Date of Hearing: April 18, 2023

ASSEMBLY COMMITTEE ON WATER, PARKS, AND WILDLIFE
Rebecca Bauer-Kahan, Chair
AB 1407 (Addis) – As Amended April 6, 2023

SUBJECT: Coastal resources: ocean recovery and restoration: large-scale restoration

SUMMARY: Requires the Ocean Protection Council (OPC), upon appropriation by the Legislature, to establish a Kelp Forest and Estuary Restoration and Recovery Framework (Framework) that has a goal of restoring a specified number of acres of kelp forests, eelgrass meadows, and native oyster beds by 2050. Specifically, **this bill**:

1) Requires OPC, upon appropriation by the Legislature, to establish a framework that has a goal of restoring at least 5,000 acres of kelp forests, 16,000 acres of eelgrass meadows, and 9,000 acres of native oyster beds by 2050.

2) Requires the Framework to include specified information, including all of the following:

    a) Identified coordinated actions that reflect a systematic, interagency approach for meeting restoration goals;

    b) A plan for monitoring progress toward 2050 goals, including biannual quantifiable goals and measurable benchmarks for evaluating progress; and

    c) Criteria by which an acre of kelp forests, eelgrass meadows, and native oyster beds can be considered restored.

3) Requires OPC to establish an interagency Ocean Restoration and Recovery Working Group that coordinates and facilitates large-scale restoration along the coast and prescribes the duties of the working group.

4) Establishes the Ocean Restoration and Recovery Fund to be administered by OPC and consisting of specified moneys. Requires the fund to be used, upon appropriation, to develop and carry out large-scale restoration and enhancement projects, as provided.

5) Requires OPC to submit several reports to the Legislature regarding the above provisions.

6) Defines several terms, including "large-scale restoration" to mean restoration or recovery activities that occur at one of the following spatial magnitudes:

    a) An entire estuary or bay;

    b) Over a footprint of at least 10 contiguous acres; and

    c) Plots of a combined footprint of 30 acres.

7) Makes findings and declarations regarding California's ocean ecosystems and the importance of large-scale restoration.

EXISTING LAW:

1) Establishes OPC in state government [Public Resources Code (PRC) § 35600 *et seq.*].

2) Requires OPC to, among other things, coordinate activities of state agencies that are related to the protection and conservation of coastal waters and ocean ecosystems to improve the effectiveness of state efforts to protect ocean resources and develop and implement a coastal climate change adaptation, infrastructure, and readiness program that does certain things, including recommend best practices and strategies to improve the climate change resilience of the state's coastal communities, infrastructure, and habitat (PRC §§ 35615-35616).

3) Specifies that kelp forests and seagrass beds, among other types of habitat, should be represented in the types of areas reserved under the Marine Life Protection Act (FGC § 2856).

FISCAL EFFECT: Unknown. This bill is keyed fiscal.

COMMENTS:

1) Purpose of this bill. This bill requires OPC to develop a framework that has a goal of restoring at least 5,000 acres of kelp forests, 16,000 acres of eelgrass meadows, and 9,000 acres of native oyster beds by 2050. According to the author, "California's marine ecosystems are under unprecedented threat from climate change, pollution and coastal development. [This bill] is critical legislation that will set California on a path to restore our vital ocean habitats so that we can preserve these cultural and natural wonders for generations to come."

2) **Background.** California is home to one of the most diverse coastal and ocean ecosystems in the world, with over 1,100 miles of coastline. The coast and ocean are treasured by residents and visitors, and supports a marine economy of over $51 billion annually.[1]

However, climate change and other stressors increasingly threaten the continued health of these coastal and marine systems. Oceans absorb about 30% of all anthropogenic carbon dioxide emissions.[2] The 2019 "*Special Report on the Ocean and Cryosphere in a Changing Climate*," approved by the Intergovernmental Panel on Climate Change (IPCC) member governments, found that climate change is already "resulting in profound consequences for ecosystems and people." The IPCC report stated that the ocean is "warmer, more acidic and less productive," with effects already being seen in the distribution and abundance of marine life, including reduction in the global fish catch potential.[3]

In California, the combination of warmer water temperatures, disease, invasive species, and the collapse of sea star populations statewide has placed California's North Coast kelp forest ecosystems in a state of emergency, with South Coast kelp struggling as well. Ocean

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[1] NOAA. (2022). Marine Economy Report – California. Accessed April 13, 2023, at https://coast.noaa.gov/data/digitalcoast/pdf/marine-economy-california.pdf.
[2] NOAA. (2020) Ocean Acidification. Accessed April 13, 2023, at www.noaa.gov/education/resource-collections/ocean-coasts/ocean-acidification.
[3] IPCC. (2019). Special Report on the Ocean and Cryosphere in a Changing Climate. Accessed April 13, 2023, at https://www.ipcc.ch/srocc/.

acidification and oxygen loss in the California Current upwelling system is further impacting biomass production and species composition. Climate change overall exacerbates the effects of numerous other stressors on species populations, such as pollution and habitat destruction.

The absorption of carbon dioxide in the oceans is contributing to a suite of changes to ocean chemistry, including more ocean acidity, a process referred to as ocean acidification. Research has shown that the increase in ocean acidity is having a negative impact on many ocean organisms, including shellfish, starfish, corals, sea urchins, and many types of plankton. Organisms that produce skeletons (e.g., corals) or shells (e.g., oysters and clams) are particularly sensitive to changes in ocean chemistry. Ocean acidification will likely have major impacts on the fisheries and aquaculture industries in California. It could also have a profound effect on marine ecosystems leading to large-scale die-offs and reduced biodiversity over the long term.

The effects of ocean acidification are further compounded by the intensification and expansion of low dissolved oxygen – or hypoxic – zones in the ocean. These regions form in part from runoff that carries nutrients and organic carbon into the ocean. The low levels of dissolved oxygen can result in “dead zones” where mass die-offs of fish and shellfish occur.

Kelp. Kelp are many species of large brown algae – or seaweed – that inhabit cold-water coastal regions around the world. Kelp forests have been found all along California’s coast for thousands of years. As many as 20 different species of kelp comprise California’s kelp forests, with each species contributing to the forest’s structural complexity. Bull kelp (*Nereocystis luetkeana*), an annual plant, and giant kelp (*Macrocystis pyrifera*), a perennial plant, are canopy-forming kelps. Kelp is a foundational species for California marine ecosystems that forms complex habitat, modifies light levels and sedimentation, attenuates wave energy, sequesters carbon, and serves as a major food source for numerous ecologically and economically important species. The kelp forests of California are one of the most diverse and productive ecosystems in the state, providing a home to more than 800 species of plants and animals, including many of the approximately 300 species important to the state’s commercial fishing industry.

Kelp forests across California have declined sharply in recent years after the onset of a marine heatwave in 2014. Bull kelp forests in northern California were devastated, experiencing greater than 95% loss in kelp canopy from 2014 to 2019 with limited recovery since 2015. Some recent monitoring in 2021 indicated good growth, but not full recovery.[4] California’s central and south coasts have been affected by declines in giant kelp, but these declines have been patchier than those on the north coast. For example, certain reefs off the Monterey Peninsula have transitioned to urchin barrens, while others remain kelp forests. The marine heatwave generally had no strong effects on giant kelp forests in southern California.

Increased sea surface temperatures have also been implicated in the spread of sea star wasting disease, a mysterious disease that was first reported in 2014 and subsequently ravaged sea star populations along the U.S. west coast. Sea stars are a major predator of purple sea urchins (*Strongylocentrotus purpuratus*), which eat kelp. With no sea stars to keep

[4] https://www.sfchronicle.com/climate/article/Satellite-images-show-kelp-forest-has-doubled-in-16589392.php

them in check, purple sea urchin populations have exploded, grazing kelp forests down to bare rock and turning once-lush reefs into “urchin barrens,” which are now persistent statewide.

Eelgrass. Eelgrass is a type of marine, flowering seagrass that grows underwater in temperate marine environments around the world, and on the West coast includes three species: *Zostera marina*; *Zostera pacifica* (a distinct species to Southern California), and non-native dwarf eelgrass, *Zostera japonica*. Eelgrass species occur in the temperate unconsolidated substrate of shallow coastal environments, enclosed bays, and estuaries. Eelgrass is a highly productive species and is considered to be a "foundation" or habitat forming species. Eelgrass contributes to ecosystem functions at multiple levels as a primary and secondary producer, as a habitat structuring element, as a substrate for other organisms, and as sediment stabilizer and nutrient cycling facilitator. Eelgrass provides important foraging areas and shelter to young fish and invertebrates, food for migratory waterfowl and sea turtles, and spawning surfaces for invertebrates and fish such as the Pacific herring. In addition, eelgrass has the capacity to sequester carbon in the underlying sediments and may help offset carbon emissions.[5]

California supports dynamic eelgrass habitats that range in extent from less than 11,000 acres to possibly as much as 15,000 acres statewide. This is inclusive of estimates for poorly documented beds in smaller coastal systems as well as open coastal areas. While among the most productive of habitats, the overall low statewide abundance makes eelgrass one of the rarest habitats in California. Collectively just five systems – Humboldt Bay, San Francisco Bay, San Diego Bay, Mission Bay, and Tomales Bay – support over 80 percent of the known eelgrass in the state. The uneven distribution of eelgrass resources increases the risk to this habitat and also contributes to its dynamic nature. Further, the narrow depth range within which eelgrass can occur further places this habitat at risk in the face of global climate change and sea level rise predictions.

Eelgrass is commonly threatened by poor coastal water quality (high turbidity and eutrophication) due to the high minimum light requirements of seagrasses. The National Oceanic and Atmospheric Administration Fisheries Service California Eelgrass Mitigation Policy recommends no net loss of eelgrass habitat function in California. The policy recommends compensatory mitigation for the loss of existing eelgrass habitat function, but only after avoidance and minimization of effects to eelgrass have been pursued to the maximum extent practicable.[6] This policy does not address mitigation for actions that affect potential eelgrass habitat.

Native oysters. Oysters are shellfish that play an essential role in the overall health and stability of marine ecosystems. They attract algae and similar organisms to form the foundation of a healthy ecosystem while improving water quality through their own filter feeding. Their shells can also help buttress fragile shoreline habitat against large waves, storm surge, or future sea level rise. Oysters provide habitat and refuge for other organisms, such as octopus, crabs, and juvenile fishes, who take shelter on the structure oyster beds

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[5] Ricart, et al. (2021). Coast-wide evidence of low pH amelioration by seagrass ecosystems. Global Change Biology. Accessed April 13, 2023, at https://doi.org/10.1111/gcb.15594.
[6] NOAA. (2014). California Eelgrass Mitigation Policy and Implementing Guidelines. Accessed April 13, 2023, at https://media.fisheries.noaa.gov/dam-migration/cemp_oct_2014_final.pdf.

provide.

Found from southern Alaska to Baja California, Mexico, the Olympia oyster (*Ostrea lurida*) is the only oyster that is native to the west coast of North America. Olympia oysters were once an important food source for native Californians and an ecologically important habitat for numerous other aquatic organisms. The Olympia oyster nearly disappeared as a result of overharvesting, coastal water pollution, and habitat degradation. Today, native oysters exist primarily as small remnant populations in bays and estuaries.

Restoration efforts. The response to the rapid kelp decline has been varied with groups in different regions leading local efforts to study and implement kelp restoration. For example, in the Los Angeles area, the Bay Foundation has piloted giant kelp restoration efforts. In Northern California, the Greater Farallones Association has led a working group to examine bull kelp restoration efforts.

As the kelp crisis has unfolded, resource managers have been constrained by a variety of knowledge gaps surrounding kelp forest ecosystem dynamics. As a first step toward addressing these gaps, OPC and DFW worked in close partnership to initiate pilot research and restoration work, largely focused on investigating the efficacy of purple sea urchin removal as a potential kelp restoration tool on the north coast. However, in order to effectively mitigate the kelp crisis at broader spatial and temporal scales, OPC and DFW required an improved understanding of the drivers of kelp collapse, more robust long-term monitoring of kelp forest health statewide, and a science-based evaluation of the efficacy of various kelp restoration options. In 2020, OPC approved funding California Sea Grant with $600,000 to create a statewide Kelp Recovery Research Program, which is intended to support solutions-oriented research projects, selected by a competitive process, aimed at restoring and protecting kelp ecosystems statewide. Additionally, OPC released an Interim Action Plan for Protecting and Restoring California's Kelp Forests in 2021, and approved the development of a statewide Kelp Restoration and Management Plan in late 2022.

Eelgrass restoration is undertaken for research purposes, to achieve management goals, or for mitigation purposes to compensate for negative impacts to the habitat. The size, approach, and evaluation of the restoration can vary widely depending on why the restoration was undertaken. Eelgrass restoration often involves the transplantation of eelgrass shoots by a variety of methods and the spreading of seed. A recent review synthesized data from 51 eelgrass restoration projects from California, Oregon, and Washington in order to identify best practices for eelgrass restoration along the U.S. West Coast. The review found that restoration method, while important, is not typically the primary driver of restoration success or failure; rather, environmental conditions have a substantial impact on whether or not a project will meet its specified success criteria.[7]

Most Olympia oyster restoration projects involve the addition of some type of hard substrate, which oysters require for attachment. This method works well in locations where naturally

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[7] Beheshti, K. and Ward, M. 2021. Eelgrass Restoration on the U.S. West Coast: A Comprehensive Assessment of Restoration Techniques and Their Outcomes. Prepared for the Pacific Marine and Estuarine Fish Habitat Partnership. Accessed April 11, 2023, at http://honu.psmfc.org/media/PMEP/Eelgrass_Restoration_Synthesis/Documents/PMEP_Beheshti_Ward_2021_EelgrassSynthesisReport.pdf

occurring populations of oysters produce sufficient larvae, but where hard substrate at the right tidal elevation is limited. The most commonly used substrate is clean Pacific oyster (*Crassostrea gigas*) shell, which is significantly larger than Olympia shell. Some projects add layers of loose shell spread flat or in mounds, while others use bagged shell. Other projects, like those in San Francisco Bay, have used structures made of "baycrete" (a mixture of oyster shell and sand from the bay, and a small amount of Portland cement), Olympia oyster shells and clam shells strung on rope, or attached to stakes.[8] Some projects have used hatchery reared oysters as a restoration method. Which method is selected depends on local conditions and the goals of each project; for example, some projects aim to recreate the natural low-lying beds of Olympia oysters, while others have shoreline protection aims as well as oyster restoration goals.[9]

Restoration targets. To arrive at the restoration targets outlined in this bill, The Nature Conservancy, one of the co-sponsors of this bill, undertook a scientific analysis that focused on quantifying the restoration potential, in terms of restorable area for each of these three habitats across the state of California.

For kelp, 40 years of satellite data from kelpwatch.org was used to identify areas where kelp canopy occurred in six non-consecutive years between 1984-2013. Areas with persistent kelp during the years 2017-2022 were removed from the historical data layer to determine restorable area by county. The years 2014-2016 were excluded due to the marine heat wave.

For eelgrass, data from the Pacific Marine and Estuarine Fish Habitat Partnership spanning back to 1937 was utilized to identify historical persistence, which is eelgrass sightings between the years 1995-2017 with at least two occurrences over a five-year time period. Contemporary eelgrass sightings during the years 2015-2017 were then subtracted from the historical data layer to determine restorable area by county.

For native oysters, similar historical and/or contemporary spatial data does not exist. Therefore, an alternative approach was required. Twenty potential bays or estuaries were identified by reviewing the work of Ridlon et al. (2021), followed by interviews with local experts to delineate potential restorable areas within each bay, considering such factors as local hydrodynamics, benthic characterization, access, and likelihood of oyster survival and recruitment. In San Francisco Bay, the San Francisco Bay Subtidal Habitat Goals Report from 2010 developed restoration targets based on the acreage of shoreline areas out to a depth of 2 meters where native oysters have been documented and correlate with monitoring data regarding oyster distribution.

OPC. OPC is tasked with (1) coordinating activities of ocean-related state agencies to improve the effectiveness of state efforts to protect ocean resources within existing fiscal limitations; (2) establishing policies to coordinate the collection and sharing of scientific data related to coast and ocean resources between agencies; (3) identifying and recommending to the Legislature changes in law; and (4) identifying and recommending changes in federal law and policy to the Governor and Legislature.

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[8] https://oysternet.sf.ucdavis.edu/how-we-restore
[9] https://nerrssciencecollaborative.org/resource/conservation-marine-foundation-species-learning-native-oyster-restoration-california

The 2020-2025 OPC strategic plan includes several objectives and targets that are complementary to this bill, including the following:

Objective 1.1 Build Resiliency to Sea-Level Rise, Coastal Storms, Erosion, and Flooding – This objective includes an action under Target 1.1.1 to fund and promote innovative and transferable nature-based infrastructure adaptation measures and projects of variable size and scale, including living shorelines, eelgrass and oyster beds, wetland and beach restoration, and other adaptation strategies such as managed retreat, where feasible.

Objective 3.1 Protect and Restore Coastal and Marine Ecosystems – This objective includes Target 3.1.4: Work with partners to preserve the existing, known 15,000 acres of seagrass beds and create an additional 1,000 acres by 2025. Under this target is an action to support projects that protect existing and potential eelgrass habitats as identified in habitat suitability mapping, consistent with the National Marine Fisheries Service's California Eelgrass Mitigation Policy as key policy and technical guidance for protecting and restoring eelgrass.

Objective 3.2 Restore and Protect Kelp Ecosystems – This objective includes Target 3.2.1: By 2020, develop and begin implementation of a statewide kelp forest research and restoration plan, which shall include potential restoration and management approaches and research and monitoring recommendations.

3) **Policy considerations.** It is likely that the Framework required by this bill will consider many of the following elements, but they are important to note here. The success of coastal and ocean restoration efforts is often highly variable, particularly due to the large variability in ocean conditions. The restoration envisioned by this bill is unlikely to proceed in a linear manner, and it is important to acknowledge that setbacks are very likely to occur. Simply reestablishing species in historic habitat will not guarantee success, unless the conditions that resulted in the loss of species in those areas has been identified and remedied.

   Additionally, the measures of restoration success are likely different for different species. For example, different kelp species have differing annual variability, and the timing of any monitoring and evaluation can influence estimates of acreage, and therefore estimates of restoration success. Acreage targets may be appropriate for eelgrass, but may not always be the best metric of success for oyster beds, or kelp if kelp farming for restoration could be included within the framework.

   The Framework will need to guide prioritizing active restoration efforts versus natural recovery, and bring together multiple restoration efforts in order to achieve synergistic effects and fiscal efficiencies. Of course, for the species considered by this bill, continued progress to reduce carbon emissions, improve water quality, and control invasive species, among other efforts, will be crucial to the success of these restoration efforts. Continued protection of, or increasing protections for, existing ocean ecosystems is also crucial to ensure climate refugia remain intact as the effects of climate change worsen.

4) **Arguments in support.** Many organizations write in support, with a large coalition of environmental and ocean organizations stating that "despite the economic, ecological, and cultural importance of key habitats like kelp forests, eelgrass meadows, and native oyster beds, these habitats are in decline due to coastal development, pollution, climate change, and

in the case of oysters, overharvest. We need intentional, active intervention to combat these ongoing and accelerating threats and restore at the ecosystem level."

5) **Related legislation.** AB 1279 (Muratsuchi) of 2021 would have required OPC to work with private and nonprofit entities to bring sustainable kelp to the coastal waters of the state, as provided. AB 1279 was later amended into a bill relating to greenhouse gas emissions.

   AB 303 (Robert Rivas) of 2021 would have established an alternative regulatory process from 2024 to 2036 for mariculture projects cultivating specified species of oyster, mussel, clam, and kelp within five 200-hectare tracts designated by the Department of Fish and Wildlife (DFW). AB 303 was not heard in the Assembly Natural Resources Committee.

   AB 2697 (Muratsuchi) of 2020 would have established the Kelp Restoration and Resilience Program within DFW and the Kelp Restoration Science Advisory Committee to advise DFW, with specified tasks for the program and the committee. AB 2697 was not heard in the Assembly Water, Parks, and Wildlife Committee.

   AB 2139 (Williams), Chapter 352, Statutes of 2016, authorizes the OPC to develop an ocean acidification and hypoxia science task force to ensure that decision making is supported by the best available science.

   SB 1363 (Monning), Chapter 846, Statutes of 2016, requires the OPC, in consultation with the State Coastal Conservancy and other relevant entities, to establish and administer the Ocean Acidification and Hypoxia Reduction Program, and specifies approaches that must be considered by the program.

REGISTERED SUPPORT / OPPOSITION:

Support

Monterey Bay Aquarium (Co-Sponsor)
The Nature Conservancy (Co-Sponsor)
Above Below
Aquarium of the Pacific
California Academy of Sciences
California Coastkeeper Alliance
California Institute for Biodiversity
Clean Water Action
Climate Reality Project, Los Angeles Chapter
Climate Reality Project, San Fernando Valley
Defenders of Wildlife
Giant Giant Kelp Restoration Project
Kelp Forest Alliance
MPA Watch
Noyo Center for Marine Science
Ocean Preservation Society
Paua Marine Research Group
Reef Check Worldwide
Save Our Shores

Sierra Club California
Surfrider Foundation
The 5 Gyres Institute
The Otter Project
Transformation Wealth Management
Trinidad Coastal Land Trust
Turtle Island Restoration Network
Wholly H2O
Wildcoast

Opposition

None on file

Analysis Prepared by: Keith Cialino / W., P., & W. / (916) 319-2096