Kelp Restoration Management Plan
Science Advisory Committee Meeting #8
Tuesday, May 20, 2025

Meeting 8 Notes Summary

Welcome & Meeting Overview

The eighth meeting of the Kelp Restoration and Management Plan (KRMP) Science Advisory Committee (SAC) was held in Santa Rosa, CA on May 20, 2025 with five KRMP SAC members, and the KRMP Project Team (i.e., California Department of Fish & Wildlife (CDFW), Ocean Protection Council (OPC), and California Sea Grant (CASG)). The Project Team provided context and instructions to facilitate a group discussion focused on characterizing the Kelp States and management strategies. Goals of the meeting were to identify appropriate spatial scales for thresholds; agree upon the thresholds to quantitatively define the four Kelp State categories (i.e., thriving ("green"), fine ("yellow"), compromised ("orange"), depleted ("red")); further refine management strategies and associated actions; and consider prioritization of potential strategies and associated actions under different Kelp States.

Kelp State Characterization: Tiered Approach and Spatial Scales

The SAC discussed a two-tiered framework for evaluating kelp ecosystem health (i.e., Kelp State) and informing management decisions:

- Tier 1 evaluation is designed to identify broad patterns of kelp decline or stability and to flag areas that may require further investigation.
- Tier 2 evaluation is designed to provide more spatially and temporally explicit context behind patterns observed within the Tier 1 evaluation.

Tier 1 proposes to use satellite-derived data (i.e., Landsat) to evaluate changes in kelp canopy, including spatial extent and persistence over time, and to quantitatively define the four distinct Kelp States, ranging from thriving to depleted. Tier 2 proposes to use additional ecological and social data to evaluate barriers to recovery and the feasibility of applying management strategies at finer spatial scales. Examples of the considered factors that may be barriers to recovery include stressors such as sedimentation, pollution, Marine Heatwaves (MHW), grazing pressure, loss of kelp structure or connectivity, changes in species interactions, and the capacity for communities or management to respond.

The SAC reviewed the quantitative definitions for 1) a thriving ("green") Kelp State, characterized by no declines in kelp, and 2) a depleted ("red") Kelp State, which reflects prolonged and widespread kelp loss within a spatially defined management area. Considerations around spatial scale(s) were brought up throughout the discussion (e.g., 1 kilometer (km^2), 5 km^2, 10 km^2), and will continue to be explored. The SAC discussed the need for additional analyses to better distinguish intermediate conditions (i.e., fine ("yellow") and compromised ("orange")), which exhibit varying degrees of kelp decline and differing capacities for recovery.

The SAC explored whether intermediate Kelp States (i.e., yellow, orange) should be distinguished using satellite data alone or should also incorporate ecological and social indicators and consider barriers to recovery. The importance of flexibility and context-specific interpretation was emphasized. A non-exhaustive set of barriers to recovery that were discussed include:

- Sediment: smothering, turbidity
- Nutrients and eutrophication: linked to temperature and climatic variability
- Chemical pollution: such as fire runoff (e.g., heavy metals) impacting kelp
- Temperature (climatic/MHW, localized)
- Salinity and freshwater flows: potential influence on localized urchin grazing near river mouths
- Ocean acidification and hypoxia: impacts to kelp forest ecosystem
- Loss of connectivity with adjacent forests (i.e. loss more contiguous rather than patchy)
- Loss of kelp age/size structure (especially for giant kelp)
- Physiological stress (e.g., nutrient depletion, kelp "paling")
- Erosion of genetic diversity and climate resilience
- Kelp microbiome
- Invasive algal species
- Loss of urchin predators
- Grazers (e.g., urchins): density, behavior, etc.
- Level of kelp harvest
- Understory community health: positive and negative interactions with kelp recruitment and succession
- Social Barriers, including loss of social capacity and/or lack of community interest, harvest of kelp and associated species, etc.

Management Strategies: Specific Actions

The SAC members participated in a group activity to suggest possible management actions that could be taken under each management strategy: Community Engagement, Tribal co-management, Inter-and Intra-agency Coordination, Restoration, Harvest Management, and Research to inform Management. Specific actions noted throughout the activity built upon

those identified throughout previous SAC meetings and CWG meeting summaries to date. Below is a non-exhaustive list of collective considerations and potential actions by management strategy.

- Community Engagement, Education/Outreach and knowledge sharing
    - Build relationships and partnerships with community through monitoring, education, and knowledge-sharing
    - Prioritize funding and research, including monitoring, with community partners
    - Host seminars/knowledge-sharing events along the coast
    - Support development of interpretive materials and signage explaining ecosystem impacts and ways to get involved
    - Provide education on ecological “thresholds”
    - Research effective education and outreach approaches
    - Connect kelp-dependent communities with each other
    - Secure funding for communities
    - Develop channels for communities to report changes and share observations
    - Engage community in conversations about restoration goals, needs, and determining appropriate strategies
    - Listen to community concerns about ways to offset social and economic losses or facilitate new “blue” workforce activities
- Tribal Co-Management
    - Build relationships and Tribal Co-Management process
    - Implement co-management and collaborative agreements per CNRA (California Natural Resources Agency) tribal stewardship strategy and Assembly Bill (AB) 1284
    - Conduct government-to-government consultation on potential management actions and changes
    - Discuss data sovereignty
    - Secure funding for tribes
    - Include/highlight cultural importance and connection to kelp
    - Gain feedback from tribes on restoration goals, strategies, and monitoring
    - Formalize partnerships – agreements, contracts, roles, and responsibilities
    - Regularly assess the effectiveness of co-management
    - Build focused partnerships in specific areas/regions with strong restoration needs
    - Invest in and facilitate tribally-led restoration
- Inter- and Intra-agency Coordination/Private and Public Partnerships
    - Build and strengthen communication of collaborative networks

    - Build and sustain CDFW-KRMP capacity
    - Map agency authority/jurisdictions and relevant watershed uses that could impact kelp
    - Intra-agency collaboration on cross-cutting resource management priorities (e.g., KRMP, other management plans, Marine Protected Areas), including harvest management of urchin predators (i.e., ecosystem-based management)
    - Host meetings to share information, research and management priorities, and other needs
    - Coordinate with other agencies to ensure awareness of management needs and actions; considerations for land-based sediment and/or pollution stressors on kelp
    - Coordinate and streamline permitting processes
    - Identify and secure resources (e.g., funding, staff capacity) for restoration and other management needs
    - Share information/leverage knowledge and resources to enhance management/protection
    - Coordinate monitoring and restoration activities, define partner roles (who does what, where), and communicate out to avoid duplicative efforts
- Restoration
    - Support kelp persistence, resilience, and recovery by addressing local stressors (e.g. pollution, sedimentation or other stressors), preventing overharvest and adverse use of kelp and key ecosystem species
    - Implement kelp restoration approaches, as identified within the KRMP Restoration Toolkit, that address the stressors and specific limitations to place-based recovery (e.g., grazer removal, invasive species management, kelp outplanting, drift kelp supplementation, predator reintroduction, etc.)
    - Consider climate-readiness of restoration approaches (e.g., genetic resilience/heat-tolerance) and incorporate kelp biobanking as a proactive measure
    - Consider potential interventions in development and support research to advance
    - Ensure sufficient monitoring occurs to inform when and where restoration should occur, as well as monitoring before, during and after restoration activities
    - Build capacity for restoration through education, infrastructure, and cross-sector coordination
    - Support economic development related to restoration, prioritizing opportunities for impacted communities

    - Consider “social restoration” techniques to restore economic and cultural connections
- Harvest Management
    - Evaluate kelp resource abundance (e.g., biomass, canopy cover)
    - Monitor kelp harvest effort
    - Monitor kelp industry economics (e.g., employment, economic, and value)
    - Consider and implement kelp harvest regulatory changes (e.g., quotas, temporary harvest closure(s), etc.), as needed
- Research to Inform Management
    - Develop climate models for proactive kelp ecosystem management (e.g. resource and fisheries projections/forecasting)
    - Research foundational bull kelp ecology (i.e., life history dynamics, dispersal/connectivity)
    - Conduct monitoring and research to effectively detect and understand significant changes in ecosystem dynamics and function
    - Monitor genetic diversity, connectivity, and heat-tolerance of kelp populations
    - Research kelp culturing techniques that can be applied to restoration
    - Evaluate costs and effectiveness of different management approaches, including existing and emerging restoration techniques, that optimize protection and conservation of kelp forest ecosystems
    - Research relationship between harvest activities and kelp and associated species
    - Assess risk and potential effectiveness of speculative interventions (e.g., induced upwelling, managed evolution, microbiome manipulation, nutrient supply/support, etc.)
    - Assess community priorities, concerns, awareness, and capacity to engage in restoration, as well as potential impacts of restoration activities on communities
    - Research climate-ready interventions and restoration scaling, including economic assessments and field trials

Management Strategies: Resource Allocation Activity

The SAC members participated in a group activity to simulate resource allocation under a hypothetical scenario that entailed a mosaic of Kelp States spanning the California coastline. SAC members were given a limited amount of “resources” (e.g., capacity, funding) to allocate across a state-wide scale, with the goal of identifying priority management strategies and associated actions distributed across a range of Kelp States.

Activity Scenario (Hypothetical Map of Kelp States):

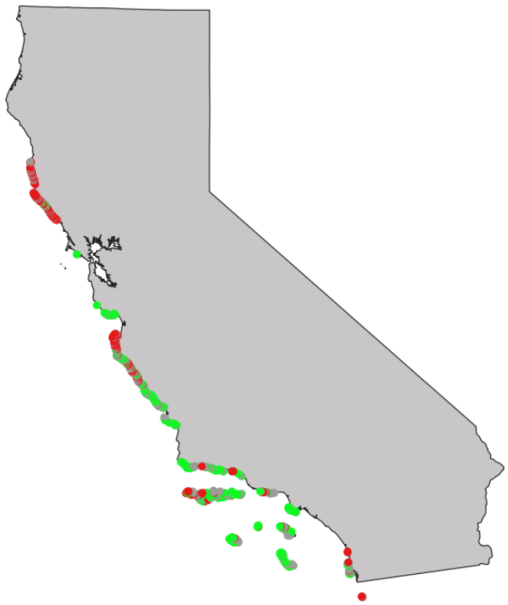

Figure 1. Map of California, depicting a hypothetical scenario of Kelp States ranging from thriving ("green") to depleted ("red"), with intermediate Kelp States shown in grey. Kelp States. Please note, Kelp State characterizations displayed in this scenario are hypothetical, and are not intended to be used for decision-making at this time.

Activity Outcomes (Management Strategies prioritization under limited resources):

Management Strategy	Kelp State				Total
	Depleted "Red"	Compromised "Orange"	Fine "Yellow"	Thriving "Green"	
Tribal co-management	2	1	2	5	10
Community Engagement, Education/Outreach & Knowledge Sharing	6	4	3	4	17
Interagency Coordination/ Partnerships	1	4	0	1	6
Restoration	17	14	3	1	35
Harvest Management	2	2	0	1	5
Research to Inform Management	7	5	6	5	23
Total	35	30	14	17	95