



Informational Item

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Item 8

Information Item: **Science Guidance for Coastal and Ocean Restoration in California**

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Location: Statewide

Strategic Plan Goals and Objectives: Goal 3: Safeguard Coastal and Marine Biodiversity; Objective 3.3: Restore vulnerable coastal and marine ecosystems.

Exhibits:

Exhibit A: [Science Guidance for Coastal and Ocean Restoration in California into a Changing Future](#)

Executive Summary:

Restoration is essential to ensuring the long-term resilience of California’s unique coastal and marine ecosystems. *Science Guidance for Coastal and Ocean Restoration in California into a Changing Future* (Exhibit A) provides scientific concepts, considerations, and recommendations intended to support more proactive, climate-ready restoration decision-making for California’s coast and ocean.

The report focuses on providing scientific guidance to inform various aspects of restoration in a changing ocean, including goal setting, project planning, restoration techniques, and approaches for monitoring. The report also includes an appendix that provides actionable guidance for restoration in several key coastal and marine ecosystems. Importantly, the report is not intended to set state policy, and does not replace or contradict any state agency’s roles or responsibilities related to restoration.

By providing explicit, targeted guidance for incorporating climate change impacts into restoration planning, *Science Guidance for Coastal and Ocean Restoration in California into a Changing Future* will inform state-level decision-making, assist restoration practitioners with project planning, and encourage a coordinated approach to coastal and marine restoration – ultimately accelerating the pace and scale of restoration in these unique yet vulnerable ecosystems.

Background

Restoration is essential to ensuring the long-term resilience of California’s unique coastal and marine ecosystems, as well as the services that these special places provide. Restoration can enable degraded ecosystems to recover and thrive, even in the face of warming waters, rising sea levels, and other climate-driven stressors such as widespread kelp loss. Yet while the need for restoration at scale has never been clearer, the uncertainties of climate change require an evolving understanding of restoration.

To effectively accelerate coastal and marine restoration in a changing ocean, California’s resource managers – especially those charged with managing, funding, or implementing on-the-ground restoration efforts – need improved scientific guidance that not only provides considerations for successful restoration projects, but also explores the ways in which climate change may affect historical approaches to restoration. The report presented here, *Science Guidance for Coastal and Ocean Restoration in California into a Changing Future*, is intended to accomplish that goal by providing scientific concepts, considerations, and recommendations to support more proactive, climate-ready restoration decision-making in California.

Report Development

Throughout 2025, the California Ocean Science Trust (OST) developed this report in close coordination with OPC via a series of meetings with a four-member scientific working group, composed of academic experts and restoration practitioners. Working group members served as scientific and technical advisors, while OPC provided policy context and state perspective in coordination with other state agencies. Working group members also received targeted input from state agencies, non-governmental restoration practitioners, and researchers.

Before the working group’s report was finalized, it was reviewed by a variety of state agencies, including the California Department of Fish and Wildlife, California Coastal Commission, California State Coastal Conservancy, California State Lands Commission, and State Water Boards, to ensure alignment with agency priorities and information needs. The report also underwent external scientific peer review for technical accuracy.

Although California Native American tribes did not directly contribute to this report, it is critical to recognize tribal leadership in protecting and restoring marine ecosystems. Tribes have stewarded the coast and ocean of what is now known as California for thousands of years, and tribes continue to uphold their obligation to care for coastal and marine ecosystems today – for example, through tribally-led initiatives such as the Tribal Marine Stewards Network. The report highlights the key role of tribes in restoration and encourages the state to continue to support tribal

stewardship through actions such as co-management, land return, and support for tribal marine programs.

Key Takeaways

Science Guidance for Coastal and Ocean Restoration into a Changing Future is intended to support California policymakers, managers, practitioners, Native American tribes, and local communities as they plan and implement coastal and ocean restoration under changing climate conditions. The report is an especially timely resource given recent statewide restoration goals, such as the coastal and marine restoration targets included in [OPC's 2026-2030 Strategic Plan](#) and the California Natural Resources Agency's [Nature-Based Solutions Targets](#), as well as broader goals related to building climate resilience, conserving biodiversity, and improving access to nature, such as the state's initiative to conserve 30% of its lands and coastal waters by 2030.

By providing a common framework for restoration grounded in best available science, the report aims to help improve coordination and accelerate restoration in coastal and marine ecosystems. Importantly, however, the report is not intended to set state policy, and does not replace or contradict any state agency's roles or responsibilities related to restoration.

The main body of the report, which includes information on critical topics such as goal setting, project planning, restoration techniques, and approaches for monitoring, can be distilled into ten key messages:

1. **Minimizing the need for restoration by preventing sources of degradation, and managing for more resistant and resilient habitats, should be prioritized.** While restoration is a useful tool for ecosystem recovery, and will be even more necessary under climate change, it is not a substitute for effective conservation – proactively protecting and managing California's natural resources to prevent degradation and loss.
2. **Climate change necessitates expanding the definition of restoration and setting a targeted vision for what success looks like.** Historically, restoration has focused on supporting recovery in place, returning lost systems and processes to places where they previously occurred. While this should continue to be an important component of restoration practice, climate change will require that restoration projects help proactively adapt ecosystems to new environmental realities.
3. **Restoration success should be measured against accomplishing project goals, as well as the return of ecosystem functioning that is comparable to reference sites, rather than the recovery of a single function.** While restoration is often motivated by the desire to recover

a particular species, ecosystem function, or ecosystem service, the overarching definition of restoration success should focus on the return of healthy ecosystem structure and function, comparable to that of an undisturbed “reference site.”

4. **Statewide restoration priorities can effectively inspire coordinated restoration action by catalyzing strategic goal-setting and investments while balancing achievability and ambition.** The State can help play a crucial role in guiding restoration efforts by establishing goals, providing funding opportunities, and improving regulatory and permitting efficiencies. Statewide actions and priorities should be grounded in science, while incorporating a level of ambition that meets the moment and drives urgent action.
5. **Restoration site suitability depends on historical and projected future extent, the feasibility of addressing drivers of degradation, project goals, and human communities’ priorities for restoring a degraded habitat.** Historical information, including tribal science and Traditional Knowledges when appropriate, can provide a starting point for restoration planning. Selection of restoration sites should also include consideration of the likelihood of restoration success, as well as social and logistical dimensions such as community support, risk tolerance of affected communities, and cost effectiveness.
6. **Restoration must meaningfully incorporate and be inclusive of the social considerations of tribes and other local communities connected to a project.** Restoration decision-making is inherently tied to social values. Restoration project goals should therefore incorporate the values, priorities, and lived experiences of local communities and California Native American tribes.
7. **Restoration techniques include methods to address stressors and assist system recovery.** Restoration interventions can be organized into two categories: stressor management, which includes actions that are intended to remove or mitigate stressors, and assisted recovery, which includes actions intended to reintroduce or promote recovery of key species. Both types of interventions are covered in detail in this report.
8. **Climate change will require developing and employing innovative restoration and management techniques.** As climate change accelerates, restoration action should shift toward more proactive, climate-ready approaches that support restoration at scale and are aimed at building resiliency. Such approaches include protecting natural processes, decelerating environmental stressors, and enhancing the capacity of systems to adapt to change.

9. **Monitoring sites before, during, and after implementation enables adaptive management and increases the likelihood of project success.** Scientific monitoring is essential across all phases of restoration work to help assess restoration effectiveness, improve management over time, and to ultimately evaluate whether project goals have been achieved.

10. **Making monitoring data publicly available and easily usable is critical for advancing our understanding of restoration and for tracking statewide restoration targets.** Advancing restoration techniques, and increasing the scale and impact of future restoration efforts, requires that restoration practitioners share monitoring data, governed by FAIR (Findable, Accessible, Interoperable, Resuable) and CARE (Collective Benefit, Authority to Control, Responsibility, and Ethics) principles.

Ecosystem-Specific Guidance

To further support agencies and practitioners in accelerating coastal and ocean restoration, the report includes an appendix that discusses several key coastal and marine ecosystems in detail: tidal wetlands, oyster beds, sandy beaches and dunes, rocky intertidal, seagrasses, kelp forests, and mid-depth subtidal rocky bottom. Each ecosystem-specific chapter includes information on stressors and restoration techniques, including stressor management and assisted recovery.

These chapters summarize and synthesize the current state of restoration science in these ecosystems and are intended to serve as actionable, practical guidance. For example, the chapter on kelp restoration includes lessons learned to-date regarding best practices for restoration techniques such as seeding and outplanting, transplanting, grazer suppression, and artificial reefs.

Moving Forward

As climate change wreaks havoc on coastal and marine ecosystems, restoration will be an increasingly important tool to safeguard both people and nature. *Science Guidance for Coastal and Ocean Restoration in California into a Changing Future* is intended to meet the urgency of this moment. By providing explicit, targeted guidance for incorporating climate change impacts into restoration planning, the report will inform state-level decision-making, assist restoration practitioners with project planning, and encourage a coordinated approach to coastal and marine restoration – ultimately accelerating restoration in California and ensuring that future restoration efforts are more resilient, effective, and equitable.