federal levels to understand decision-makers’ science needs and scope the work of what had then become the the Panel. Over a three-year period, the 20-member Panel examined the full range of impacts related to changing ocean conditions, going beyond OAH to include related stressors and impacts.

The Panel’s final report, “[Major Findings, Recommendations, and Actions](#),” was released April 4, 2016. It is also supported by a series of [scientific publications and technical guidance documents](#). We now call upon the SAT to work with Ocean Science Trust, OPC, and other state agencies to take up the Panel’s recommendations and actions.

For each Recommendation, the Panel provides specific Actions that can be taken immediately. However, some of the Actions require additional scientific input before they can be fully implemented by decision-makers. In this workshop, we must identify which of the Panel’s Actions would be appropriate for the SAT to advance.

THEME 1 ADDRESS LOCAL FACTORS THAT CAN REDUCE OAH EXPOSURE		THEME 2 ENHANCE THE ABILITY OF BIOTA TO COPE WITH OAH STRESS		THEME 3 EXPAND AND INTEGRATE KNOWLEDGE ABOUT OAH	
RECOMMENDATION 1	Reduce local pollutant inputs that exacerbate OAH Action 1.1: Generate an inventory of areas where local pollutant inputs are likely to exacerbate OA. Action 1.2: Develop robust predictive models of OAH. Action 1.3: Develop an incentive-based strategy for reducing pollutant inputs.	RECOMMENDATION 4	Reduce co-occurring stressors on ecosystems Action 4.1: Integrate OA effects into the management of ocean and coastal ecosystems and biological resources.	RECOMMENDATION 6	Establish a coordinated research strategy Action 6.1: Create agreement among the multiple organizations that fund OAH research to establish joint research priorities.
RECOMMENDATION 2	Advance approaches that remove CO₂ from seawater Action 2.1: Use demonstration projects to evaluate which locations are optimal for implementing CO ₂ removal strategies. Action 2.2: Generate an inventory of locations where conservation or restoration of aquatic vegetation habitats can be successfully applied to mitigate OA. Action 2.3: Consider CO ₂ removal during the habitat restoration planning process.	RECOMMENDATION 5	Advance the adaptive capacity of marine species and ecosystems Action 5.1: Inventory the co-location of protected areas and areas vulnerable to OAH. Action 5.2: Evaluate the benefits and risks to active enhancement of adaptive capacity.	RECOMMENDATION 7	Build out and sustain West Coast monitoring program that meets management needs Action 7.1: Define gaps between monitoring efforts and management needs. Action 7.2: Enhance comparability of and access to OAH data.
RECOMMENDATION 3	Revise water quality criteria Action 3.1: Agree on parameters that will be part of OAH criteria.			RECOMMENDATION 8	Expand scientific engagement to meet evolving management needs Action 8.1: Create a science task force.

Discussion: Advancing the Work of the West Coast Ocean Acidification and Hypoxia Science Panel

Steve Weisberg, Member, Science Advisory Team, Panelist, West Coast Ocean Acidification and Hypoxia Science Panel, Executive Director, Southern California Coastal Water Research Project

The State is now looking to the SAT to provide advice on science needs going forward, help identify what is most vulnerable, and prioritize next steps.



Decision-Makers' Science Needs Going Forward

Jonathan Bishop, Chief Deputy Director, State Water Resources Control Board

Recommendation 3 – Revise water quality criteria – of the Panel relates to the Clean Water Act, and is squarely within jurisdiction of the SWRCB. To accomplish this, I need the SAT to:

- identify the right water quality parameters; and
- define thresholds for those parameters.

We also need knowledge on the relevant thresholds for specific organisms of management concern. The SWRCB is flexible in how these criteria are implemented; criteria may be tailored to specific regions or locations.

Another critical component is the need to start monitoring ocean acidification right away. Our key questions are:

- What are the environmentally relevant parameters that should be monitored to measure changes to water quality caused by OAH?
- What are the local inputs that exacerbate OAH? And do these local inputs have a measurable impact on coastal water quality?
- Does controlling or reducing local inputs have a measurable benefit on coastal water quality?

Mary Small, Deputy Executive Officer, State Coastal Conservancy

The State Coastal Conservancy (SCC) is restoring eelgrass in several locations around the State to provide habitat and to research whether eelgrass can protect shorelines from sea-level rise. SCC is interested in understanding the benefits of eelgrass in ameliorating OAH, and sequestering carbon (as it relates to Panel Recommendation 2 – Advance approaches to reduce CO₂ in seawater), however, we are not aware of very much data collection in California eelgrass beds. We look to the members of the SAT to help collect data to advance our understanding of both of these potential benefits of California eelgrass.

Louise Bedsworth, Deputy Director, Governor's Office of Planning and Research

The Office of Planning and Research (OPR) is not a regulatory body, but we play a role in how funding decisions are made related to mitigating climate change. Authorized by the California Global Warming Solutions Act of 2006 (AB 32), the cap-and-trade program is one of several strategies that California uses to reduce greenhouse gas emissions that cause climate change. Proceeds from the sale of credits under the program are deposited into the Greenhouse Gas Reduction Fund (GGRF). GGRF investments are authorized by the Legislature, and must be used for programs that reduce emissions of greenhouse gases. Recommendation 2 relates to the types of projects eligible for funding under the Greenhouse Gas Reduction Fund. However, such projects must clear a very high bar in terms of scientific justification and data availability. California is also developing a scoping plan to meet the 2030 carbon reduction targets of AB 32, which will incorporate an assessment of the carbon stored in natural systems of California. The SAT should consider how it may support this process as it moves forward.

Becky Ota, Marine Habitat Conservation Program Manager, California Department of Fish and Wildlife

Addressing water quality issues in California through the lens of OAH will influence decision-making at CDFW, as water quality relates to many of its projects. I am keenly interested in addressing the challenges to and cost of restoring eelgrass and other types of aquatic vegetation such as kelp. There is a great need to quantify and understand the ability of these restoration projects to effectively store carbon. Such information would help CDFW prioritize funds and projects.

Debbie Aseltine-Neilson, Senior Marine Biologist Specialist, California Department of Fish and Wildlife

Key science gaps CDFW is interested in include understanding:

- how effective California aquatic vegetation (seagrasses, kelp etc.) is at buffering surrounding waters and sequestering carbon;
- local pollutants that can measurably drive OAH, and which locations in California are most impacted;
- the link between land-based runoff, ocean acidification, and harmful algal blooms that impact fisheries; and
- the other impacts of climate change, such as storms, changes in sediment flow, etc.

Key science and management efforts that the CDFW is actively engaged in that relate to Panel Recommendation 4 (Reduce co-occurring stressors on ecosystems) include:

- SAT working group on climate change and fisheries (addressing fishing stressor); and
- the implementation of the State Wildlife Action Plan (addressing multiple stressors including nutrient and pollutant inputs, changes in sediment quality and quantity, and shoreline development).

Deborah Halberstadt, Executive Director, Ocean Protection Council, Deputy Secretary for Oceans and Coastal Policy, California Natural Resources Agency

Currently, the State is very interested in exploring the potential of eelgrass to mitigate climate change. In particular, we must evaluate the potential for eelgrass relative to other mechanisms to sequester carbon, and to ameliorate the negative impacts of OAH. In my role, I also must manage the expectations of policymakers around this issue. Thus I call upon the SAT, in partnership with the science community, to ensure that policy discussions among agencies going forward are supported by the best available science.

Jennifer DeLeon, Science Policy Advisor and Tribal Liaison, State Lands Commission

The State Lands Commission (Commission) is a user of the information synthesized by the Panel, but does not directly issue funds or regulate ocean acidification. The Commission is very interested in understanding the influence of local inputs on OAH, so that it can incorporate this knowledge into the permit review process. More specifically, the agency would benefit from knowing which pollutants should be minimized and the levels at which pollutants have a negligible impact on local OAH. With this information, the Commission may be able to determine a threshold of local pollutants to incorporate into their evaluations of proposed projects along the coast.

Exploring the Panel's Recommendations and Proposing Outcomes

Theme 1. Address local factors that can reduce OAH exposure

Recommendation 1: Reduce local pollutant inputs that exacerbate OAH

There is a need for robust predictive models of OAH. Currently, modeling tools do not effectively scale to nearshore coastal environments. We can start by building upon existing Regional Ocean Modeling Systems by bringing them nearshore with a small spatial resolution. These models should also be coupled with biogeochemical models scaled to the nearshore environment. Key existing efforts that must be taken into account and linked include:

- the OPC's investment in [Modeling in Support of Management of Coastal Hypoxia and Acidification in the California Current Ecosystem](#); and
- [Northwest Fisheries Science Center modeling projects](#) to predict how North Pacific species and ecosystems will respond to OA.

The SAT aims to remain updated on these efforts as they move forward.



Recommendation 2: Advance approaches to remove CO₂ from seawater

There are many ongoing aquatic vegetative habitat restoration projects, thus it is important to support such efforts and prevent loss of existing aquatic vegetated habitat. The SAT could consider mapping locations that are optimal to direct restoration. While there are data with respect to the ability of seagrass to sequester carbon and ameliorate OAH, projects such as the [Zostera Experimental Network](#) (ZEN) can provide valuable insights into seagrass physiology and growth. Additionally, there are many co-benefits of eelgrass restoration and conservation, such as providing nursery grounds for many fisheries and opportunities for citizen science and education.

Proposed outcome: Convene a SAT working group to generate an inventory of locations where conservation or restoration of aquatic vegetated habitats could be successfully applied to mitigate OA.

Recommendation 3: Revise water quality criteria

SAT members expressed the critical need to take on this issue because relevant and effective water quality criteria are the foundation to successfully implement many of the Panel's Recommendations. Current water quality criteria need to be revised such that they appropriately and adequately measure the physical, chemical, and biological impacts of ocean acidification. Several SAT members noted that knowledge gaps exist, particularly around which biological criteria should be used, but agreed that there is sufficient published information to provide consensus guidance on setting new criteria. Guidance on this issue is needed soon, as the SWRCB will be moving forward in adopting new criteria in the coming years. These revised water quality criteria would not only benefit SWRCB, but also California Natural Resources Agency, including the OPC and CDFW, as well as others.

Proposed outcome: Create a SAT working group to develop new water quality criteria. Convene a 1-day workshop to provide guidance on new water quality criteria.



Theme 2. Enhance the ability of biota to cope with OAH stress

Recommendation 4: Reducing co-occurring stressors on ecosystems

This Recommendation relates to fisheries in the context of ecosystem-based management, a concept in need of a common definition. One approach might be to prioritize or rank stressors on ecosystems. Such an exercise could highlight opportunities to restructure current management practices so that they consider impacts of OAH stressors that are already being managed. With respect to fisheries management, there needs to be a solid natural and social scientific foundation for any proposed changes to management – an issue that is currently being explored by the SAT through its Climate Change and Fisheries Working Group.

Recommendation 5: Advance adaptive capacity of marine species and ecosystems

We must begin thinking about the risks, benefits and cost of advancing adaptive capacity of marine species and ecosystems. This refers both to protecting natural genetic diversity, as well as active genetic enhancement. Oregon is already taking action on this issue by developing hardy shellfish broodstock for aquaculture. Thus we must map locations vulnerable to OAH (e.g., 'hotspots') at the regional level, which can then be coupled with modeling efforts.



Theme 3. Expand and integrate knowledge about OAH

Recommendation 6: Establish a coordinated research strategy

This Recommendation must be conducted at the West Coast regional level. The SAT stands ready to contribute to such an effort if appropriate. For example, it may be useful to provide guidance on future research planning and priorities with a focus on monitoring (see below - proposed outcome under Recommendation 7).

Recommendation 7: Build out and sustain a West Coast monitoring program that meets management needs

The SAT may be able to play a role in identifying gaps between monitoring and management needs (e.g., coupling biological and physical metrics, frequency of monitoring). In addition, monitoring for OAH can and should align with existing monitoring efforts - there is a need to inventory existing monitoring efforts and their quality, methods and comparability. Rather than conflicting or competing monitoring of protected areas with others, we must think about integration and complementarity. For example, MPAs can be used to understand the ecological consequences of climate change by providing long-term data that are removed from fishing impacts.

Proposed outcome: SAT working group to identify priorities for research and monitoring that help identify parameters that should be measured at monitoring sites, and identify research priorities. Holding a workshop should be considered.

Recommendation 8: Expand scientific engagement to meet evolving management needs

Again, this is a regional not state recommendation. However, if needed the SAT could serve in the interim period until the region (via the Pacific Coast Collaborative, a West Coast-wide body that serves as a forum for issues faced by the region) identifies how it would like to move forward.

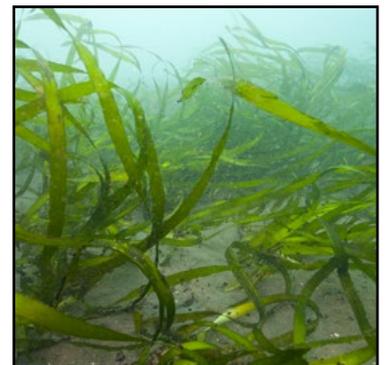
Proposed outcome: SAT delivers an official letter to the OPC requesting that California work with regional leaders to establish a science task force.

Provided below is a summary of the issue areas discussed throughout the afternoon.

An informal tally was taken to understand general SAT member interest in each issue, however it is important to note that the tally does not represent decision-making urgency or need. Going forward, Ocean Science Trust will take this discussion into account, and work with the SAT Executive Committee and decision-makers to evaluate level of priority, and identify next steps. Going forward, Ocean Science Trust will work with the SAT to evaluate and potentially take on these issues in a timely manner.

1. Issue: Explore the ability of aquatic vegetated habitats to mitigate OAH and climate change

- **Tally results:** High interest
- **Key interested SAT member(s):** Jay Stachowicz; Karina Nielsen
- **Ideas on scope:** Initially, this working group would address questions related to the capacity of aquatic vegetated habitats to ameliorate the effects of OAH and sequester carbon. Over the long term, these questions could be expanded to explore ecosystem services of such habitats. There is a need for guidance on how to leverage existing restoration efforts and strengthen understanding of sequestration, particularly for eelgrass (e.g., the need to map monitoring efforts, restoration efforts and ocean acidification hotspots.)



2. Issue: OAH water quality criteria

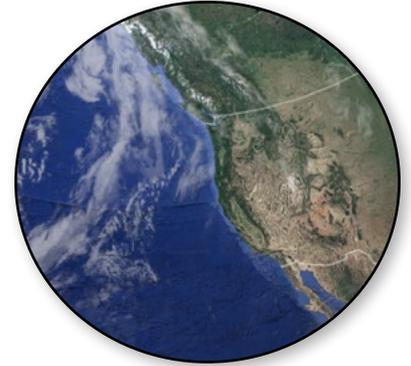
- **Tally results:** High interest
- **Key interested SAT member(s):** Alexandria Boehm
- **Ideas on scope:** Identify appropriate physical, chemical and biological parameters to monitor OAH; and develop relevant concentrations and identify critical thresholds of these parameters.

3. Issue: Research planning and priorities

- **Tally results:** High interest
- **Key interested SAT member(s):** Mark Carr and Gretchen Hofmann
- **Ideas on scope:** This is an immediate opportunity to begin incorporating OAH into protected area monitoring given Mark Carr's upcoming work to create siting plan recommendations for long-term statewide MPA monitoring. This working group could also provide guidance of future research planning and priorities, including identifying vulnerabilities and tradeoffs, and potentially advising on where to invest funds.

The group also discussed a series of additional issues that are region-wide in scope, reiterating support for these actions to move forward through the appropriate regional mechanisms:

- Create an inventory of existing monitoring efforts
- Creation of a scientific task force
- Advance the adaptive capacity of marine species and ecosystems
- Modeling of OAH drivers



5. Workshop Wrap Up

Concluding Thoughts and Next Steps

Francisco Chavez, Co-chair, Science Advisory Team, Senior Scientist, Monterey Bay Aquarium Research Institute

The need to act is now

The opportunity for action is now, and the SAT will be a leader on implementing and executing the actions outlined in the West Coast Ocean Acidification and Hypoxia Science Panel's Major Findings, Recommendations and Actions. In the coming months, Ocean Science Trust, the SAT Executive Committee, and the OPC will evaluate the suggestions made here, and begin implementing next steps. We also will begin formalizing how this interdisciplinary community works together by drafting a SAT Working Procedures document so that the SAT has an expanded and valuable impact throughout the State.

Finally, attendees urged action. Michael Bell, Oceans Program Director, The Nature Conservancy, suggested that the SAT explore ways to simplify existing research and monitoring efforts so that they are more appropriate for citizen science and fishing fleets to capture data. Matt Armsby, Program Manager and Attorney, Resources Legacy Fund, reiterated the urgency for the SAT to act on the Panel's Recommendations and Actions. There is a limited political and policy opening to consider taking action on OAH in the State. Concrete next steps must be taken now.

-- Adjourn --

California Ocean Protection Council

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