Committee Staff Summary for July 16, 2026 MRC

6. Kelp Restoration and Management Plan (KRMP) Development

Today's Item **Information ☒** **Action ☐**

Receive and discuss Department update on KRMP development progress and timeline, including recent scientific advisory committee and community workgroup meetings and outcomes, and receive a report on the urchin culling project completed at Tanker Reef in Monterey.

Summary of Previous/Future Actions

• Commission referred KRMP development topic to Marine Resources Committee (MRC)	February 2022
• MRC and Tribal Committee (TC) received Department overview of plans and process for KRMP development	March 2022; MRC and August 2022; TC
• MRC received Department update on KRMP development	March 2023; MRC
• MRC received a comprehensive kelp report prepared by Department and California Ocean Protection Council (OPC), and an update on KRMP development	November 2023; MRC
• MRC and TC received Department updates on kelp management and KRMP development	July 16-17, 2025; MRC and April 14, 2026; TC
• Written update on KRMP efforts and engagement	November 6, 2025
• **Today's update**	**July 16, 2026; MRC**

Background

Beginning in 2014, bull kelp populations in Mendocino and Sonoma counties dramatically declined to levels outside of the range of normal variability. The decline was caused by elevated sea surface temperature, poor nutrient availability, and drastic increases in purple sea urchin (*Strongylocentrotus purpuratus*) populations. The altered ecosystem conditions have persisted and, in some areas, worsened in subsequent years.

In October 2019, the Commission received a Department update confirming that dramatic bull kelp declines were persisting across the northern California coastline. Based on interest in tracking kelp conditions and kelp restoration strategies, the Commission referred the topic to MRC.

In February 2022, the Department, in partnership with OPC, initiated planning to develop a statewide, ecosystem-based, adaptive KRMP for giant kelp (*Macrocystis pyrifera*) and bull kelp (*Nereocystis luetkeana*). The Commission referred KRMP development to MRC to track the plan's progress. KRMP development began in earnest in October 2022, after funding was secured and a project management team was contracted.

KRMP development is being informed through tribal engagement and two formal groups: a community working group and a science advisory committee. The KRMP will serve as a cohesive kelp management strategy with three core components:

1. A harvest management framework and other fishery management plan elements required by the Marine Life Management Act (harvest management framework).
2. An innovative framework for ecosystem-based management of kelp forests (EBM framework).
3. A restoration toolkit.

The Department has provided five KRMP development updates to MRC since February 2022:

1. March 2022: Proposed a multi-pronged approach and process for developing the KRMP.
2. March 2023: Provided an overview of the three core components under preparation.
3. November 2023: Presented accelerated initiation of kelp research and restoration efforts, along with collaborative projects to explore tools like urchin suppression and kelp enhancement for the KRMP restoration toolkit; summarized tribal engagement and initial meetings with the community working group and science advisory committee; and shared the 2023 kelp report.
4. July 2025: Provided an estimated timeline for plan completion and implementation by 2027; an update on tribal engagement and meetings of the community working group and science advisory committee; and planned next steps for continued tribal, stakeholder, and community engagement.
5. November 2025: Shared a written update on tribal engagement efforts and updates on efforts within the community working group and scientific advisory committee.

Once adopted by the Commission, the KRMP will guide the management, protection, and restoration of California's kelp forests. For more information on KRMP development, including summaries of community working group and science advisory committee meetings, visit the Department's website at https://wildlife.ca.gov/Conservation/Marine/Kelp/KRMP.

Update

Today, the Department will present an update on recent progress on KRMP development, including guidance from the scientific advisory committee, recommendations from the community working group, and tribal engagement efforts, as well as an overview of the KRMP development timeline (Exhibit 1). The Department has also provided a written report summarizing the urchin culling project completed at Tanker Reef in Monterey (Exhibit 2).

Significant Public Comments

Keith Rootsaert, Founder, Giant Giant Kelp Restoration Project, expresses concerns with the "Tanker's Reef" report provided by the Department. He points to unanswered questions, the end of urchin culling access, and delays in project reporting as primary sources of frustration. He additionally provides draft monitoring recommendations for the Tanker Reef effort (Exhibit 3). In a separate comment, he transmits Monterey temperature and light monitoring data, which he interprets as indicating an increase in warm green water conditions and, therefore, a need for the KRMP to examine warm water, climate-acclimated kelp survival in the region (Exhibit 4).

Recommendation (N/A)

Exhibits

1. Department presentation
2. Tanker Reef Project Report, dated June 2026
3. Email from Keith Rootsaert, Founder, G2KR, received July 1, 2026
4. Email from Keith Rootsaert, Founder, G2KR, received July 2, 2026

Committee Direction/Recommendation (N/A)

Kelp Restoration and Management Plan Development

July 16, 2026

Presented to:

Marine Resources Committee

CA Fish and Game Commission

Presented by:

Dr. Kristen Elsmore

Sr. Environmental Scientist Specialist

CDFW Marine Region

Overview

- Development of the Kelp Restoration and Management Plan (KRMP)
  - Development Process
  - Timeline
  - Progress to Date
  - Looking Ahead

Kelp Restoration and Management Plan (KRMP)

- **Overarching Goal**: *To develop a robust, adaptive, climate-ready approach to managing, protecting, and restoring giant and bull kelp forest ecosystems statewide for consideration and adoption by the Fish and Game Commission*

- **Core Components**:
  - Overarching ecosystem-based management framework
  - Adaptive kelp harvest framework
  - Restoration toolkit

PC: Kristen Elsmore, CDFW

KRMP Development Approach

- **Tribal Engagement**
- Solicitation, establishment, and convening of **Community Working Group** (CWG)
- Establishment and convening of **Science Advisory Committee** (SAC)


PC: CDFW|K. Elsmore


PC: CDFW|K. Elsmore

With Support from: StrategicEarth CONSULTING Sea Grant California

KRMP Development Timeline

Science Advisory Committee

Tribal Engagement and Consultation

Community Working Group

2023-2026

Recommendations informing the KRMP

On the Ground Research

2025 - 2026

KRMP Drafting, CEQA, and Finalization

2027 - 2028

Peer Review, Regulatory Process, and Implementation

KRMP Tribal Engagement

- Tribal Notification Letters
  - May 2023; April 2026
- Listening Sessions and Forums
  - June 2023; July 2024; June 2026
- CFGC Tribal Committee
  - August 2022; April 2023; August 2024; April 2026
- Representatives from several California Native American tribes on the CWG and SAC


PC: R. Fisher| Strategic Earth

Exploration of co-management pathways and consultation is ongoing

KRMP Community Working Group (CWG)

- Role and Composition:
  - Formed in 2023
  - 23 Members
  - Representing regional community sectors
  - Tasked with informing KRMP development, including gathering and sharing information with their communities
- Progress to Date:
  - 6 full CWG meetings; 8 subcommittee meetings
  - Developed and voted on recommendations to inform the KRMP


PC: R. Fisher| Strategic Earth

KRMP Science Advisory Committee (SAC)

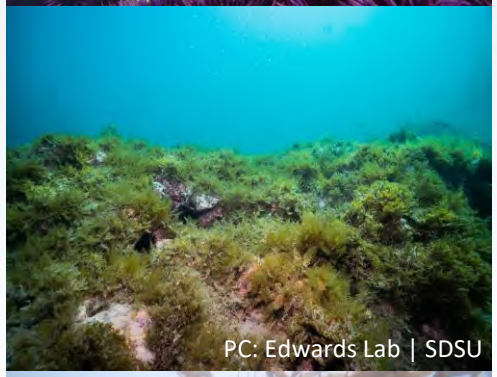

PC: K. Elsmore | CDFW

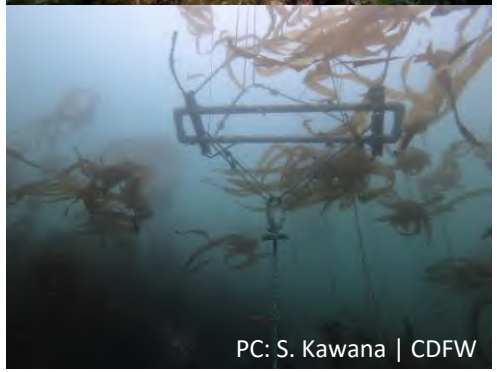
- Role and Composition:
  - Formed in 2023
  - 12 Members
  - Representing broad scope of disciplines and geographic areas
  - To provide scientific expertise on all aspects of the KRMP
- Progress to Date:
  - 12 full SAC meetings and additional topic-specific subgroup meetings
  - Refined characterization of “Kelp States”
  - Developing indicators and thresholds for management strategies
  - Developing the Kelp Restoration Toolkit

KRMP Restoration Toolkit Assessment

- Tools being assessed:
  - Managing grazing pressure
    - Remove or reduce grazers from the system
    - Move or relocate grazers from the system
    - Modify grazer behavior via dietary supplementation, grazer predator protection or enhancement
  - Managing competitive pressure
    - Remove or reduce competitive invasive species
    - Move or relocate competitive invasive species
  - Managing kelp spore supply/availability
    - Move or relocate kelp source material from the system
    - Supplement kelp source material into the system
    - Building physiological or genetic resilience of kelp


PC: K. Elsmore


PC: Edwards Lab | SDSU


PC: S. Kawana | CDFW

Kelp Biomass and Harvest Assessment

- Assessment of kelp biomass, production, and harvest
  - Project Lead: Woods Hole Oceanographic Institution
- Progress to Date:
  - Partnership with commercial harvesters in Northern, Central and Southern California
  - Drone surveys paired with commercial kelp harvest activities
  - Bull kelp biomass conversion factor development:
    - In situ biomass turnover sampling
    - Finer-scale remote-sensing techniques to detect bull kelp
    - Biomass model development


PC: K. Elsmore | CDFW

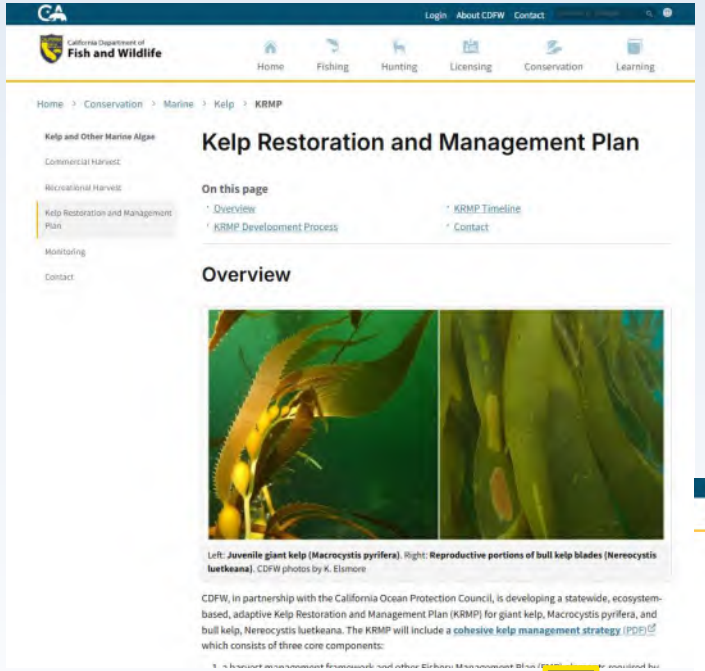

PC: K. Elsmore |CDFW


PC: S. Kawana | CDFW

KRMP: Next Steps 2026

- Tribal Engagement:
  - Additional opportunities for Tribal input and engagement
- Community Working Group:
  - Community input and priorities on KRMP components
- Science Advisory Committee:
  - Evaluation of potential restoration tools and approaches, harvest frameworks, other considerations
  - Decision tree for overarching management framework

KRMP Progress To Date



Scroll down to learn more about the process to date

- **Follow along on the KRMP Website** – meeting summaries in the timeline
- Reach out to **kelp@wildlife.ca.gov** with any questions

Thank You

Dr. Kristen Elsmore
Senior Environmental Scientist Specialist
State Managed Finfish and Nearshore Ecosystems Program
Department of Fish and Wildlife
Marine Region
Email: kelp@Wildlife.ca.gov

Tanker Reef Project Report

Giant Kelp, *Macrocystis pyrifera* (Photo Credit: CDFW)

California Department of Fish and Wildlife

Marine Region

June 2026

Citation: [1]Elsmore, K., [1]S. Kawana, [2]S. Lonhart, [3]A. Bauer-Civiello, [4]K. Rootsaert. 2026. Tanker Reef Project Report.

Affiliations: [1]California Department of Fish and Wildlife; [2]Monterey Bay National Marine Sanctuary; [3]Reef Check; [4]Giant Giant Kelp Restoration Project.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ACRONYMNS

CCR	California Code of Regulation
CDIP	Coastal Data Information Program
G2KR	Giant Giant Kelp Restoration
KFM	Kelp Forest Ecosystem Monitoring
MBNMS	Monterey Bay National Marine Sanctuary
NAUI	National Association of Underwater Instructors
PADI	Professional Association of Diving Instructors
QAQC	Quality Assurance and Quality Control
RCCA	Reef Check California
RM	Restoration Monitoring
SBLTER	Santa Barbara Coastal Long Term Ecological Research
UPC	Uniform Point Contact

EXECUTIVE SUMMARY

The California Fish and Game Commission adopted a temporary amendment to existing regulations in Section 29.06, Title 14, California Code of Regulations to remove the daily recreational bag limit for the take of sea urchins at Tanker Reef in Monterey County for a three-year period (April 1, 2021-2024). In conjunction with the proposed regulations, the California Department of Fish and Wildlife worked closely with community partners and other agency partners to establish specific performance criteria to evaluate the efficacy of the proposed activity at Tanker Reef. This included targeted and ecological subtidal monitoring designed to assess whether recreational divers can lower sea urchin densities enough to support kelp recovery and if these efforts lead to natural kelp regrowth.

In just over a two-year period, recreational divers conducted over 1,529 dives and culled an estimated 749,320 sea urchins within the Tanker Reef regulatory boundary, concentrating efforts to protect and maintain a 100 meter $(m)^2$ "grid" focal area. Subtidal monitoring indicated that within five months of organized culling effort, urchin densities in the grid were reduced to the targeted 2 urchins m^{-2} density. Divers maintained targeted urchin densities, through repeated passes at the grid (8.7 total) and defending the surrounding area. Within the grid, increases in giant kelp individual density were observed in spring of 2022 and reached a maximum (0.3 m^{-2} ±0.9 Standard Error (SE)) in summer of 2022. Maximum stipe density reached 2.4 m^{-2} (±0.5 SE) in the summer of 2023, where individual and stipe density in the control remained near-zero. After urchin culling ceased in July 2023, urchin densities at the grid increased to similar levels as the control. Kelp densities, both of individuals and of stipes, remained persistent throughout the duration of the evaluation period.

These data show that within the documented timeframe, organized recreational culling can rapidly reduce urchin densities in a 100 m^2 focal area to target thresholds and increase kelp individual and stipe densities reflective of new and emergent forested areas. Assessment of potential impacts associated with in-water urchin culling were assessed in a separate, unpublished study; however, preliminary results document measurable damage that can occur to both organisms and the substrate. The underlying reef geomorphology and benthic community structure are important considerations for the application of in-water culling as a future tool.

BACKGROUND

In response to severe broadscale decline of kelp forests along California's north coast, in December 2020, the California Fish and Game Commission (Commission) temporarily amended Section 29.06 of the Sport Fishing Regulations (Title 14, California Code of Regulations) for sea urchins at Caspar Cove in Mendocino County and Tanker Reef in Monterey County (CDFW 2020; CDFW 2023). The temporary provisions were intended to support data collection to inform the state's response to the loss of kelp forests within state waters (CDFW 2020; CDFW 2023). From here on, this report will focus on activities associated with Tanker Reef in Monterey. The temporary regulatory amendment allowed divers with valid California sport fishing licenses unlimited take via in-water culling of purple urchins (*Strongylocentrotus purpuratus*) and red urchins (*Mesocentrotus franciscanus*) at the 685-acre site for a three-year period (April 1, 2021 through April 1, 2024). Tanker Reef (Figure 1) historically supported giant kelp (*Macrocystis pyrifera*), although kelp canopy cover has been variable since 1984 (Figure 2; Bell et al. 2026; see also Kelpwatch.org), documenting canopy cover up to just over six acres at its maximum historical extent in 1986.

The regulatory action at Tanker Reef was intended to evaluate the feasibility and effectiveness of kelp restoration efforts driven by recreational diver participation, as well as any potential environmental impacts associated with the large-scale sea urchin removal. As outlined in Joint Memorandum on Petition 2020-001, submitted to the Commission in August 2020, the California Department of Fish and Wildlife (CDFW), California Ocean Protection Council (OPC), and Monterey Bay National Marine Sanctuary (MBNMS) expected that the temporary sportfishing regulations at Tanker Reef would provide an improved understanding of the following key management questions related to kelp ecosystem recovery in central California:

1. Can recreational divers reduce sea urchin densities to levels expected to facilitate kelp regrowth (<2 urchins m^{-2}) via in-water urchin culling?
2. Does the reduction of sea urchin grazing pressure via in-water urchin culling by recreational divers facilitate natural kelp regrowth?
3. Are there negative impacts associated with in-water sea urchin culling by recreational divers (e.g. bycatch, damage to underlying reef structure, disturbance to marine mammal populations)?
4. Can recreational divers collect, analyze, and communicate data/results in a way that is both scientifically sound and informative to resource managers?

This report aims to address the first two of the four questions posed within the Joint Memorandum, and briefly addresses the latter two questions.

The Giant Giant Kelp Restoration (G2KR) project, a community-led entity, was established and took on the responsibility for coordinating sport fishers, overseeing urchin-culling efforts, and addressing the questions outlined above, posed within the

Joint Memo from OPC, CDFW, and MBNMS, in association with the rulemaking process. Agency scientific divers from CDFW and MBNMS collaborated with Reef Check California (RCCA) to conduct two independent but coordinated sets of subtidal surveys to assess changes associated with culling. The monitoring surveys by agency and RCCA citizen-science divers were designed to specifically address questions 1 and 2 above, and this report is focused on those results, though questions 3 and 4 are also addressed.

METHODS

Study Area

Tanker Reef is a shallow (8 - 20 m depth), low-relief, rocky reef located off Del Monte Beach in Monterey, California (Figure 1), within Monterey Bay National Marine Sanctuary, a federal marine protected area. As part of the Monterey Formation (Eittreim et al. 2002), Tanker Reef, also known as the “Shale Beds” or “Tanker’s Reef” by local divers, consists of horizontal slabs of friable mudstone interspersed with angled ledges up to 1 m high and areas covered by fine sand (Figure 1). The temporary regulatory amendment encompassed an area of 685 acres, which was originally selected based on the following criteria 1) the area was outside any state-designated marine protected area, 2) it was accessible from both shore and vessel, 3) giant kelp had historically occurred in the area, and 4) high densities of exposed sea urchins were observed in the area in 2020.

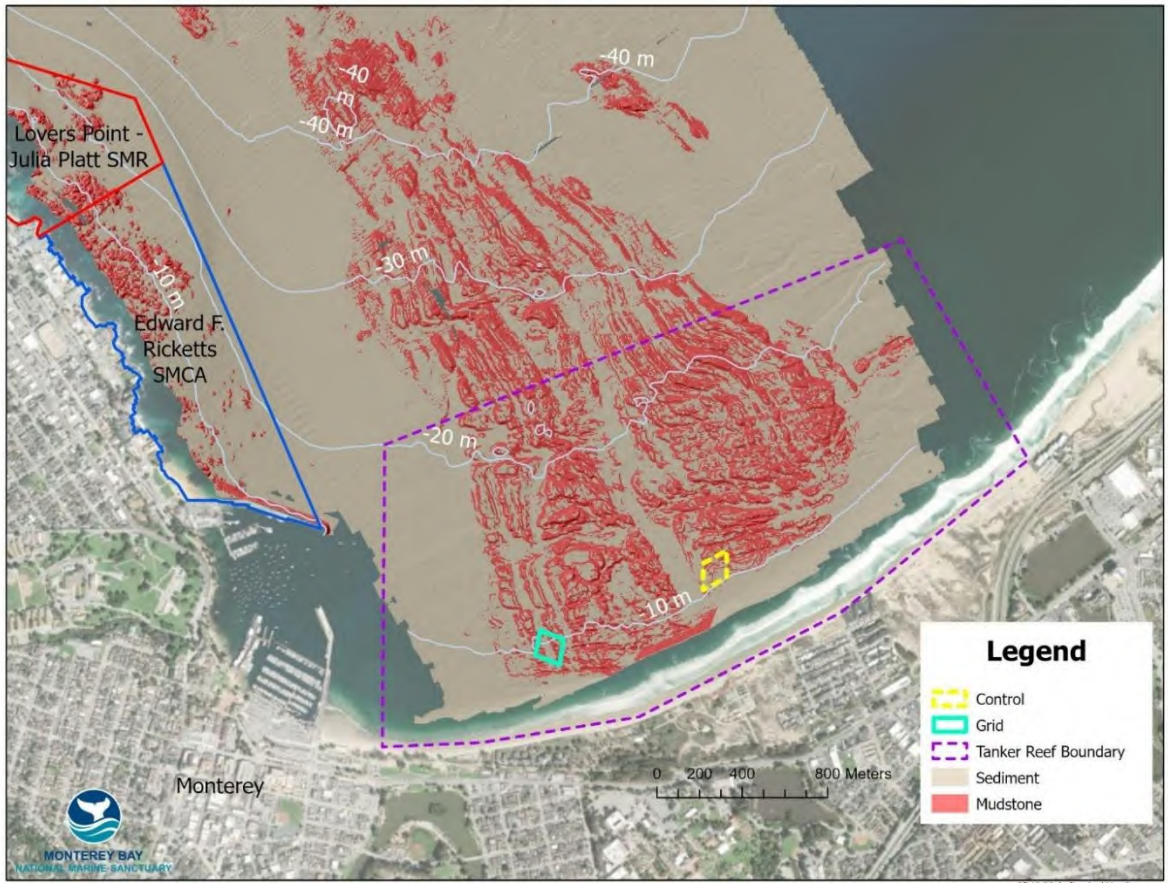


Figure 1. Tanker Reef and the 685-acre regulatory boundary (purple dashed line) in Monterey, California. The 2.5-acre treatment area (aka the grid; green polygon) and the control (dashed yellow polygon) are displayed. The underlying geology of the area, composed primarily of mudstone, is shown in red. Courtesy of Chad King, MBNMS.

A broad look at kelp canopy cover within the broader regulatory boundary was acquired using Landsat imagery packaged by the Santa Barbara Coastal Long-term Ecological Research network (SBCLTER; Bell et al. 2026). Landsat is a remote sensing satellite imagery tool that provides kelp canopy data at 30 m resolution, dating back to 1984. While other canopy mapping techniques, such as PlanetScope imagery and drones, can produce data at finer-scale resolution, Landsat serves as a useful tool to evaluate kelp canopy dynamics on broader spatial and temporal scales. Historically, the 685-acre Tanker Reef regulatory boundary supported up to around six acres of kelp canopy cover at its maximum extent in 1986 (SBCLTER, Figure 2). Canopy cover across the reef was dynamic and experienced extended periods of time with low and near-zero coverage. With the exception of a slight uptick in 2016 (~0.5 acres), canopy cover remained very low (< 0.001 acres) across the broader regulatory boundary area since 2005.

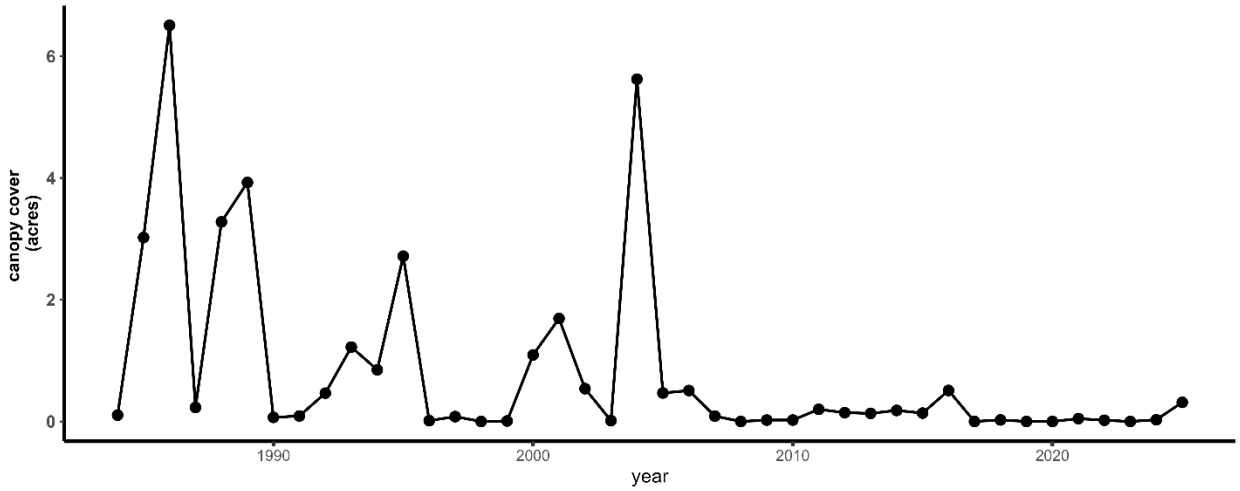


Figure 2. Changes in the annual maximum of Landsat-derived Macrocystis pyrifera kelp canopy cover from 1984 to 2025 within the regulatory boundary of Tanker Reef, as indicated in Figure 1 (Bell et al. 2026).

Sea surface and bottom temperatures were measured throughout the duration of the regulatory timeframe and evaluation period (Figure 3). Sea surface temperatures for the area were sourced from a nearby Datawell Waverider MkIII surface buoy, positioned at Cabrillo Point (36.6263°N, −121.9071°W) in Pacific Grove, CA, and maintained by the Scripps Institution of Oceanography Coastal Data Information Program (CDIP, https://cdip.ucsd.edu/). Bottom temperatures were sourced from two HOBO© temperature loggers deployed at depth (10 m and 12 m) by RCCA at the grid. Mean daily surface and bottom temperatures generally tracked one another, with surface temperatures generally remaining above those of bottom temperatures, with convergence of surface and bottom temperatures coinciding with winter and early spring months. Such patterns are consistent with intra-annual patterns of thermal stratification, mixing, and seasonal upwelling in the region.

In general, surface temperatures observed within the evaluation time period (Figure 3) remained within the normal range for the central coast region, with mean monthly temperatures typically spanning 11°C to 17°C (Scheil and Foster 2015). Temperatures exceeding 17°C occurred across a total of 28 days within the four-year time period between April 2021 and April 2025, with six days in 2021, four days in 2022, and 18 days in 2023, and a maximum observed surface temperature reaching just above 18°C in August of 2023 (Figure 3). Temperatures above 21°C, which have been documented to negatively impact frond elongation and overall growth of giant kelp (Schiel and Foster 2015), were not observed.

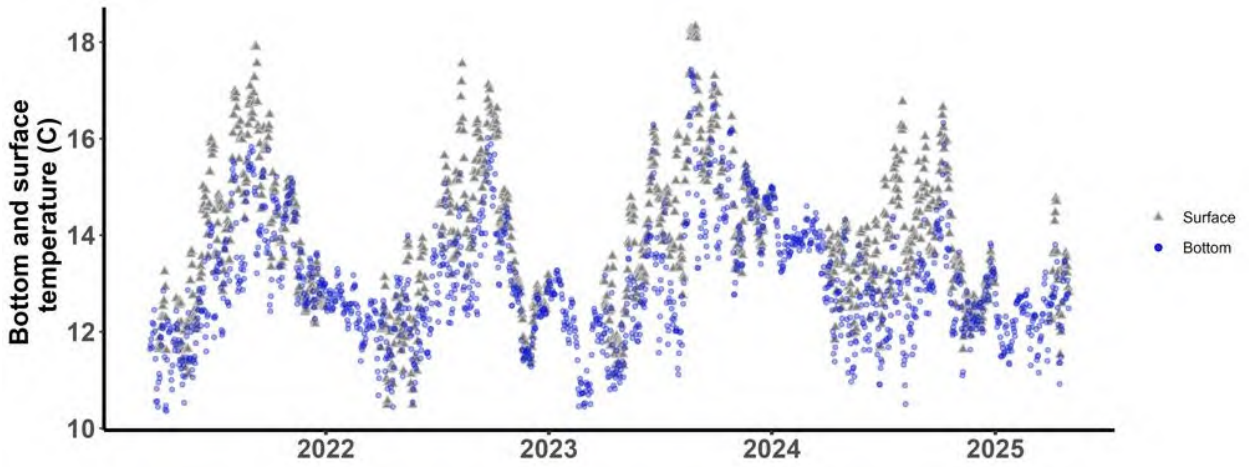


Figure 3. Surface and bottom daily mean temperatures in degrees Celsius. Surface temperature, shown in blue circles, was derived from the CDIP Cabrillo Point surface Waverider buoy 158. Bottom temperature, shown in gray triangles, was derived from HOBO temperature loggers deployed by Reef Check California at depth on the grid.

Study Sites

A 100 m by 100 m square area (hereafter, the grid) was designated as the primary section of Tanker Reef where sport divers would initially focus sea urchin culling efforts. Prior to the onset of sea urchin culling activities, divers from RCCA and G2KR, operating under a permit issued by MBNMS, installed stainless steel eye-bolts along the grid perimeter in 10 m intervals along the north and south borders and in 25 m intervals along the east and west borders. A lead-line was then attached to the bolts, delineating the grid boundary.

The grid was subdivided using cave lines into ten 10 m by 100 m “lanes” running approximately north to south, each marked at both ends with a lettered sign (*A* - *K*, excluding *I*), and were bolted down every 25 m. In 2021, a 100 m measuring tape was placed along the center of each lane to guide diver navigation (Figure 4). A total of 18 non-overlapping transects were established within the 10 grid lanes, each 30 m long and 2 m wide, covering nearly 11% of the grid’s total area (Figure 5). All transects were placed ≥5 m inside the grid perimeter lead-line, which created a buffer zone along the entire border of the grid intended to reduce confounding edge effects.

The control site (Figure 1), where no urchin culling occurred, was established 500 m east of the grid and remained within the Tanker Reef regulatory boundary. Depth, substrate composition, and sea urchin density in the control were similar to those in the grid (Figure 7). The control was surveyed by sampling six lanes, each 100 m in length, running north to south, with fixed GPS coordinates at the northern end of each lane. Within each of the six lanes, three 30 m by 2 m transects spaced 5 m apart (0-30 m, 35-65 m, and 70-100 m) were sampled, totaling 18 transects.

In addition to the grid and control, which were monitored and surveyed by agency divers and RCCA divers, sea urchin culling activities occurred in roughly 25 acres surrounding the grid; however, these additional areas were not surveyed by agency or RCCA divers.

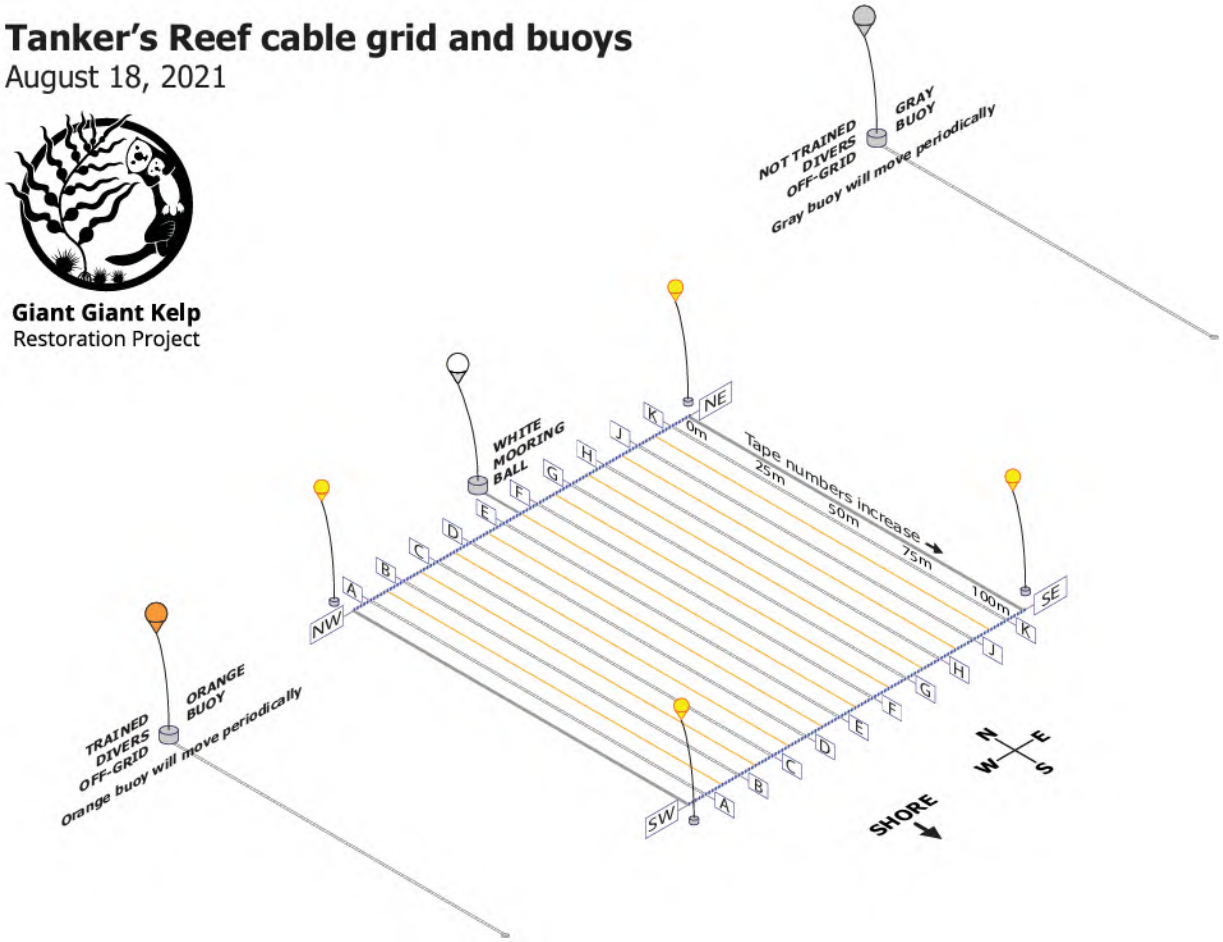


Figure 4. The "grid" area and 10 m by 100 m "lanes." Courtesy of G2KR.

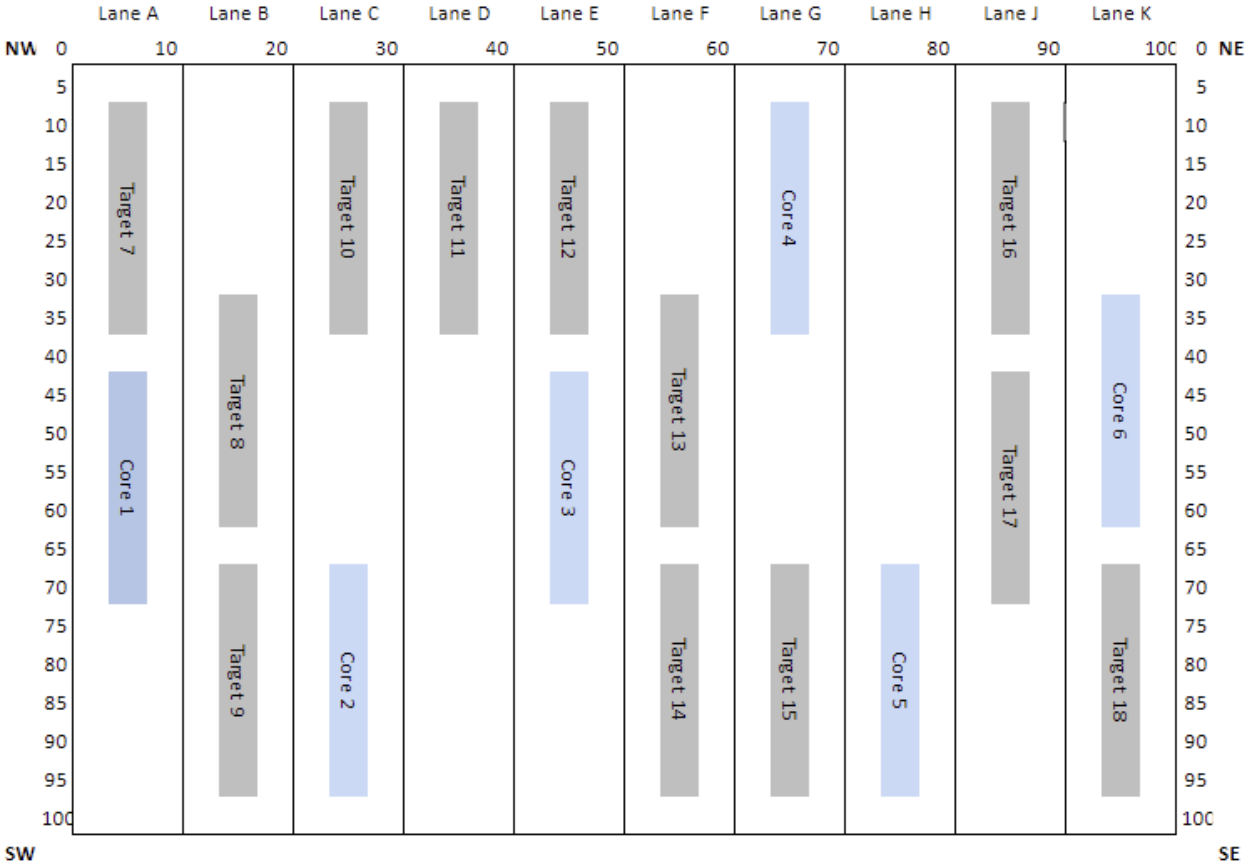


Figure 5. Spatial distribution of 18 30 m by 2 m transects within the grid, where volunteer divers culled sea urchins at the direction of G2KR. Agency divers collected only targeted monitoring data at all 18 transects. RCCA divers collected restoration monitoring data at the 12 "target" transects and kelp forest monitoring data at 6 "core" transects. Courtesy of RCCA.

Study Participants

When the amended temporary sport fishing regulation took effect on April 1, 2021, anyone with a valid fishing license could legally harvest or cull sea urchins at Tanker Reef. Concerns for diver safety and a desire to manage volunteer divers led to two recreational diving certification agencies (the Professional Association of Diving Instructors (PADI) and the National Association of Underwater Instructors (NAUI)) developing a course curriculum to certify kelp restoration divers. G2KR trained local dive shop instructors and created instructional slides for students to use as part of the course. G2KR provided additional class materials free to the instructors and included safety protocols and methods to collect data. An emphasis was placed on minimizing errant strikes with hand-held hammers, thereby reducing strikes to non-urchins and the reef itself in an effort to reduce collateral damage.

Certified divers were managed by G2KR via internet assignments, organized meetups, and boat charters. Starting in the spring and summer of 2021, divers with a valid sport

fishing license and a kelp restoration certification were directed by G2KR to the grid and specific lanes and, in some cases, specific areas within a lane. Divers culled all visible and accessible red and purple sea urchins using hand-held hammers. The goal was to reduce urchin density within the grid to <2 urchins m^{-2}, which was expected to facilitate kelp regrowth.

Culling efforts led by divers were broken down into two general categories: counting and non-counting. Counting divers would track the number of sea urchins culled and the time spent culling during each dive; these data were used to calculate a culling rate (urchins culled per minute). These individual rates for the last 30 days were then averaged among all counting divers to generate an average culling rate. In contrast, non-counting divers only recorded the time spent culling, and an estimate of the number of sea urchins culled was calculated by multiplying time spent culling by the average culling rate.

Data management by G2KR was facilitated by a SalesForce™ web-based portal, which allowed divers to record additional information, such as: date and location of the dive, dive buddy, time spent culling, area covered while on the grid, marine mammal disturbances, benthic disturbance and bycatch, location of invasive species, trash collected, other marine life comments and observations, and damage to the grid infrastructure. Data underwent weekly QAQC, and Tableau™ data visualization tools on the website displayed project progress and the status of individual effort.

Monitoring Efforts

One monitoring group (hereafter, RCCA divers) consisted of citizen-science divers using standard kelp forest ecosystem monitoring methods. These volunteer scientific divers were trained by RCCA, a community-based science organization, to identify and count a list of fishes, invertebrates, and algae. Data were collected along 30 m by 2 m transects as either density data via counts of individuals or percent cover via the uniform point contact survey method. RCCA divers used a combination of two survey protocols: 1) Kelp Forest Ecosystem Monitoring (KFM; RCCA standardized survey protocol; Bauer-Civiello et al. 2026), which included surveys of fishes, invertebrates, and algae, and 2) Restoration Monitoring (RM; Freiwald et al. 2021), which focused on urchins and kelp only. Survey frequency (using both KFM and RM protocols) occurred twice per year (approximately May and September; Figure 6). Surveys were typically completed within 1-2 days at the grid and within 1-2 days at the control area, usually completing both sites in the same week.

Of the total 18 transects established on the grid, six were surveyed using the KFM protocol (labeled as “Core” in Figure 5), which include Uniform Point Contacts (UPC) to estimate percent cover of substrate, relief, and cover (Figure 7); swath counts of 13 algae taxa; swath counts of 35 invertebrate taxa; swath counts of 35 fish taxa; and all occurring along the same 30 by 2 m transect. The remaining 12 transects were surveyed with RM protocols (labeled as “Targeted” in Figure 5), which targeted purple and red urchin, kelp (same as KFM), and fishes (same as KFM).

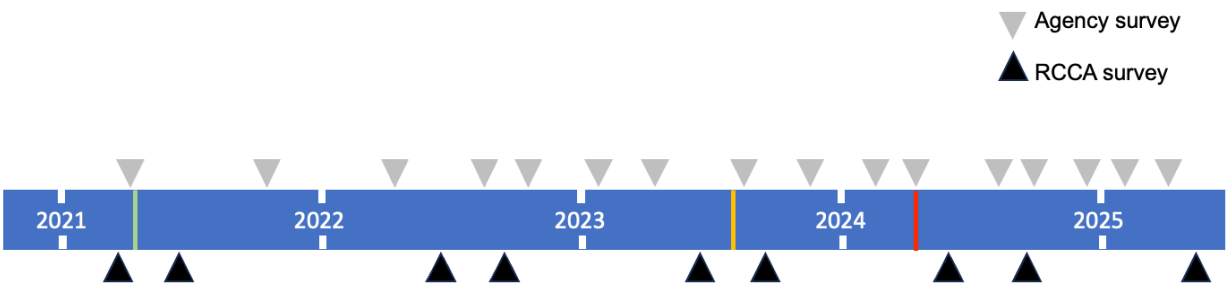


Figure 6. Frequency and timing of surveys at Tanker Reef, both in the ”grid” where sea urchin culling occurred from April 2021 until July 2023, and at the control site, where no culling occurred. Gray triangles indicate when agency scientists completed “targeted” surveys of sea urchins and kelp, and black triangles indicate when RCCA divers collected “ecosystem” survey data, which includes algae (including kelp), invertebrates (including sea urchins), and fishes. The three vertical lines indicate: April 1, 2021, when culling was allowed (green line); July 2023, when culling stopped in the grid (orange line); and April 1, 2024, when the regulatory modification at Tanker Reef sunsetted, reverting back to the prior sportfishing regulation for sea urchins (red line).

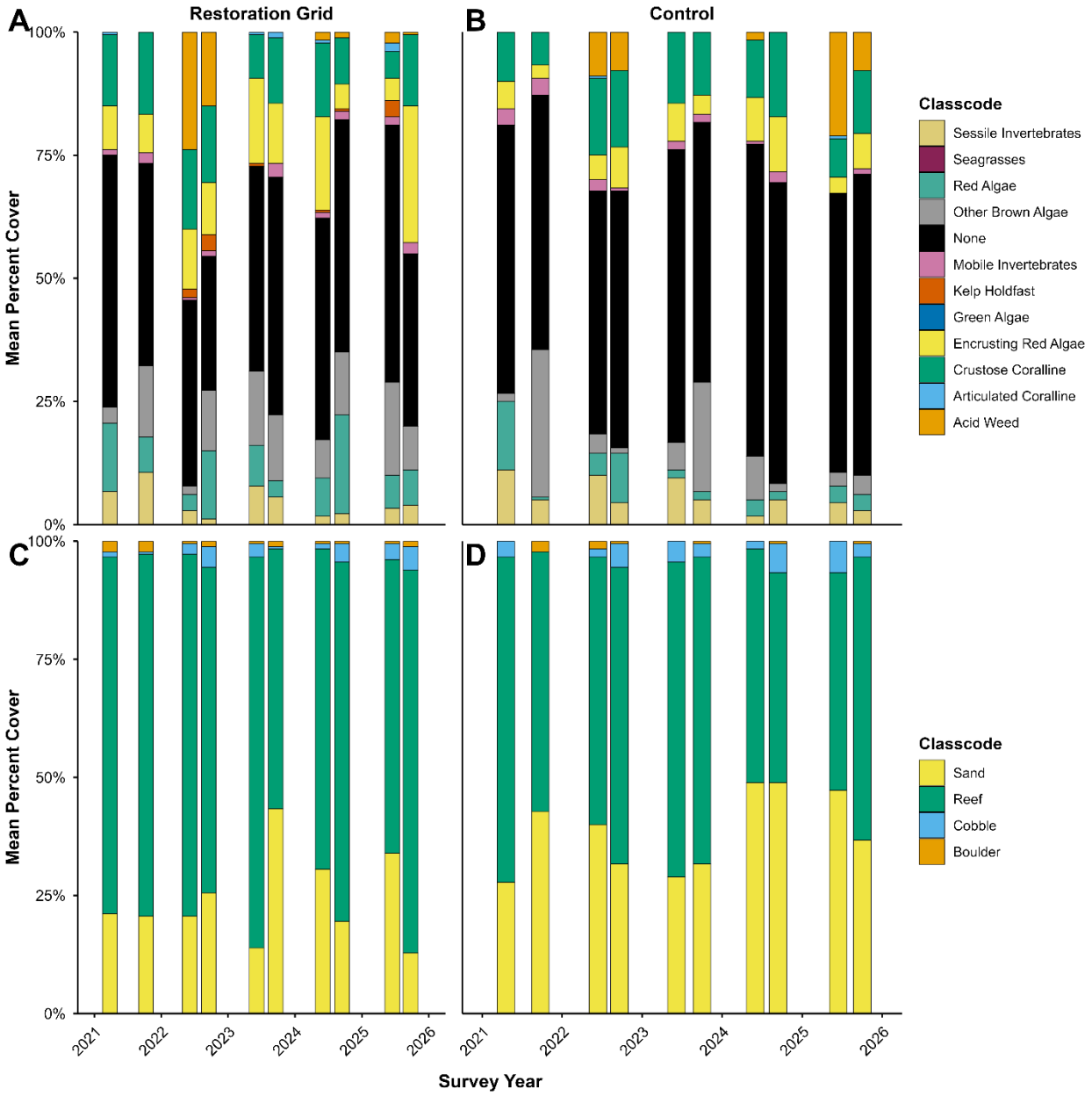


Figure 7. Uniform Point Contact (UPC) data collected by RCCA divers, comparing the mean percent cover of invertebrates and algae attached to the benthos at the A) restoration grid and B) control sites, and the mean percent cover of substrate type at the C) restoration grid and D) control sites by survey year.

The second monitoring group (hereafter, agency divers) consisted of scientific divers from CDFW and MBNMS. Agency divers collected data on three taxa: purple urchin, red urchin, and kelp (Order Laminariales), which was almost exclusively giant kelp (*Macrocystis pyrifera*). Survey frequency varied from 2-5 surveys per year (Figure 6). Surveys at both the grid and the control were typically conducted within a week and took from 2-5 days to complete.

Along the 30 m by 2 m transect, each agency diver of the buddy pair surveyed a single side of the transect tape, covering 30 m^2. Agency divers used flashlights to thoroughly look for all sea urchins and kelp on the transect, peering under ledges, and moving aside understory and turf algal species for an unobstructed view of the substrate. For each species of sea urchin, the first ≥50 individuals encountered by each diver were measured to the nearest centimeter (test diameter), and the distance along the transect was recorded. Any additional sea urchins encountered were not measured but were counted along the entire length of the transect. All giant kelp encountered were recorded: adults (>1 m stipe length) were recorded by the number of stipes occurring 1 m above the holdfast; juveniles (<1 m stipe length) were counted as individual thalli, regardless of stipe number. Beginning in November 2023, giant kelp recruits (i.e., a positive giant kelp identification but no bifurcation in the initial blade) were also recorded separately as counts. Giant kelp showing the first bifurcation of the blade were considered juveniles and counted as such. Additional transect-level information recorded included depth, ambient bottom temperature, location of extensive patches of sand covering the reef, and sporadic events (e.g., seasonally dense cover of acid weed *Desmarestia* spp.).

To standardize sea urchin and kelp data with agency diver surveys, starting in June 2022, RCCA divers modified the RM and KFM survey protocol to include giant kelp recruits (giant kelp <1 m in size), bull kelp recruits (bull kelp <30 cm in size), unidentified kelp recruits, 'no blade' kelp, and counting sea urchins <2.5 cm in diameter. In addition, the UPC survey was modified to include the invasive bryozoan *Watersipora* spp. and *Desmarestia* spp. due to initial observations and surges in understory coverage, respectively. Only sea urchins >2.5 cm were recorded in 2021 by RCCA divers. Direct comparison of RCCA and agency urchin density data highlighted the importance of enumerating urchins <2.5 cm. For example, up to 46% of urchins encountered on the site were <2.5 cm and not captured in the data using RCCA's standard KFM protocols. As such, RCCA protocols were adjusted to include the full size range within their RM protocols 2022 onward.

RCCA also collected sea urchin size-frequency data (test diameter to the nearest cm, by species) in March and October of 2021, where up to 50 urchins per 30 m by 2 m transect were sized to the nearest cm (test diameter). Starting in 2022, only agency divers collected sea urchin size-frequency data.

A total of 25 subtidal survey timepoints were conducted by agency (n=16) and RCCA (n=9) monitoring groups (Figure 6) throughout the Tanker Reef project timeframe (March 2021 to June 2025). Agency and RCCA divers each conducted one pre-culling targeted and ecological monitoring survey at both the grid and control sites in spring 2021 before organized urchin culling occurred following the regulatory amendment, which went into effect on April 1, 2021. Agency and RCCA divers conducted surveys through April 2025, one year after the regulatory amendment sunset on April 1, 2024.

RESULTS

Sea Urchin Culling

Recreational divers self-reported sea urchin culling efforts at the grid from April 17, 2021, until July 30, 2023, when culling ceased in the grid and was focused elsewhere on Tanker Reef. Divers self-reported over 700,000 sea urchins culled within the broader Tanker Reef regulatory boundary (purple dashed line in Figure 1), although the majority (66%) of the urchin removal efforts in this timeframe were outside of the grid as part of a strategy to reduce the number of sea urchins migrating into the grid between targeted culling efforts. Culling by divers within the grid was stepwise and incremental, completing an initial pass through the entire grid prior to revisiting culled areas, as reflected in pulses of time spent culling, relative to the self-reported urchins culled (Figure 8). In just over two years, divers conducted removal efforts over the entire grid 8.7 times. By April 2024, there were 18 instructors and 252 divers who performed 1,529 dives, culled an estimated 749,320 sea urchins (228,861 urchins within the grid; 520,459 urchins outside of the grid), and had no reported diving safety incidents.

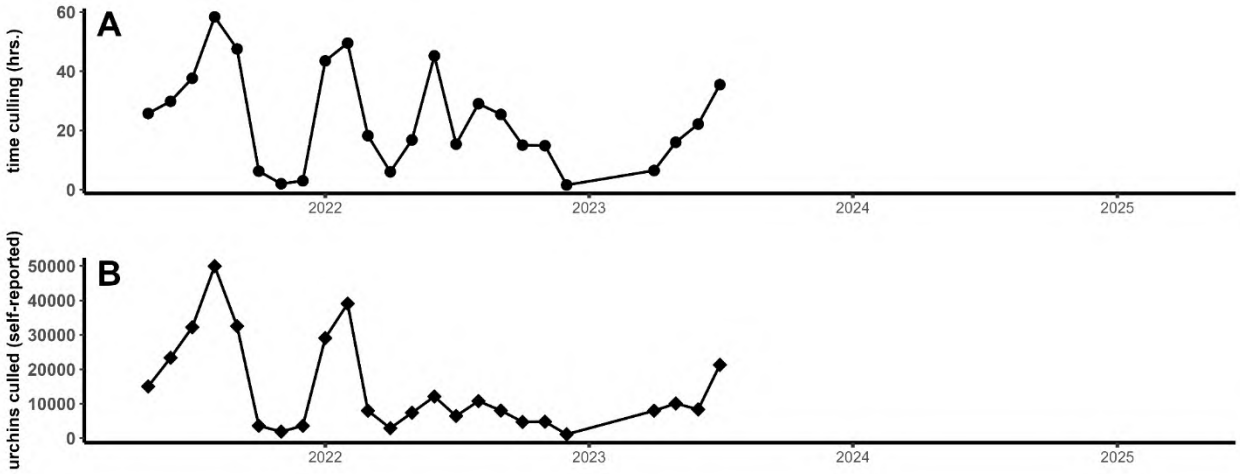


Figure 8. Time series of urchin culling effort data collected at the grid by G2KR throughout the duration of the regulatory amendment. Metrics are summed by month. A) self-reported time spent culling (in hours), B) self-reported estimates of urchins culled.

Subtidal Surveys

Across four years of monitoring, following initiation of organized urchin culling in April 2021, purple urchin densities generally remained higher at the control site than at the grid (Figure 9; Panel *A*). During the pre-culling survey in spring 2021, mean purple urchin density was similar, but slightly higher at the control compared to the grid (8.5 m^{-2} ±0.9 SE and 6.8 m^{-2}±1.3 SE, respectively). By Fall 2021, five months after organized culling efforts were underway (Figure 9; Panel *A*), purple urchin density at the grid was 1.6 m^{-2} (±0.3 SE), below the 2 m^{-2} threshold, and relatively unchanged at the control. Purple urchin densities were as low as 0.7 m^{-2} (±0.2 SE) at the grid in summer 2022. Purple urchin densities remained at or below the 2 m^{-2} threshold through early 2023, after which densities hovered just above the threshold until early 2024. Purple urchin

densities at the control varied through this timeframe but remained well above densities within the grid. In the time period between 2024 and 2025, purple urchin densities at the grid remained above the threshold, and while they were still lower than densities observed at the control, the pattern of variability through time generally tracked that observed at the control (Figure 9; Panel *A*). Excluding the pre-culling timepoint, purple urchin density at the grid reached its highest (6.4 m^{-2}±1.4 SE) in early 2025, which was just below the pre-culling density of 6.8 m^{-2} observed in spring of 2021. The control site, including pre-culling timepoint, also reached its highest purple urchin density (11.3 m^{-2}±1.6 SE) in early 2025.

Red urchin densities at both the control and grid were considerably lower than purple urchin densities throughout the survey time period. At the control, mean red urchin densities ranged from 0.08 m^{-2} (±0.02 SE) up to 0.53 m^{-2} (±0.07 SE). At the grid, mean red urchin densities ranged from 0.04 m^{-2} (±0.01 SE) up to 0.65 m^{-2} (±0.67 SE). In general, the red urchin densities at the grid remained lower than those of the control site, including the pre-culling survey timepoint (Figure 9; Panel *B*).

Adult giant kelp individuals were rare at both the grid and the control in 2021, reaching a max individual density of 0.002 m^{-2} (±0.001 SE) and 0.04 m^{-2} (±0.02 SE), respectively. At the grid, giant kelp individual mean density started to increase in the spring of 2022, with a sharp jump up to 0.3 individuals m^{-2} (±0.9 SE) in the summer of 2022, and hovered around this density into early 2023 (Figure 9; Panel *C*). Starting in spring 2023 and continuing through spring 2025, mean densities of giant kelp individuals remained stable, around 0.15 individuals m^{-2}. Giant kelp individual densities at the control site remained near-zero for this entire time period. Bull kelp individuals were only observed in 2022, with one and twenty-two individuals observed at the control and grid, respectively, in June 2022, and five individuals observed at the grid in September 2022.

Giant kelp stipe densities at the grid were low in 2021 and showed a slight increase during the summer and fall of 2022 at the grid, reaching a maximum in the summer of 2023 (2.4 m^{-2} (±0.5 SE), and a lower but stable plateau around 0.7 stipes m^{-2} for 2024 and 2025 (Figure 9; Panel *D*). Giant kelp stipe densities at the control site remained near-zero for this entire time period.

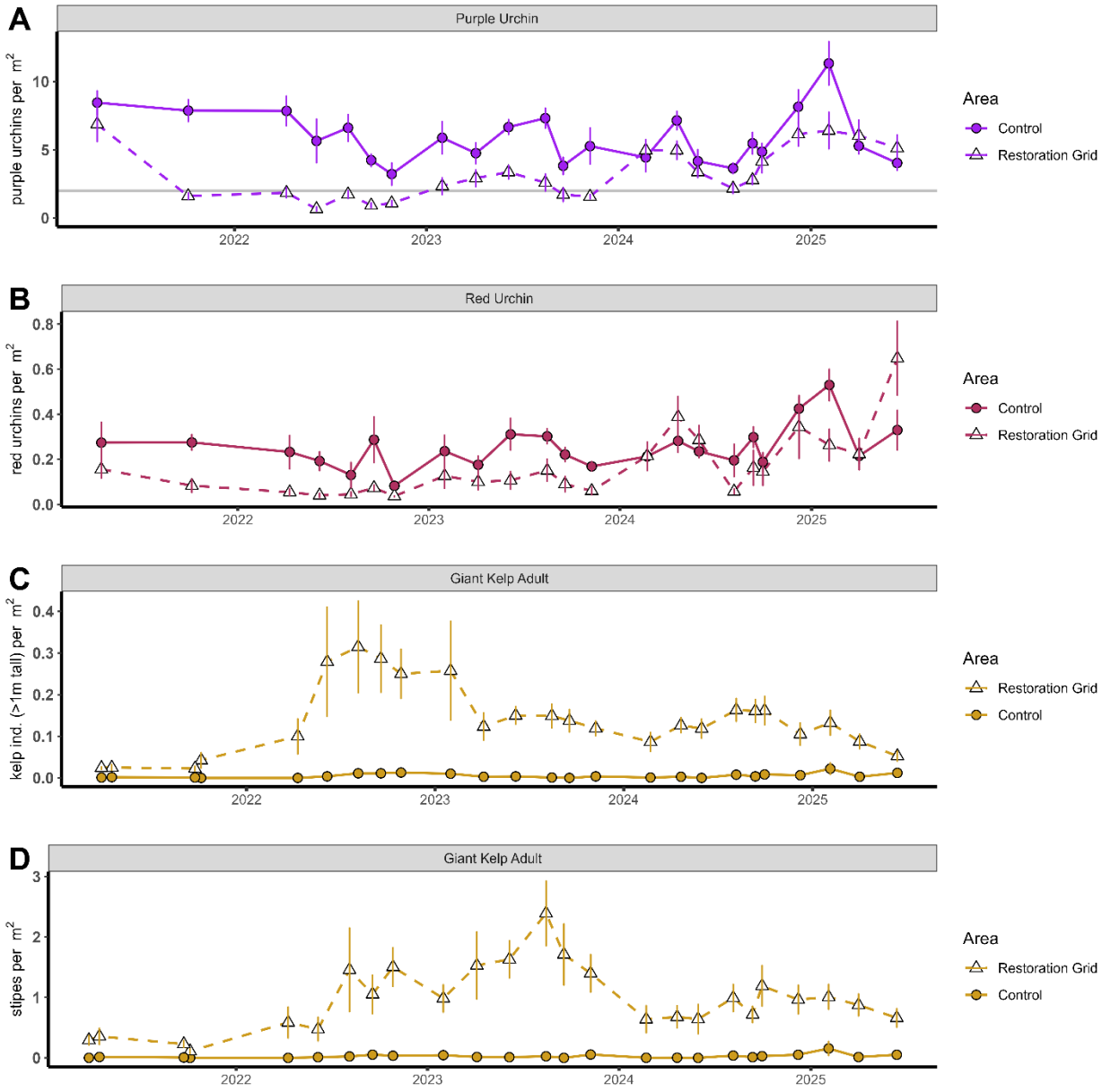


Figure 9. Combined survey data from both agency and RCCA monitoring groups for the grid (triangle; culling present) and control (filled circle; culling absent) at Tanker Reef, CA, USA. Panel A) purple urchin densities m^{-2} and the target density of 2 m^{-2} (gray line), Panel B) red urchin densities m^{-2}, Panel C) adult giant kelp densities m^{-2}, and Panel D) giant kelp stipe densities m^{-2}.

CONCLUSION

Throughout the duration of the regulatory amendment allowing urchin culling *in situ* at Tanker Reef, which went into effect April 1, 2021, and sunset April 1, 2024, recreational divers with valid sport fishing licenses conducted organized culling, and citizen-science and agency divers conducted independent monitoring to collectively advance

understanding of the efficacy of *in situ* culling in the central coast region. This report focuses on addressing the first two of the four questions posed within the Joint Memorandum from OPC, CDFW, and MBNMS, in association with the Commission rulemaking process, with the latter two questions briefly addressed.

Subtidal surveys combined with self-reported urchin culling data were used to assess Question 1: Can recreational divers reduce sea urchin densities to levels expected to facilitate kelp regrowth (<2 urchins m^{-2}) via in-water urchin culling? Results shown in Figures 8 and 9 (Panels *A* and *B*) collectively suggest that urchin densities can be reduced and maintained by recreational divers to levels at or below 2 urchins m^{-2}. Importantly, initial density reductions were observed in a relatively short period of time (e.g., months); however, recreational divers continued to revisit the site to re-cull areas in order to maintain relatively low urchin densities (Figure 8). During the three-year regulatory amendment, at the scale of a 2.5-acre grid, efforts from over 250 trained recreational divers showed that coordinated removal efforts were both feasible and effective. Unlike other locations within the state where coordinated urchin removals have occurred and necessitated little-to-no urchin removal maintenance (i.e., along the Palos Verdes Peninsula; Johnson et al. 2024), the grid, and Tanker Reef more broadly, has limited natural physical barriers to urchin intrusion. Despite a persistent sand channel on the north side of the grid, dynamic sand movement and sedimentation patterns, as well as a continuous low-lying reef, presented challenges to managing urchin densities and evaluating the effort (Figure 7; Panels C and D).

Subtidal surveys combined with the initiation and cessation time of urchin culling efforts were used to assess Question 2: Does the reduction of sea urchin grazing pressure via in-water urchin culling by recreational divers facilitate natural kelp regrowth? Results shown in Panels *C* and *D* of Figure 9 show giant kelp individual and stipe density increased at the grid within a year of culling effort initiation. This, in contrast to a near-zero presence of kelp at the control site, suggests kelp regrowth occurred following culling efforts. Kelp densities, both of individuals and of stipes, remained persistent throughout the duration of the evaluation period. This pattern highlights that kelp remained on the site for over a year after the organized urchin culling efforts ceased. The temporal shifts observed in the peaks of stipes m^{-2} and of individuals m^{-2} (Figure 9; Panels *C* and *D*) are consistent with observed patterns of emergent kelp forests, likely driven by natural succession processes such as self-thinning (Dayton et al. 1984; Elsmore et al. 2022). Early observations showed many kelp individuals consisted of one to a few stipes, which shifted over time to become fewer but larger individuals consisting of many stipes. This is reflective of kelp dynamics observed in new and emergent forested areas (Dayton et al. 1984; Elsmore et al. 2022).

Kelp forests along California's coast typically support individual densities ranging from 0.5 m^{-2} to 3 m^{-2} and stipe densities ranging from 1.9 m^{-2} to 15 m^{-2} (North 1971). Peak individual kelp densities observed (0.3 m^{-2}) at the Tanker Reef grid were below that of typical forests within the state, while peak stipe densities observed (2.4 m^{-2}) were within the range of typical California kelp forests, albeit on the lower end. The maximum giant kelp stipe densities were observed in summer of 2023, which coincided with the cessation of organized urchin culling in late July 2023. The temporary regulations

remained in place for an additional 8 months, during which organized culling did not occur, and it is unknown how continued efforts would have influenced observed kelp and urchin dynamics at the site.

While this study did not directly assess Question 3, whether there were negative impacts associated with in-water urchin culling (e.g., bycatch, damage to underlying reef structure, disturbance to marine mammal populations), that question was addressed in a separate, unpublished study (Lonhart and Osorio, unpublished). Preliminary results document measurable collateral damage that can occur to both organisms and the substrate, though the magnitude and extent of damage due to culling by divers at scale remain an open question. Importantly, the underlying reef geomorphology and benthic community structure are important considerations for the application of this as a future tool.

Limited capacity for this study prevented us from evaluating Question 4, however, participating divers and G2KR collected and analyzed many additional types of datasets and presented their findings on the G2KR website; however, for this study, we did not assess whether those data products were scientifically sound and/or informative to resource managers. Future collaborative efforts should consider utilizing established sportfishing reporting platforms for recording recreational diver participation. Having divers submit data through CDFW-established reporting systems would have provided streamlined information gathering, accessibility, and reduced workload and capacity demands associated with independent evaluations.

ACKNOWLEDGEMENTS

We would like to thank the suite of project participants and contributors for their specific contributions to the contents of this report. The survey design was developed by Steve Lonhart (MBNMS), Dan Abbott (RC), Jan Freiwald (RC), Keith Rootsaert (G2KR), Mike Esgro (OPC), and James Ray (CDFW). The infrastructure and equipment (e.g., buoys, lines, hammers) that divers used at Tanker Reef were paid for by private donations and by SeaTrees. We would like to thank the >250 volunteer divers that contributed to the urchin removal efforts and 18 instructors that helped train participating divers. Additionally, we would like to thank the >40 trained citizen-science RCCA volunteers who contributed time to support the subtidal monitoring and HOBO temperature sensor deployments. SeaTrees also supported costs of RCCA surveys. We would also like to thank CDFW and MBNMS staff who provided dive and vessel support to conduct the monitoring surveys, including Dave Osorio and Chad King.

LITERATURE CITED

Bauer-Civiello, A., D. Abbott, J. Freiwald. 2026. Reef Check Restoration Monitoring Protocol. 1st Edition. Reef Check Foundation, Westlake Village, CA, USA.

Bell, T, K. Cavanaugh, D. Siegel. 2026. SBC LTER: Time series of quarterly NetCDF files of kelp biomass in the canopy from Landsat 5, 7 and 8, since 1984 (ongoing) ver

23. Environmental Data Initiative. https://doi.org/10.6073/pasta/2c1218b7ebe6967da52000adf02f6a8b.

CDFW. 2023. State of California, Department of Fish and Wildlife, Draft Initial Statement of Reasons for Regulatory Action (Pre-publication of Notice Statement). Amend Section 29.06, Title 14, California Code of Regulations Re: Recreational Sea Urchin Bag Limit Exemption. https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=216482&inline

Dayton, P.K., V. Currie, T. Gerrodette, B.D. Keller. 1984. Patch Dynamics and Stability of Some California Kelp Communities. Ecological Monographs. Vol. 54(3), p.253-289.

Eittreim, Stephen L.; Anima, Roberto J.; Stevenson, Andrew J. 2002. Seafloor geology of the Monterey Bay area continental shelf. Marine geology. Vol.181 (1), p.3-34.

Elsmore, K., K.J. Nickols, T. Ford, K.C. Cavanaugh, K.C. Cavanaugh, B. Gaylord. 2022. *Macrocystis pyrifera* forest development shapes the physical environment through current velocity reduction. Marine Ecology Progress Series. Vol. 694, p.45-59.

Freiwald, J., McMillan, S. M., & Abbott, D. (2021). Reef Check California Instruction Manual: A Guide to Monitoring California's Kelp Forests, 10th Edition. Reef Check Foundation, Marina del Rey, CA, USA.

Johnson, M., S. Taylor, P. Campbell, J. Demeter, H. Burdick, T. Ford., J. Williams, C. Williams, D. Pondella. 2024. Palos Verdes Kelp Forest Restoration Project, Project Year 11: July 2023 – June 2024 (S-183390001-19133-001), Prepared for: California Department of Fish and Wildlife.

Lonhart, S.I. and D. Osorio. Unpublished. Cm-scale assessment of collateral damage due to urchin culling. https://sanctuarysimon.org/dbtools/project-database/index.php?ID=100516

North, W.J. 1971. The biology of giant kelp beds (*Macrocystis*) in California. Nova Hedwigia. p.33:1-600.

Schiel, D. R. & Foster, M. S. 2015. The Biology and Ecology of Giant Kelp Forests. University of California Press, Oakland California, USA.

From: Keith Rootsaert [redacted]
Sent: Wednesday, July 1, 2026 10:44 AM
To: FGC <FGC@fgc.ca.gov>
Subject: G2KR Written Comments

Dear FGC Staff,

Attached are our written comments for the July 16, 2026 MRC meeting.

These are submitted prior to the Written Comment deadline of July 2 at 5:00 PM.

Thank you,

Keith Rootsaert

Giant Giant Kelp Restoration

[redacted]

Giant Giant Kelp
Restoration Project

Tanker's Reef Monitoring Recommendations, design, and reporting

CDFW, MBNMS, and OPC wrote a memorandum on August 5, 2020 outlining their expectations for the Tanker's Reef Project. This memo was discussed in several Teams meetings and resulted in a Draft Monitoring Recommendations document on November 23, 2020 that confirms four scientific questions and how the project should attempt to answer them. For the July 2026 MRC meeting the Tanker Reef Project Report addresses only two of the four scientific questions.

The third question "*Are there negative impacts associated with in-water urchin culling?*" was very important to MBNMS. A study was conducted by MBNMS/CDFW to determine if damage to structure and animals was possible using tools that we do not use. Our divers were trained not to damage the reef or cause bycatch, but our training, tools, and in-water efforts were not evaluated. The unsatisfying conclusion is that there is a non-zero chance of damage.

The fourth question "*Can recreational divers collect, analyze, and communicate data/results in a way that is both scientifically sound and informative to resource managers?*" was very important to G2KR and we invested considerable time and effort to develop curriculum, analyze, and submit our observations bi-weekly to the joint agencies. Although there are several discrepancies, The Tanker Reef Project Report unfortunately does not consider whether our data collection and analysis was heard or helpful.

When kelp actually grew, the joint agencies insisted on adding a new fifth question "*What happens when the culling stops?"* that effectively ended the effort. This was a horrible question to ask when the community of 252 trained divers were asking FGC to continue kelp restoration efforts. This new fifth question was not addressed in the report.

In the Draft Monitoring Recommendations there is no mention or intent to end urchin culling. Our culled area was 10x the size of the treatment area and our intent was to continue culling urchins in the 685 acres area. However, MBNMS addressed the MRC in the third season and insisted the culling must stop everywhere for the sake of their research, so FGC voted to sunset the amendment.

Our success at restoring an 11-acre kelp forest created a target for urchins. If we stopped before the forest became self-sustaining, we would be feeding urchins kelp, making them more reproductive. When we first heard the joint agencies' intent, we abandoned culling urchins in the treatment area on July 30, 2023, 8 months early. For the last three years we sadly documented the demise of the kelp we restored.

We succeeded at culling urchins and restoring kelp, but instead of reporting every year on the project results to FGC to petition to advance our efforts to better granitic substrate (abandoning their research project), only a much-delayed partial Tanker Reef Project Report is provided at the MRC meeting, 5 years after the project start.

The following are the Draft Monitoring Recommendations, 11-23-20 (not cited in the Tanker Reef Project Report):

Project design, monitoring, and reporting recommendations for urchin culling at Tanker Reef

Background

There is considerable scientific evidence that the reduction of sea urchin grazing pressure can facilitate kelp regrowth in urchin-dominated habitats. In-water urchin culling (i.e. smashing or crushing sea urchins *in situ*) has the potential to be an effective method of kelp restoration, if sufficient focused effort can be sustained and ocean conditions are favorable for kelp regrowth. This concept has strong support within the California recreational dive community. However, significant uncertainties about in-water urchin culling by recreational divers must be addressed, including 1) the efficacy of such efforts at reducing urchin densities to the level required for kelp regrowth and 2) ecological effects, including potential unintended negative impacts, such as bycatch or damage to underlying reef structure.

In June 2020, the California Fish and Game Commission (FGC) received Petition 2020-001, which proposes to amend the sport harvest regulations for sea urchin. Specifically, the petition proposes to allow recreational divers with valid California sport fishing licenses to take unlimited purple and red sea urchin via in-water culling at Tanker Reef in Monterey County, a system historically dominated by giant kelp (*Macrocystis pyrifera*). This amendment would complement a similar effort currently under way at Caspar Cove in Mendocino County, a system historically dominated by bull kelp (*Nereocystis luetkeana*). As outlined in joint comments on Petition 2020-001, submitted to the California Fish and Game Commission in August 2020, the California Department of Fish and Wildlife (CDFW), California Ocean Protection Council (OPC), and Monterey Bay National Marine Sanctuary (MBNMS) expect that regulatory amendments approved at Tanker Reef will provide an improved understanding of the following key management questions:

- Can recreational divers operating under the proposed sea urchin sport harvest regulations reduce sea urchin densities to levels expected to facilitate kelp regrowth (<2 urchins/m^2) via in-water urchin culling?
- Does reduction of sea urchin grazing pressure via in-water urchin culling facilitate natural kelp regrowth?
- Are there negative impacts associated with in-water urchin culling (e.g. bycatch, damage to underlying reef structure, disturbance to marine mammal populations)?
- Can recreational divers collect, analyze, and communicate data/results in a way that is both scientifically sound and informative to resource managers?

Following on from the joint agency comments referenced above, this document is intended to provide specific recommendations on design, monitoring, and reporting for the Tanker Reef effort, to ensure that management questions are addressed in a scientifically robust manner.

Goals

Based on the management questions posed above, participants should aim to accomplish the following:

- Reduce purple and red sea urchin densities to threshold levels expected to facilitate kelp regrowth (<2 total urchins/m^2 along fixed transects within a designated treatment site) via in-water urchin culling and maintain those densities while the amendment is in place.
- Conduct robust monitoring to evaluate the ecological effects of in-water urchin culling, with a focus on purple and red sea urchin and kelp density in treatment sites compared to control sites.
- Document any observations of direct or indirect impacts of in-water urchin culling on non-target organisms (e.g., bycatch, damage to underlying reef structure, disturbance of marine mammal populations).
- Collect, analyze, and communicate data/results in a way that is both scientifically sound and informative to resource managers.

Survey design, monitoring, and reporting recommendations

CDFW, OPC, and MBNMS are providing the following specific recommendations to participants. These recommendations will increase the likelihood that information collected at Tanker Reef will meet the goals identified above.

- A ~1-2 acre treatment site and a ~1-2 acre reference site should be established at Tanker Reef.
    - The treatment site should also be located near existing kelp, to maximize spore settlement potential; should be adjacent to sand, to provide some protection from urchin incursion; and should be characterized by urchin densities that are representative of barrens in the broader Monterey region.
    - The reference site should meet these same criteria but should be located on the east side of Tanker Reef to reduce the potential for undirected urchin culling to occur in this area.
    - Existing seafloor mapping data, along with diver observations of kelp and urchins, should inform selection of both the treatment and reference sites.
- In-water urchin culling efforts should be conducted along fixed transects at the treatment site, with the goal of reducing purple and red sea urchin densities to <2 total urchins/m^2 along those transects within 1 year of the amendment. These densities should be maintained through organized culling efforts while the amendment is in place.
- A monitoring protocol shall be used with sufficient statistical power to detect changes in the following key ecological metrics over time: density of purple sea urchins, density of red sea urchins, and density of giant kelp.
    - Before and after culling efforts, divers should survey fixed transects, collecting data on purple sea urchin density, red sea urchin density, and giant kelp density using kelp forest monitoring protocols (e.g., PISCO or RCCA) used for marine protected area monitoring statewide. Transects should also be surveyed at regular intervals while the amendment is in place.
    - CDFW, OPC, and MBNMS staff will advise participants in determining the appropriate number of transects, location of transects, length and width of transects, and survey frequency once the treatment and reference sites have been established.

- Any observations of direct or indirect impacts of in-water urchin culling on non-target organisms should be documented. For example, divers could conduct video surveys before and after organized culling efforts.
- Sea otter observations should be conducted by a land-based observer before and during culling efforts to avoid disturbance. Disturbance is defined as divers approaching within 50 feet of a sea otter or inducing a change in sea otter behavior.
- A self-reporting system must be established through which divers can report data on their efforts, including the following:
    - Date of dive
    - Dive time
    - Approximate location of dive within treatment area
    - Number of urchins culled
    - Noteworthy observations
    - The self-reporting system should be modeled after the self-reporting form for Caspar Cove: www.tinyurl.com/CasparCoveDiveLog
- Some attempt should be made to quantify undirected urchin culling, for example via cameras or land-based observers.
- To the extent practicable, agency divers will verify data collected by participants, and may establish complementary studies, such as a centimeter-scale assessment of the impacts of urchin culling on hard substrate and broad biodiversity surveys.
- Leaders managing participants should meet regularly with CDFW, OPC, and MBNMS staff to ensure efforts are addressing the goals listed above.

Criteria for success

This amendment will be considered a success if:

- Recreational divers are able to clear 1-2 acres of reef at the treatment site (i.e. reduce urchin densities to <2 total urchins/m^2 along fixed transects within the first year of the amendment, and keep that area cleared for the duration of the amendment, with no significant bycatch, damage to reef structure, or disturbance to marine mammals).
- Recreational divers are able to self-organize, develop and implement biological monitoring protocols, and adequately collect and report biological data to state and federal agencies to assess effectiveness of their efforts.

From: Keith Rootsaert [redacted]
Sent: Thursday, July 2, 2026 02:34 PM
To: FGC <FGC@fgc.ca.gov>
Subject: MRC Agenda Item 6

Dear FGC Staff,

Attached is our Monterey Temperature and Light update that repeats previously provided information and is updated through June 26, 2026.

Warm green water conditions are increasing. Kelp prefers cold nutrient rich water to grow with plenty of sunlight. We are anticipating even warmer conditions later this summer. Summer cold water upwelling helps kelp grow, but the resulting algae bloom limits sunlight at depth that kelp craves.

Out-planting kelp is proposed in our petition 2023-23MPA. The KRMP should explore now if warm water climate-acclimated kelp can survive in this region with warmer and warming conditions.

Thanks,

Keith Rootsaert
Giant Giant Kelp Restoration

Monterey Dive Sites 10/24/25 to 6/26/26

Temp. (F)	Light (Lumens)	Depth (m)
Mr. Ed's		10/24/2025
58.94	126	5 m
Mt. Chetron		10/24/2025
60.57	132	5 m
Bottles		11/29/2025
57.24	261	1m
57.95	491	6m
57.90	361	10m
57.76	183	15m
57.45	109	20m
Metridium Mt.		11/29/2025
58.05	730	1m
58.31	1256	5m
57.98	622	10m
57.76	271	15m
57.67	146	19m
Mt. Chetron		11/29/2025
59.74	292	1m
58.40	731	5m
58.19	709	10m
58.04	407	15m
57.89	210	20m
57.78	129	23m
Metridium Mt.		12/5/2025
58.43	2137	1 m
57.53	1357	5 m
57.26	786	10 m
57.08	419	15 m
56.99	246	20 m
MacAbee Pinnacle		12/5/2025
57.68	1653	1 m
57.61	1463	5 m
57.32	770	10 m
57.07	363	15 m

Temp. (F)	Light (Lumens	Depth (m)
Aumentos Rocks		12/31/2025
58.51	68	2 m
58.18	59	5 m
58.17	41	10 m
58.00	34	15 m
VT3		12/31/2025
57.65	62	1 m
57.89	67	5 m
57.89	47	10 m
Monterey Harbor		1/1/2026
58.25	115	1 m
Mr. Ed's		1/1/2026
58.32	111	1 m
58.38	385	5 m
58.36	397	10 m
Tanker's Reef		1/1/2026
58.67	233	1 m
58.15	217	5 m
58.12	247	10 m
Crest Wall		1/2/2026
58.43	155	1 m
58.46	196	5 m
58.40	98	10 m
Eric's Pinacle		1/2/2026
58.45	202	1 m
58.62	480	5 m
58.28	99	10 m
58.24	106	15 m
Mt. Chetron		1/3/2026
58.78	466	1 m
58.67	321	5 m
58.56	128	10 m
58.52	156	15 m

Temp. (F)	Light (Lumens)	Depth (m)
Shale Island		1/3/2026
60.32	2621	1 m
59.09	1351	5 m
58.80	734	10 m
58.61	497	15 m
Metridium Mountain		1/9/2026
58.81	2189	1 m
58.12	762	5 m
57.78	225	10 m
57.71	87	15 m
Mt. Chetron		1/9/2026
58.43	1227	1 m
57.85	511	5 m
57.83	163	10 m
57.99	66	15 m
Cabrillo Point		1/10/2026
57.39	716	1 m
57.64	396	5 m
57.32	165	10 m
Tanker's Reef		1/10/2026
58.85	2121	1 m
57.56	679	5 m
57.11	229	9 m
Metridium Mountain		1/11/2026
58.36	1351	1 m
57.90	524	5 m
Hopkins		1/11/2026
58.26	1858	1 m
57.82	385	5 m
57.41	139	8 m
Mt. Chetron		1/16/2026
60.41	1501	1 m
57.80	1111	5 m
57.39	573	10 m
57.27	276	15 m

Temp. (F)	Light (Lumens)	Depth (m)
Tanker's Reef		1/16/2026
59.83	1640	1 m
57.71	1227	5 m
56.96	399	10 m
Mt. Chetron		1/24/2026
57.70	917	1 m
58.13	1189	5 m
Mr. Ed		1/24/2026
58.53	1996	1 m
58.31	1493	5 m
57.96	1053	10 m
57.60	667	15 m
Tanker's Reef		1/24/2026
58.95	1351	1 m
58.14	813	5 m
57.74	234	10 m
Monterey Harbor		1/31/2026
58.93	18	2 m
MacAbee Pinnacle		1/31/2026
58.14	0	1 m
57.64	0	5 m
57.35	0	10 m
Anchor 1		2/6/2026
59.89	1835	1 m
58.19	1032	5 m
57.88	622	10 m
57.71	371	15 m
Mr. Ed		2/7/2026
58.60	1004	1 m
58.87	1025	5 m
58.61	585	10 m
Mt. Chetron		2/7/2026
59.57	2644	1 m
59.14	1610	5 m
58.64	751	10 m
58.15	408	15 m

Temp. (F)	Light (Lumens)	Depth (m)
Monterey Harbor		2/7/26 13:44
58.41	47	2 m
Tanker's Reef		2/7/26 14:59
59.51	641	1 m
59.18	613	5 m
58.88	206	10 m
Mt. Chetron		2/13/26 10:22
59.25	2094	1 m
58.57	1410	5 m
58.14	579	10 m
57.90	345	15 m
Mr. Ed		2/13/26 11:27
59.41	1926	1 m
58.53	1451	5 m
58.20	988	10 m
57.96	484	15 m
Monterey Harbor		2/14/26 8:29
57.81	150	2 m
Bottles		2/14/26 9:09
57.20	683	1 m
58.07	740	5 m
57.90	325	10 m
57.68	228	15 m
Mt. Chetron		2/14/26 10:37
57.81	306	1 m
57.92	291	5 m
57.80	208	10 m
57.59	57	15 m
Hopkin's Deep		2/16/26 9:53
57.56	129	1 m
57.69	99	5 m
57.71	74	10 m
57.64	41	15 m
Metridium Mt.		2/16/26 10:55
56.26	535	1 m
57.82	369	5 m
57.67	153	10 m
57.63	52	15 m

Temp. (F)	Light (Lumens)	Depth (m)
Mt. Chitron		2/20/26 9:52
56.72	469	1 m
56.80	192	5 m
57.09	78	10 m
57.05	55	15 m
Hopkins Deep		2/20/26 11:05
57.23	1142	1 m
57.15	345	5 m
57.22	307	10 m
57.14	166	15 m
57.04	100	20 m
Crest Wall		2/22/26 9:32
58.52	1880	1 m
57.36	1294	5 m
57.16	781	10 m
57.16	706	15 m
Cabrillo Point		2/22/26 11:51
58.46	3106	1 m
57.44	1325	5 m
56.75	395	10 m
56.57	38	15 m
Eric's Pinnacle		2/27/26 10:22
61.19	1597	1 m
58.41	1181	5 m
56.81	316	10 m
56.45	217	14 m
MacAbee Pinnacle		2/27/26 12:13
64.30	1622	1 m
58.74	1396	5 m
57.84	668	10 m
57.41	441	12.5 m
Mr. Ed		3/14/26 10:01
58.13	1414	1 m
55.35	437	5 m
VT3		3/14/26 10:47
58.05	1315	1 m
56.26	485	5 m
53.78	166	10 m
52.91	160	13 m

Temp. (F)	Light (Lumens)	Depth (m)
Bottles		3/20/26 10:29
60.06	2886	1 m
53.42	581	5 m
52.08	131	10 m
51.73	57	15 m
MacAbee Pinnacle		3/20/26 11:44
59.92	2760	1 m
54.29	688	5 m
52.14	116	10 m
51.93	68	13 m
Monterey Harbor		3/21/26 7:34
59.47	19	3 m
Mt. Chetron		3/21/26 9:09
58.03	695	1 m
57.40	384	5 m
55.11	130	10 m
53.66	31	15 m
MacAbee Pinnacle		3/21/26 10:22
59.35	1495	1 m
57.08	856	5 m
53.88	186	10 m
Monterey Harbor		3/21/26 13:39
59.18	401	3 m
Tanker's Reef		3/21/26 14:47
60.99	4081	1 m
59.37	1781	5 m
54.71	619	9 m
Mt. Chetron		4/4/26 9:43
60.39	2299	1 m
59.60	1403	5 m
56.59	1207	10 m
55.00	729	15 m
VT3		4/4/26 10:57
61.21	3416	1 m
59.50	1513	5 m
57.04	1122	10 m
56.40	1024	15 m

Temp. (F)	Light (Lumens)	Depth (m)
Aumentos		4/10/26 10:43
60.37	994	1 m
59.38	1157	5 m
56.88	961	10 m
53.02	649	15 m
Bottles		4/10/26 12:01
63.40	5169	1 m
59.46	1467	5 m
57.56	1692	10 m
53.94	1330	15 m
Hopkins		4/25/26 9:43
58.49	620	1 m
58.19	324	5 m
57.59	174	10 m
Shale Island		4/25/26 11:07
58.59	428	1 m
58.60	449	5 m
57.74	165	10 m
Tanker's Reef		4/25/26 14:37
59.30	761	1 m
58.53	284	5 m
57.32	139	9 m
Mr. Ed		4/26/26 9:37
57.27	299	1 m
57.51	128	5 m
57.43	87	10 m
Mt. Chetron		4/26/26 10:47
57.70	348	1 m
57.58	217	5 m
57.11	149	10 m
55.69	128	15 m
54.18	106	19 m
Mr. Ed		5/31/26 9:14
57.49	684	1 m
56.48	368	5 m
55.64	187	10 m
53.20	72	15 m

Temp. (F)	Light (Lumens)	Depth (m)
MacAbee Pinnacle		5/31/26 11:33
58.67	1521	1 m
57.00	1026	5 m
55.11	261	10 m
53.79	170	13.5 m
Aumentos		6/13/26 9:22
54.95	658	1 m
53.02	402	5 m
52.75	228	10 m
52.41	94	15 m
Shale Island		6/13/26 11:00
61.28	2754	1 m
54.90	1024	5 m
52.63	323	10 m
52.25	111	15 m
Monterey Harbor		6/20/26 8:52
61.26	502	2 m
Bottles		6/20/26 9:28
61.57	983	1 m
61.00	739	5 m
60.77	570	10 m
60.31	437	15 m
Cabrillo Point		6/20/26 11:06
62.74	2381	1 m
61.70	2939	5 m
61.00	1188	10 m
60.14	924	15 m
Mt. Chetron		6/21/26 9:45
62.12	422	1 m
61.94	436	5 m
61.78	336	10 m
55.14	240	15 m
Cabrillo Point		6/21/26 11:34
62.48	812	1 m
62.09	790	5 m
59.56	678	10 m
55.49	485	13 m

Temp. (F)	Light (Lumens)	Depth (m)
Bottles		6/28/26 8:52
63.56	1194	1 m
62.89	921	5 m
55.84	482	10 m
54.35	98	15 m
MacAbee Pinnacle		6/28/26 10:17
65.85	3352	1 m
63.36	2091	5 m
60.32	1029	10 m

Notes:

Giant kelp thermal limit is 58 -59 degrees F

Normal Monterey diving temperature range is 50-55 degrees F

The Marine Heat Wave began September 15, 2026

Item in red is an error when the sensor detached and dropped to the bottom