Palos Verdes Kelp Forest Restoration Project

Project Year 11: July 2023 – June 2024 (S-183390001-19133-001)

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3. Report of Kelp Restoration Activities Including Stated Components in Scientific Collecting Permit (SCP).

A) Kelp Restoration Goals

Macrocystis pyrifera (giant kelp) canopy cover at Palos Verdes Peninsula has decreased by approximately 80% since the first large-scale survey in 1911 (Ford and Meux 2010, MBC 2019). Sedimentation, development, urban runoff, and storms slowed kelp growth. At the same time, the loss of key urchin predators and competitors allowed urchins to overrun the reef and devour the remaining kelp. Subtidal observations based upon mapping efforts conducted in 2010 identified large expanses of nearshore rocky reef that were dominated by high densities of *Strongylocentrotus purpuratus* (purple sea urchins) and *Mesocentrotus franciscanus* (red sea urchins). In total, 152 acres were described to exist in an urchin barren state.

It is within this context that The Bay Foundation initiated the Palos Verdes Kelp Restoration Project through *in situ* culling of *S. purpuratus* on the Palos Verdes Peninsula. The goal is to reduce populations of *S. purpuratus* to natural densities (associated with stable giant kelp communities in southern California) to catalyze recruitment and development of giant kelp and other macroalgae. Decreased *S. purpuratus* grazing pressure allows for the enhancement of the biogenic habitat of rocky reefs that have historically supported kelp forests. Ultimately, this increases spatial and temporal stability, as well as biomass and production associated with the rocky reef ecosystems on the Palos Verdes Peninsula.

B) Timeline of Restoration Goals

Restoration and monitoring activities have been conducted in kelp reference, restoration, and barren sites since July 2013. The field work involved in this project is subject to sea state, oceanographic conditions, and weather. At the beginning of the project, urchin suppression efforts expanded each year to encompass two coves (Underwater Arch and Honeymoon) and three open shore areas (Marguerite, Resort Point, and Hawthorne). These areas are located somewhat centrally on the Palos Verdes Peninsula. These sites are nearly contiguous and share similarities in ocean exposure. An additional site, Point Fermin, was started to the south and east of these other locales in the summer of 2015. Point Fermin is roughly the south-east terminus of the Palos Verdes Peninsula. White Point, located just north of Point Fermin, was established as a new site in summer 2018. During this reporting period (Year 11) of July 1, 2023 through June 30, 2024, restoration efforts were focused at Point Fermin, Underwater Arch Cove, and White Point.

The progression of restoration activities is outlined in Table 1, while Table 2 provides hours of diver effort to achieve these results. Restoration efforts projected for this operational year, July 1, 2023 through June 30, 2024 are listed in Table 3.

Table 1. Restoration progress by site Years 1-11. Restoration efforts were made in year 11 reducing purple sea urchin densities in Underwater Arch Cove, Point Fermin, and White Point. In these sites there is significant overlap with past clearing efforts. The area restored in this case is not necessarily "newly" restored as past years denoted some of the same space as "area cleared". TBF is using GIS to overlay these maps to determine the extent to which these efforts overlap spatially. These results will be incorporated into future reporting.

Site Name	Area Cleared (Acres) Year 1 July 2013 - June 2014	Area Cleared (Acres) Year 2 July 2014 - June 2015	Area Cleared (Acres) Year 3 July 2015 - June 2016	Area Cleared (Acres) Year 4 July 2016 - June 2017	Area Cleared (Acres) Year 5 July 2017- June 2018	Area Cleared (Acres) Year 6 July 2018- June 2019	Area Cleared (Acres) Year 7 July 2019- June 2020	Area Cleared (Acres) Year 8 July 2020- June 2021	Area Cleared (Acres) Year 9 July 2021- June 2022	Area Cleared (Acres) Year 10 July 2022- June 2023	Area Cleared (Acres) Year 11 July 2023- June 2024	Total Area (acres)
Honeymoon Cove	4.84	3.56	0	0	0	0	0	0	0	0	0.00	8.40
Underwater Arch Cove	3.77	4.49	0	2.34	0.28	0	0	0	0	0	4.35	15.23
Marguerite	0	5.07	3.68	5.27	0	0	0	0	0	0	0.00	14.01
Hawthorne	0	2.72	1.56	0	0.89	0	0	0	0	0	0.00	5.17
Point Fermin	0	0	3.93	1.13	0.22	0	0	0	0.89	3.56	4.26	13.99
Resort Point	0	0	0	0	3.78	0.22	0	0	0	0	0.00	4.00
White Point	0	0	0	0	0	3.11	4.38	1.33	1.33	0	0.56	10.71
Total Area	**8.61**	**15.84**	**9.16**	**8.74**	**5.17**	**3.33**	**4.38**	**1.33**	**2.22**	**3.56**	**9.17**	**71.50**

Table 2. Total diving effort to meet project goals Years 1-11.

July 1, 2013 - June 30, 2023		
Effort (dive hours)	**Monitoring**	**Restoration**
The Bay Foundation	2,579	185
Commercial Sea Urchin Harvesters	0	9,396
LA Waterkeeper	133	1,031
AAUS Volunteer Divers	0	361
Subtotal	2,713	10,612
Total Dive Hours	**13,325**	

Table 3. Restoration areas targeted for July 1, 2023 through June 30, 2024. Periodic monitoring of all sites will continue to ensure that *S. purpuratus* densities remain at no more than two per m^2. All sites are monitored with the following methods: video transects, photo points, urchin dissections, and response monitoring. Exploration of rocky reef along the Palos Verdes Peninsula will continue to identify existing or potentially emergent urchin barrens in the coming year.

Site Name	Estimated Total Barren Area (Acres)	Start Date	Total Restored Area (Acres)	Area Restored 7.1.2023-6.30.2024 (Acres)	Status	Centroid
Underwater Arch Cove	10.88	July 2013	15.23	4.35	In progress	33.752, -118.415
White Point	10.15	July 2018	10.71	0.56	In progress	33.713, -118.315
Point Fermin	7.24	July 2015	13.99	4.26	In progress	33.704, -118.291

Table 4. Restoration start and completion dates for all sites. Dates are based on TBF biologist post monitoring dates for each site.

Site Name	Post Restoration Started	Restoration Completed	Notes *start/completion date based on post monitoring date
Honeymoon Cove	11/4/2013	1/6/2015	Constant work, no inactive periods
Underwater Arch Cove	7/31/2013	In Progress	Main restoration accounting for 8.26 acres; Incursion from tidepool requiring additional clearing in 2.62 acres from 4/7/17 - 7/6/17. Reclearing resumed in Yr 11 with 4.35 acres cleared within the reporting period. Restoration will continue into Year 12.
Marguerite	10/2/2015	6/23/2017	6 month break from 11/24/15 - 6/27/16 on account of wasting disease.
Hawthorne	1/20/2015	5/31/2016	14 month break from 5/31/16 to 7/25/17 where 0.89 acres were restored ending work on 8/25/17.
Point Fermin	7/22/2015	In Progress	Initial work from 7/22/15 through 2/4/16; 7 month break until 10/7/16 where work continued until 12/14/16; then 7 month break until 0.22 acres on 7/7/17; subsequent surveys have identified large expansive barren thought to be a result from intrusion from a refuge urchin population. Restoration started again in January 2022 and will continue into Year 12.
Resort Point	9/20/2017	7/3/2018	Constant work, no inactive periods.
White Point	7/10/2018	In Progress	Inactive periods were common during year 8 due to a combination of COVID restrictions and poor ocean conditions precluding restoration activities from occurring. The only post-restoration monitoring occurred from 9/15/20 through 11/11/20. Restoration activities began again during the Year 9 reporting period and were paused in the summer of 2022. The site has started restoration activities once again in Year 11, with most of the restoration effort being completed with the help of volunteer AAUS divers.

Description of Restoration, Control, and Reference Sites

All project restoration and reference sites are located on the Palos Verdes Peninsula, Los Angeles County, California. Table 5 shows all potential restoration sites along with the area in hectares initially described in 2010 surveys, and representative central GPS coordinates for each.

Table 5. Area and GPS coordinates for restoration, reference, and control sites.

Restoration Site Name	Area (Hectares)	Perimeter (Meters)	Centroid (Decimal Degrees)
Honeymoon Cove	4.07	1,509	33.764, -118.423
Christmas Tree Cove	4.09	2,264	33.761, -118.419
Marguerite	5.19	2,522	33.757, -118.418
Underwater Arch	5.36	2,183	33.752, -118.415
Hawthorne	8.96	1,789	33.747, -118.414
Portuguese Point	1.73	1,604	33.737, -118.376
Inspiration Point	2.57	1,965	33.736, -118.368
White Point	6.07	2,395	33.713, -118.315
Point Fermin	4.37	3,367	33.704, -118.291

The following sites were identified as urchin barrens in 2010 and are located within the Marine Protected Areas (MPAs) surrounding Point Vicente. Three of these sites received restoration work in the past, pre-MPA, (2005-2011) i.e., Kaplan Cove, Long Point and Old Marineland. Restoration work was conducted on a limited basis inside the MPA in the early part of 2012. Further restoration efforts within the MPAs might yield benefits to the goals of the MPAs generally and specifically to the MPA cluster on PV.

Site Name	Area (Hectares)	Perimeter (Meters)	Centroid (Decimal Degrees)
Point Vicente East	4.8	2,812	33.740, -118.406
Kaplan Cove	2.3	1,115	33.737, -118.401
Long Point	0.82	1,240	33.736, -118.398
Old Marineland	1.2	744	33.737, -118.395
120 Reef	1.74	1,226	33.738, -118.392
Abalone Cove Kelp	9.1	3,397	33.740, -118.385
Reference Site Name	**Area (Hectares)**	**Perimeter (Meters)**	**Centroid (Decimal Degrees)**
Point Vicente West	-	-	33.740, -118.412
Rocky Point North	-	-	33.779, -118.426
Ridges North	-	-	33.787, -118.420
Control Site Name			
Abalone Cove West	9.10	3,397	33.740, -118.385
Marguerite Central*	5.19	2,522	33.757, -118.418

*Marguerite Central was initially a control site. Urchin suppression started in 2015, changing the status of this site to a restoration site.

C) <u>Pre-Restoration Monitoring</u>

Seven restoration sites have been established off Palos Verdes: Honeymoon Cove, Marguerite, Underwater Arch Cove, Hawthorne, Resort Point (a geographical extension of Honeymoon Cove), White Point, and Point Fermin. Pre-restoration monitoring is conducted on all sites per California Department of Fish and Wildlife (CDFW) standards stipulated in the terms of the SCP. Restoration sites are divided into 30m by 30m blocks each comprised of 15 transects (2m by 30m swath) monitored by divers. Each 30m transect is divided into three 10m long segments to estimate the density of *S. purpuratus*, *M. franciscanus*, *M. pyrifera* and a characterization of the substrate and relief. In certain instances, these blocks, or the individual transects comprising them, are truncated to fit the natural topography. This fine scale and spatially comprehensive methodology allows for greater resolution of inter-block variability and has been beneficial to the adaptive management of restoration teams. During the initial phase of the project (July 2013 to March 2014), all 15 transects (per block), covering 100% of the restoration block were pre-monitored. Field staff engaged in the adaptive management of the project noted the time-consuming nature of pre-monitoring transects in comparison to post monitoring. To continue to make progress in a manner consistent with contracts and the ecology of the region, program management staff at TBF, in consultation with National Oceanic and Atmospheric Administration (NOAA) biologists, conducted an applied power analysis on the pre-monitoring data set from July 2013 through February 2014. This analysis described no loss in statistical strength, and equally, no gain in accuracy in continuing to pre-monitor all transects within any given restoration block. Based on the applied power analysis, a reduction of sampling area by 66% allowed for a substantial increase in restoration efforts, while making the pre-restoration monitoring more efficient and cost-effective. TBF biologists pre-monitor five transects per restoration block.

The urchin density graph (Figure 1) is derived from data collected along the 2m x 30m swaths within a restoration block, five transects for pre and all fifteen for post. The values of those data are averaged across the 30m x 30m restoration block to estimate the total abundance of *S. purpuratus* pre and post restoration. The site map in Figure 2 shows the location of each restoration block corresponding to pre and post survey densities in Figure 1. All data collected (i.e., date, area, team members, level of effort, *M. franciscanus* and *S. purpuratus* densities, *M. pyrifera* density, rugosity, and substrate) are entered, quality assured and quality controlled (QAQC), and managed utilizing a georeferenced database.

During Year 11of the project, pre-monitoring activities occurred at Point Fermin, Underwater Arch Cove, and White Point (Figure 2). Specific areas of Point Fermin were previously restored between July 2015 – December 2016. Visual surveys in 2020 and 2021 of Point Fermin reported high densities of *S. purpuratus* in the area. Resultingly, restoration activities were reinitiated in January 2022 and continued throughout Year 11. Similarly, Underwater Arch Cove and White Point had been cleared in previous years (See Table 1), but observations made during yearly video monitoring informed the need for the reinitiation of restoration activities. The following graph displays the estimated *S. purpuratus* densities before and after restoration activities for areas monitored in Year 11 at Point Fermin, Underwater Arch Cove, and White Point[within each 30m by 30m block]. The following map displays the estimated *S. purpuratus* densities before restoration activities for areas pre-monitored in Year 11 at each site [within each 10m segment]. Site maps are also included in Appendix A.

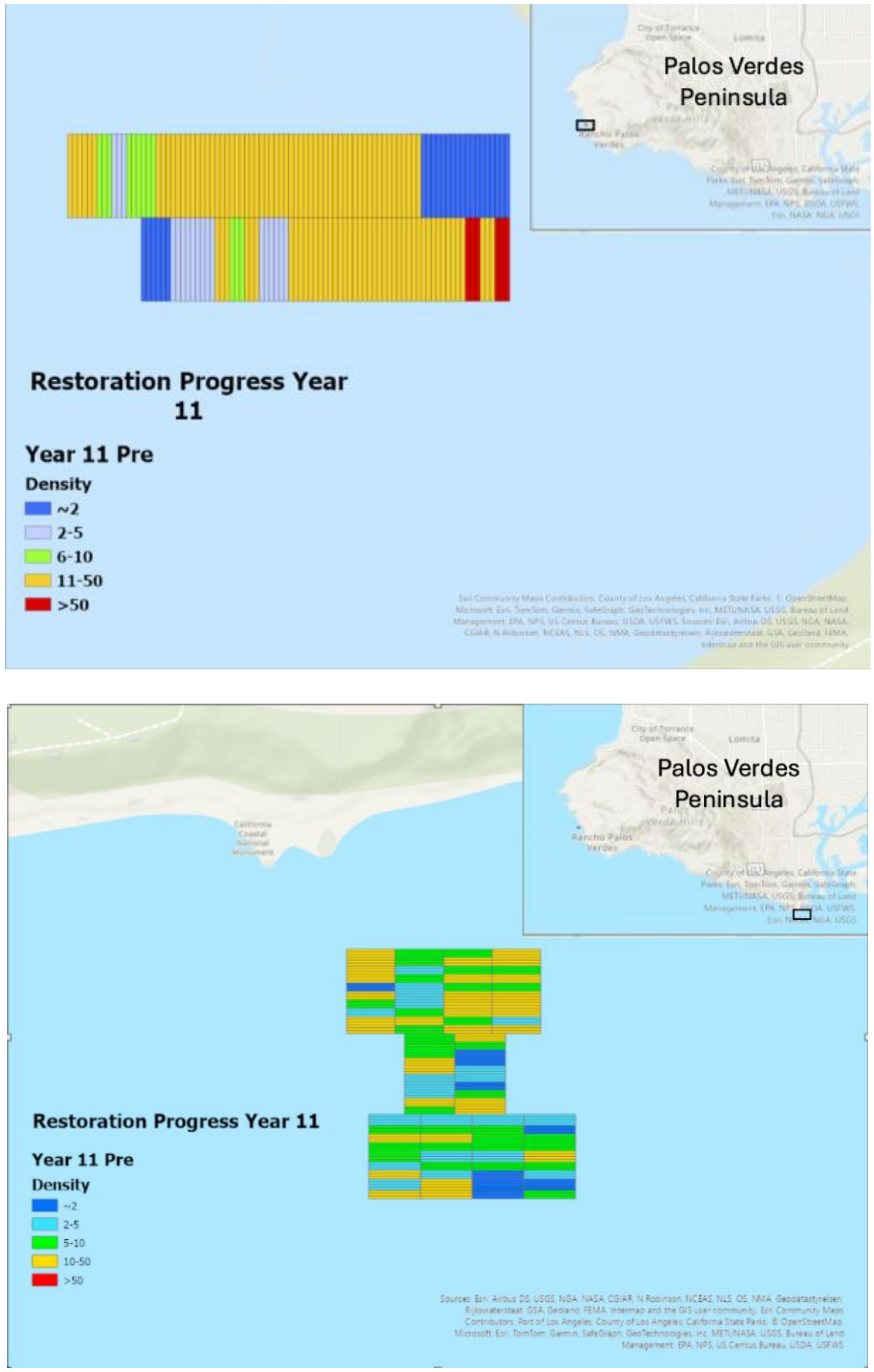


Figure 1. Density of *S. purpuratus* (individuals per square meter) pre-restoration at Underwater Arch Cove (top) and Point Fermin (bottom), Palos Verdes Peninsula, California. Black square in the inset map indicates the White Point and Point Fermin locations in reference to the peninsula. Average *S. purpuratus* densities for Underwater Arch Cove and Point Fermin were 16.3 and 16.5 per m2 respectively, with some localized areas exceeding 75 per m2 (ESRI 2024)

D) Monitoring of all Permitted sites

i. Monitoring Timeline

Table 6. Restoration and monitoring timeline July 2023 - December 2024.

Task	2023						2024											
	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Urchin Suppression																		
Compliance Monitoring																		
Response Monitoring																		
Analysis and Reporting																		

The project year ended June 30th, 2024. Response monitoring for Honeymoon Cove, Marguerite, Underwater Arch and Hawthorne is conducted by Vantuna Research Group and is completed in summer of each project year. Response monitoring for White Point and Point Fermin is conducted by TBF and Paua Marine Research Group biologists.

Compliance Monitoring (July 2023 through June 2024)

Monitoring is conducted weekly to bi-monthly depending upon the rate of activity of restoration teams in the preceding week. These sites support very high *S. purpuratus* densities, limiting macroalgae development and growth. In addition, the topography of these sites consists of high relief, deep crevices, and stacked boulder complexes making restoration activities challenging. Furthermore, due to the location of the active restoration blocks at Point Fermin, White Point, and Underwater Arch Cove (less than 30ft depth), combined with the typical inclement oceanic conditions (persistent wind and swell), TBF and restoration divers are often precluded from working continuously throughout the reporting period. TBF endeavors to utilize all workable weather opportunities that allow for safe, effective, and productive restoration activities. In normal circumstances, compliance monitoring work is performed by TBF biologists to ensure that restoration work is achieving performance standards. The standards are (1) the initial reduction of *S. purpuratus* to a density of two per square meter and (2) that this is being applied in a comprehensive manner sweeping through an area and not leaving patches and pockets of high *S. purpuratus* densities. All restoration areas are surveyed before and after *S. purpuratus* suppression to determine the success of restoration, and the results are entered in a georeferenced database. Post-monitoring can be completed more quickly than pre-monitoring as only the densities of *M. franciscanus* and *S. purpuratus* are counted. All 15 transects, covering 100% of the block are surveyed during post-monitoring to ensure that no pockets of high-density *M. franciscanus* and *S. purpuratus* remain at the site. Figure 1 displays the estimated *S. purpuratus* densities before and after restoration activities within each 30m by 30m restoration block of Point Fermin. Figure 2 displays the estimated *S. purpuratus* densities after restoration activities within each 10m segment of Underwater Arch Cove and Point Fermin. All restoration sites are re-surveyed, by roaming over the area, on a quarterly to annual basis to ensure that *S. purpuratus* densities remain at two per m^2 and to observe the response of the biota to the restoration actions.

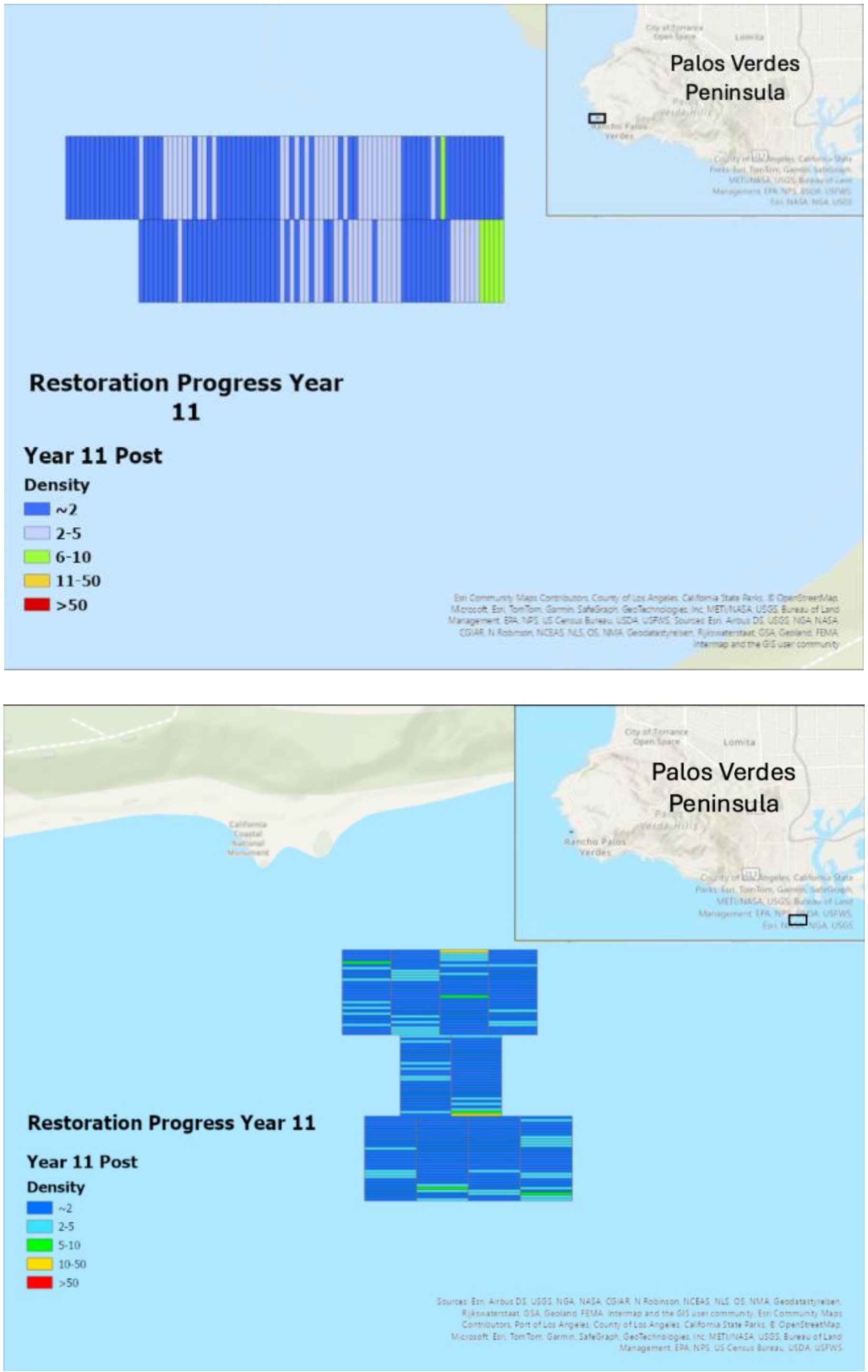


Figure 2. Density of *S. purpuratus* (individuals per square meter) post-restoration at Underwater Arch Cove (top) and Point Fermin (bottom), Palos Verdes, California. Black square in the inset map indicates where the restoration areas are located off Palos Verdes. Average *S. purpuratus* densities for White Point and Point Fermin were 2.12 and 1.85 per m2 respectively, after restoration is (ESRI 2024).

Response Monitoring (June 2023 through July 2024)
This monitoring focuses on responses of the natural community to restoration activities. The focus of this effort is subtidal utilizing an adapted Cooperative Resource Assessment of Nearshore Ecosystems (CRANE) methodology led by the Vantuna Research Group. These data provide values relating to production, species richness, and biomass.

In April 2021, *Sea Urchin Mass Mortality Rapidly Restores Kelp Forest Communities* was published in the Marine Ecology Progress Series, (Williams et al 2021). This study focused on the effects of reduced *S. purpuratus* densities on the kelp forest, resulting from culling and disease. The results describe a convergence across "every community data type (kelp and macroinvertebrates, benthic cover, fish density, fish biomass), the community composition at all 3 site types (Kelp Reference, Barren-Control, Barren-Restoration) became more similar following the impact" (Williams et al 2021). In the discussion, the authors note that restoration through culling mimics sea urchin mass wasting events via the reduction of sea urchin densities and grazing pressure. The effect of this impact being the drastic reduction of sea urchin densities can be successful in pushing rocky reef systems back over their ecological tipping point from an urchin barren stable state to a kelp forest stable state (Williams et al 2021). It is noted elsewhere in the study that the effect of this shift was present and consistent across several sites for the five years following the reduction of the urchin density.

ii. Quantity of urchins removed and collected for GSI studies and justification for removal
The estimated total number of *S. purpuratus* culled within restoration sites is 5,140,486 therefore reducing the overall average density across all sites from 16.97per m^2 to 1.30per m^2. *S. purpuratus* density in some sites are less than the target density of $2/m^2$. These low values may, in part, be attributed to habitat patchiness, physical differences among sites, and presence or accretion of sediment. Also, the cryptic nature of *S. purpuratus* suggests that the average density is likely higher than observed during response monitoring. Table 7 below shows the estimated number of urchins removed from each site by year.

Table 7. Estimated quantity of *S. purpuratus* culled by restoration site (July 1, 2013 – June 30, 2024)
Specific areas restored at Underwater Arch Cove in Years 1 and 2 were re-cleared in Years 4 and 5, and now again in Year 11. It has been postulated that the source of these urchins may be from a neighboring refuge i.e., a large neighboring tide pool system and associated mussel bed. Some areas of Point Fermin that were partially restored in Years 3-5 were re-cleared in Year 9, 10, and 11. White Point, which was originally cleared in Years 6-9, is now being re-worked in Year 11 since most of the original restoration area has reverted to urchin barren.

Site Name	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Total by Site
Underwater Arch Cove	503,189	762,649	0	35,866	9,348	0	0	0	0	0	178,295	1,489,345
Honeymoon Cove	821,425	514,811	0	0	0	0	0	0	0	0	0	1,336,236
Hawthorne Cove	0	136,997	60,320	0	8,778	0	0	0	0	0	0	206,095
Marguerite	0	378,523	151,114	47,847	0	0	0	0	0	0	0	577,483
Point Fermin	0	0	160,862	27,263	6,529	0	0	0	59,388	404,078	125,950	784,070
Resort Point	0	0	0	0	49,632	8,559	0	0	0	0	0	58,191
White Point	0	0	0	0	0	330,686	230,479	50,105	33,736	0	44,060	689,066
Total Urchins Culled	**1,324,613**	**1,792,979**	**372,296**	**110,975**	**74,287**	**339,245**	**230,479**	**50,105**	**93,124**	**404,078**	**348,305**	**5,140,486**

Justification for Removal:
No sea urchins were collected for gonadosomatic condition in Year 11. *Urchin Gonad Response to Kelp Forest Restoration on the Palos Verdes Peninsula* was published in August 2023 in the Bulletin of the Southern California Academy of Sciences. The study compared data collected in 2014, on the gonad condition of *M. franciscanus* and *S. purpuratus* within urchin barren, restoration, and an extant kelp bed on Palos Verdes (Grime et al 2023). The results describe,
'*Mesocentrotus franciscanus* urchin gonad weight at a given test diameter in restoration sites was higher than in urchin barrens and similar to kelp reference sites throughout most of the year following the completion of restoration activities", (Grime et al 2023). The study concluded, among other findings, that gonad production had recovered, in response to the culling of *S. purpuratus*, in *M. franciscanus* 8 months following restoration.

iii – vi: Field Condition Notes
Restoration activities have been conducted primarily at two sites (Point Fermin and Underwater Arch Cove) throughout the Year 11 reporting period, with the addition of re-initiating purple urchin culling at White Point with volunteer AAUS scientific divers. As indicated elsewhere in this report and in other communication with CDFW, field conditions such as sea state, visibility, and oceanic conditions (wind and swell) may limit effective windows for restoration and subtidal monitoring. Pt. Fermin has a southern exposure which may impart a different seasonal pattern of wave energy, compared to other sites previously restored on the Palos Verdes Peninsula. Whatever the cause(s) good progress was made in Year 11 conducting work off Point Fermin.

Table 8. Response monitoring (CRANE) Site Locations. See Appendix B for all CRANE data tables.

Designation	Site	Lattitude	Longitude
Restoration	Underwater Arch Cove	33.75291	-118.41499
	Honeymoon Cove	33.76459	-118.42406
	Hawthorne	33.75068	-118.41558
	Marguerite	33.75694	-118.41772
Reference	Ridges North	33.78697	-118.42065
	Rocky Point North	33.77966	-118.42739
	Point Vicente West	33.74073	-118.41283

iii. Species Richness
Species richness is the number of unique species found at a site. The species richness values are derived from the CRANE surveys provided by VRG. Since restoration events, species richness has increased in all restored sites (Table 9). Though these values are variable from year to year, the restored sites post 2013-14 (post 2015 for Marguerite Central) have similar richness values and sometimes even higher values than reference sites.

Table 9. Fish Species Richness (total number of species).

SiteType	Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Reference	Point Vicente West	8	6	10	11	12	13	9	11	10	11	8	8	9	11
	Ridges North	6	11	7	6	5	10	5	12	8	7	5	3	8	2
	Rocky Point North	8	8	8	8	6	7	9	11	8	4	6	6	9	4
Restoration	Hawthorne	10	6	8	7	10	13	11	12	12	7	9	8	9	6
	Marguerite Central	6	10	10	9	10	10	7	9	11	9	11	12	5	10
	Underwater Arch Cove	6	9	6	12	7	8	11	9	9	8	8	8	8	4
	Honeymoon Cove	NA	2	4	8	5	12	7	8	8	5	5	6	2	7

iv. Density of Kelp Forest and Ecosystem Species

As a measure of kelp forest density, we analyze the number of stipes per 100 m^2 that are greater than one meter in height. The *M. pyrifera* stipe density is provided by VRG during their annual CRANE surveys. The years following restoration activities (2016) showed an immediate increase in the *M. pyrifera* stipe density for all four restoration sites (Figure 3). Increases in stipe density post-2015 are orders of magnitudes higher than the years prior to restoration (2011-2014). Differences in stipe density post-restoration are likely explained by natural inter and intra-annual variation in response to other drivers; e.g., kelp canopy cover, transmissivity, temperature, nutrient availability, wave events, and upwelling. It should be noted that restoration events did coincide with a natural mass mortality event that contributed to decreased urchin density in 2015-2016. The peninsula has experienced multiple large wave events during the winters of 2021 through 2023 and some marked periods of prolific precipitation in winters and springs of 2022-2023 and 2023-2024.

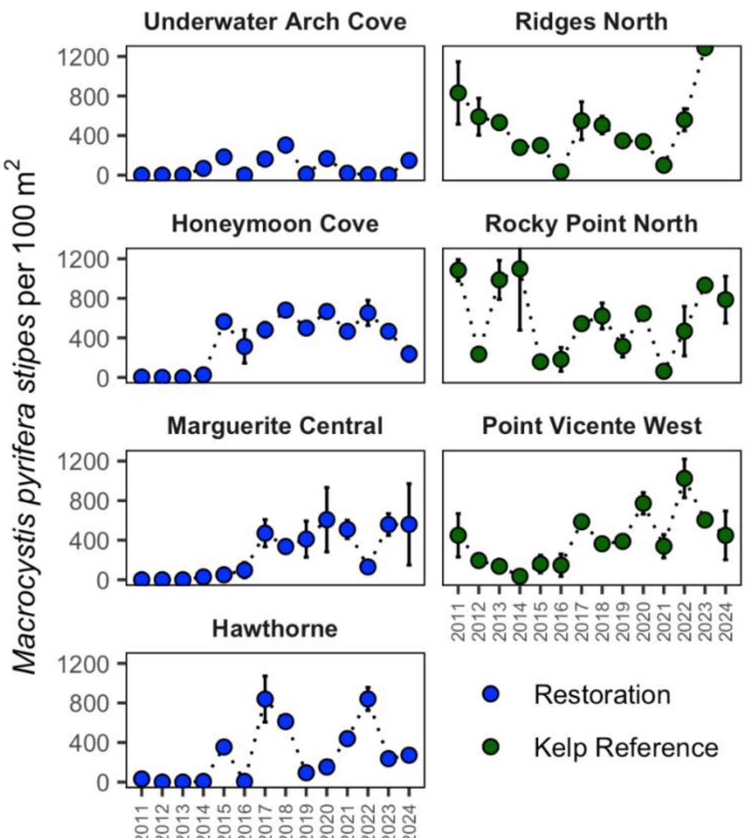


Figure 3. *Macrocystis pyrifera* stipe density (individuals per 100 m^2). Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. Stipe density was not significantly different by site designation in 2024 (t= -1.81, p=0.197).

Densities of Mesocentrotus franciscanus* and *Strongylocentrotus purpuratus

Both *M. franciscanus* and *S. purpuratus* densities began declining in 2013-2014, commensurate with the initiation of sea urchin culling (Figures 5 & 7). Their numbers remained low except for increases in *S. purpuratus* densities in Underwater Arch Cove. Although VRG CRANE surveys show a sharp decline prior to restoration activities at Marguerite Central, TBF fine-scale density data shows that our restoration efforts did decrease purple urchin high-density patches further between 2014-2016. Decreases prior to restoration activities could possibly be a result of early effects of the observed 2015-2016 natural wasting event, or discrepancies in CRANE surveying. TBF suspended *S. purpuratus* suppression from the fall of 2015 through the spring of 2016 to monitor the wasting event. Suppression continued in the late spring of 2016 once lesions on *M. franciscanus* and *S. purpuratus* were no longer found and densities of greater than 2 per m^2 persisted within our restoration sites. *M. franciscanus* densities also dropped during this time, even though TBF does not cull this species. The decline in abundance was most likely caused by three factors, (1) *M. franciscanus* and *S. purpuratus* wasting event, (2) commercial sea urchin harvesters extracting the *M. franciscanus* for the fishery, and (3) an increase in cryptic behavior. The increase in *S. purpuratus* density at Underwater Arch Cove helped inform the target of restoration efforts in year 11 of this project.

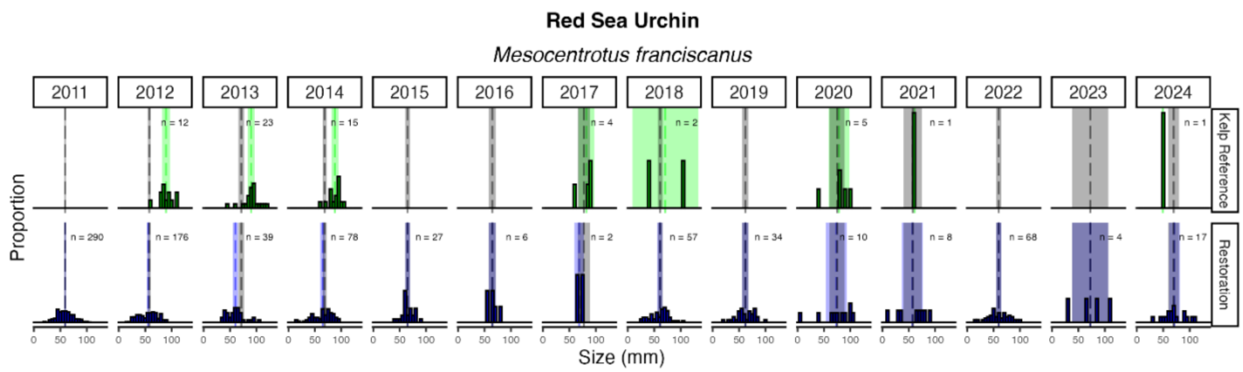


Figure 4. Mean *M. franciscanus* density (Individuals per 100 m^2) and size at kelp forest reference sites shown in green (Ridges North, Rocky Point North, and Point Vicente West) and restoration sites shown in blue (Underwater Arch, Honeymoon Cove, Marguerite Central and Hawthorne).

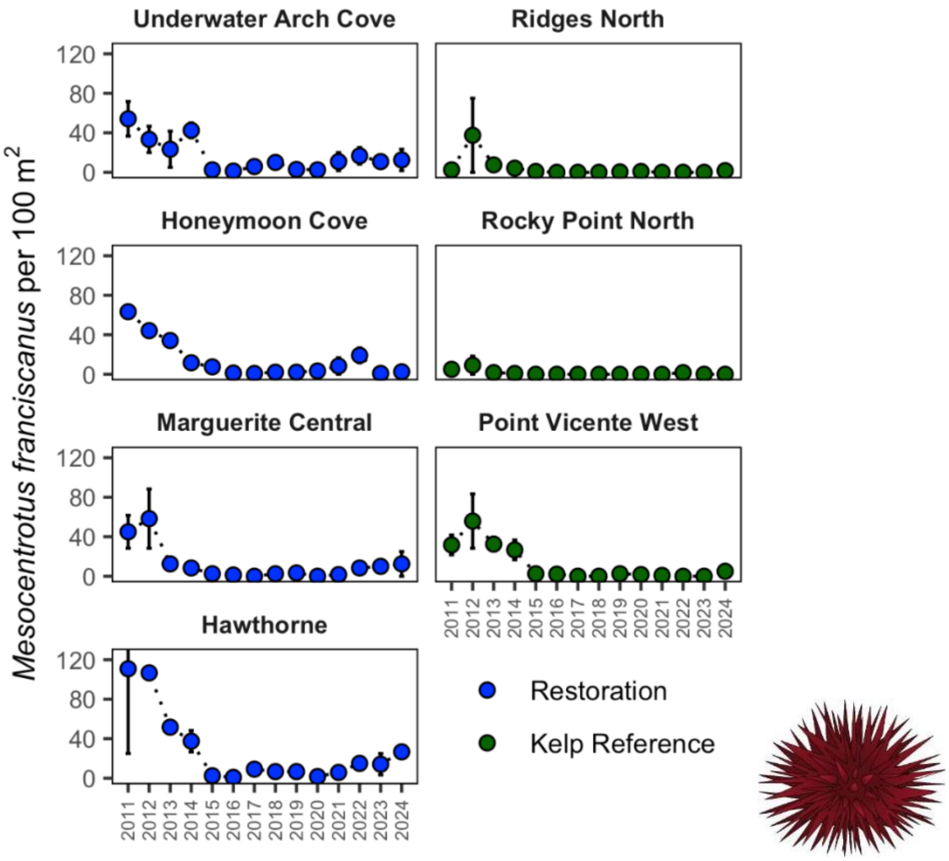


Figure 5. *M. franciscanus* density (individuals per 100 m^2). Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *M. franciscanus* density was not significantly different by site designation in 2024 ($t = 2.18$, $p = 0.104$).

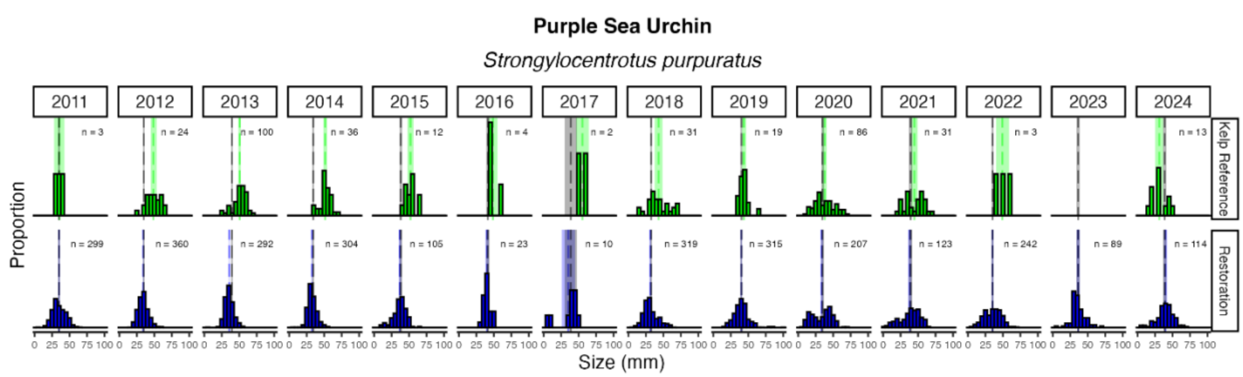


Figure 6. Mean *S. purpuratus* density (Individuals per 100 m^2) and size at kelp forest reference sites shown in green (Ridges North, Rocky Point North, and Point Vicente West) and restoration sites shown in blue (Underwater Arch, Honeymoon Cove, Marguerite Central and Hawthorne).

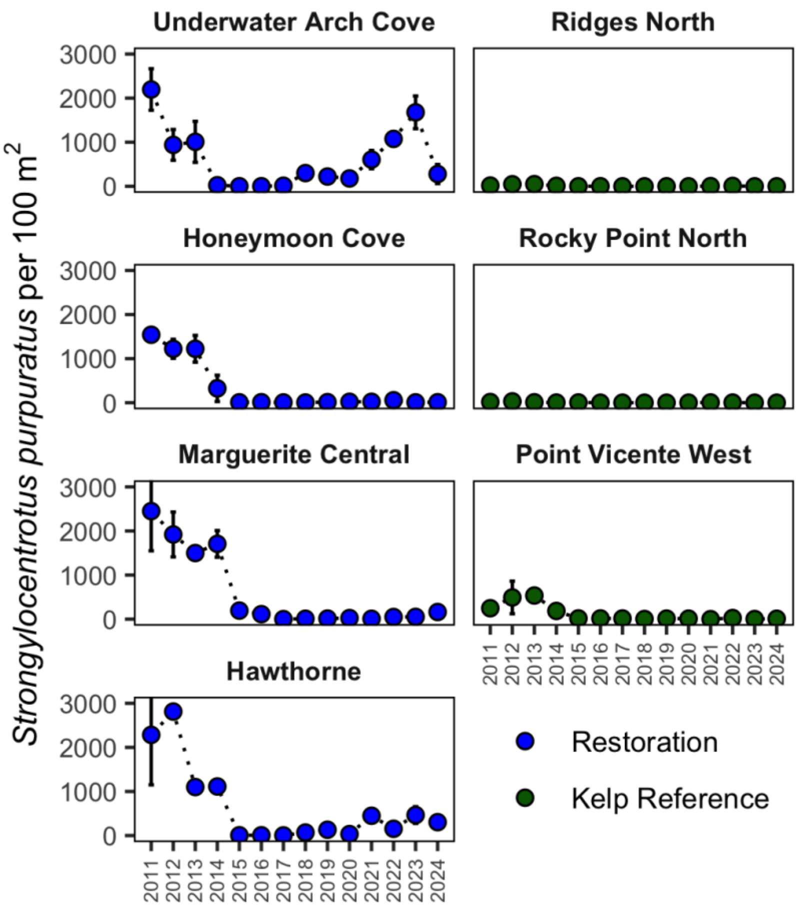


Figure 7. *S. purpuratus* density (individuals/100 m^2). Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *S. purpuratus* density was not significantly different by site designation in 2024 ($t= 2.77$, $p = 0.069$).

Panulirus interruptus

Panulirus interruptus (California Spiny Lobster) were quantified in CRANE invertebrate swaths. Prior to *S. purpuratus* removal in restoration sites, *P. interruptus* were not found within the sites (Figure 8). There has been a notable increase in the abundance of *P. interruptus* within restoration sites since 2016. While the abundance in restoration sites declined in 2019, the population observed remained larger than pre-restoration abundance levels. In 2020, the population in restored areas exceeded the population observed in reference sites. In 2021, the population in reference sites was slightly larger than the population observed in restored sites. In 2022, abundance levels increased in both restoration and reference sites with numbers in reference sites surpassing all previous years dating back to 2011. In Year 10 (2023), zero lobsters were observed on any transects in restoration or reference sites, hence their exemption from Figure 8. It should be noted that *P. interruptus* abundance is highly variable among sites and years, exemplified by the variability in populations across both kelp reference and restoration sites. This variability could be attributed to two factors: (1) commercial lobster fishing pressure is heavy throughout the Palos Verdes region, (2) *P. interruptus* are mobile and can select for areas based off preferable habitat and oceanographic conditions.

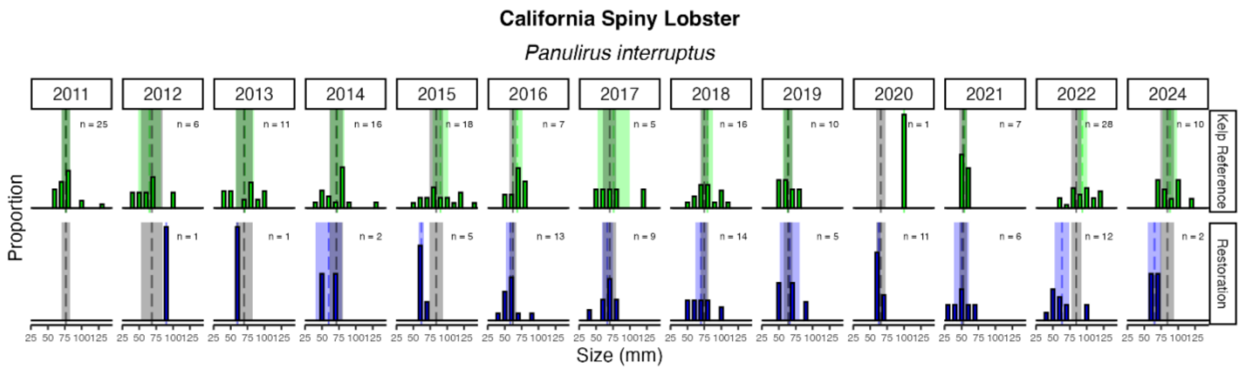


Figure 8. Mean *P. interruptus* density (Individuals per 100 m^2) and size at kelp forest reference sites shown in green (Ridges North, Rocky Point North, and Point Vicente West) and restoration sites shown in blue (Underwater Arch, Honeymoon Cove, Marguerite Central and Hawthorne). In 2023, zero observations were made during CRANE surveys and has not been included in the plot.

v. Density and biomass of kelp bass and California sheephead

Fish Data Processing
Sites were sampled over a period of several months and seasons. Therefore, young-of-the-year (YOY) were removed prior to fish density calculations because they could numerically dominate the assemblage at some sites sampled early in the season but decline later in the year due to natural mortality. YOY were generally defined as fishes <10 cm, except for some smaller species, where they were defined as individuals less than between 1.5 and 5 cm based on published species-specific growth rates and expert opinion. Total length (TL) estimates were converted to biomass using standard species-specific length-weight conversions from the literature. YOY were not excluded from biomass calculations, as their small size will influence biomass estimation less than abundance estimation. Density and biomass were then summed across all three portions (bottom, midwater, and canopy) of each transect, except for when the water depth is less than 6m, meaning that the volumes of the canopy and midwater portions would overlap, in which case no midwater portion was included. Density values were then scaled to the number per $100m^2$.

Paralabrax clathratus (kelp bass) abundance and biomass has gradually increased in restoration sites since restoration efforts were started (Figures 9 & 11). Overall, density and biomass in restoration sites depict the same trends as kelp reference sites, with no significant difference by site type (Williams et al 2021).

Kelp bass recruit to kelp canopy and use kelp as a refuge to hide from predators or to ambush prey. Biomass of kelp bass from all years shows that the largest biomass of kelp bass is within the Point Vicente MPA site, which is markedly higher than other reference and restoration sites. This is expected as fishing is not allowed within this area, allowing for fish to grow larger without fishing pressure. All current restoration sites are outside MPAs where fishing is allowed. In 2024, kelp bass biomass was not statistically significant between sites indicating that restoration sites are performing similarly.

Semicossyphus pulcher (California sheephead) abundance and biomass has been variable among monitoring years for all sites (Figures 10 & 12). That being said, surveys from 2024 revealed the majority of sites had increases in *S. pulcher* density, (only Underwater Arch Cove showed a decrease). The observed biomass in 2024 continued to exhibit expected annual variation across both reference and restoration sites, and analysis indicated no significant differences by site type.

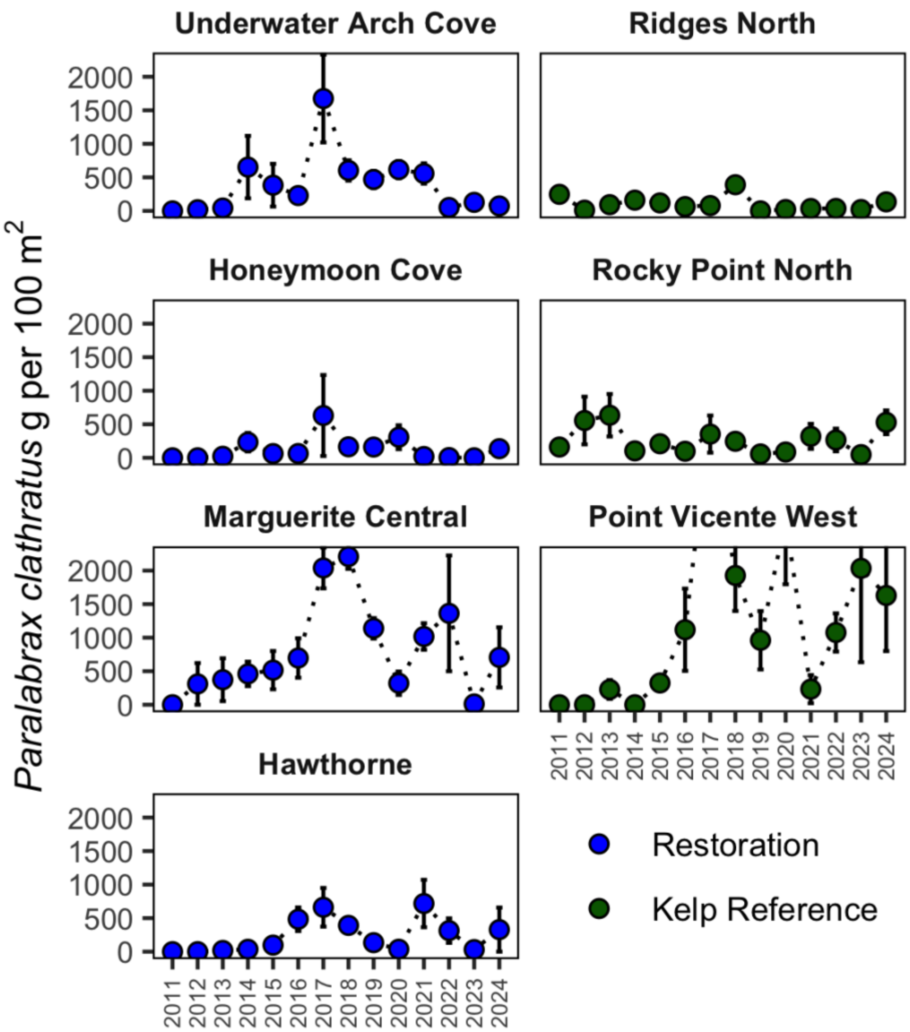


Figure 9. Density of *P. clathratus* by site type: restoration and reference. Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *P. clathratus* density was not significantly different by site designation in 2024 ($t = -1.36$, $p = 0.249$).

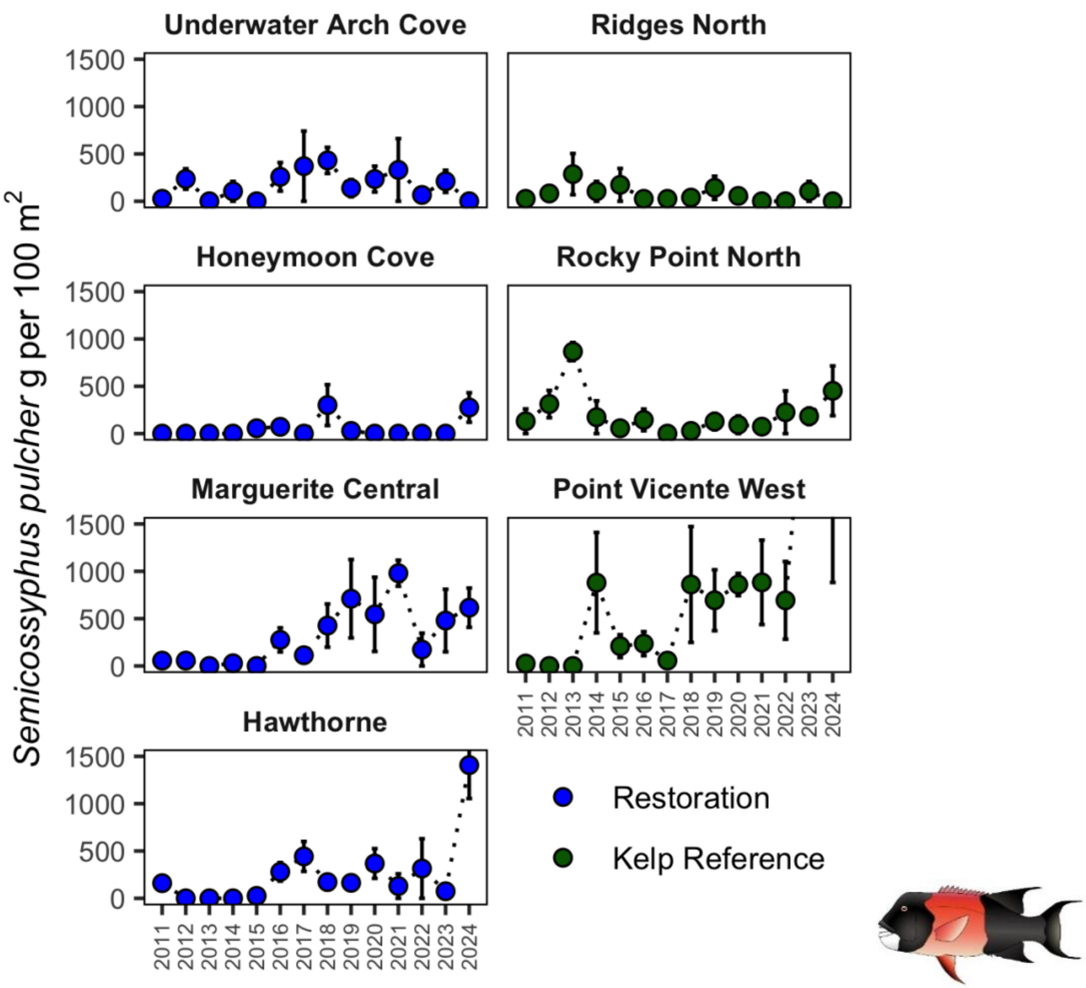


Figure 10. Density of *S. pulcher* by site type: restoration and reference. Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *S. pulcher* density was not significantly different by site designation in 2024 ($t = -0.97$, $p = 0.249$).

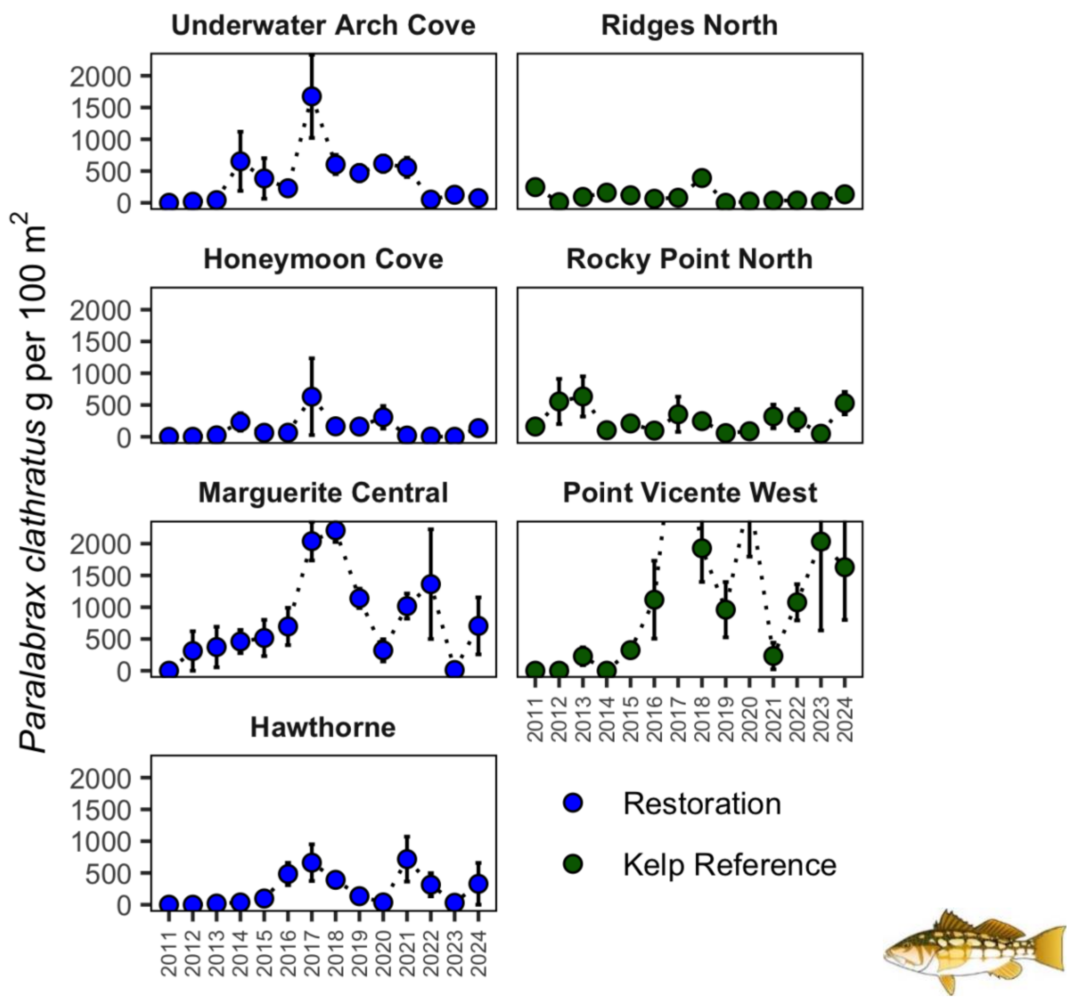


Figure 11. Biomass of *P. clathratus*, per 100 m^2, by site type: restoration and reference. Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *P. clathratus* biomass was not significantly different by site designation in 2024 ($t = -0.97$, $p = 0.421$).

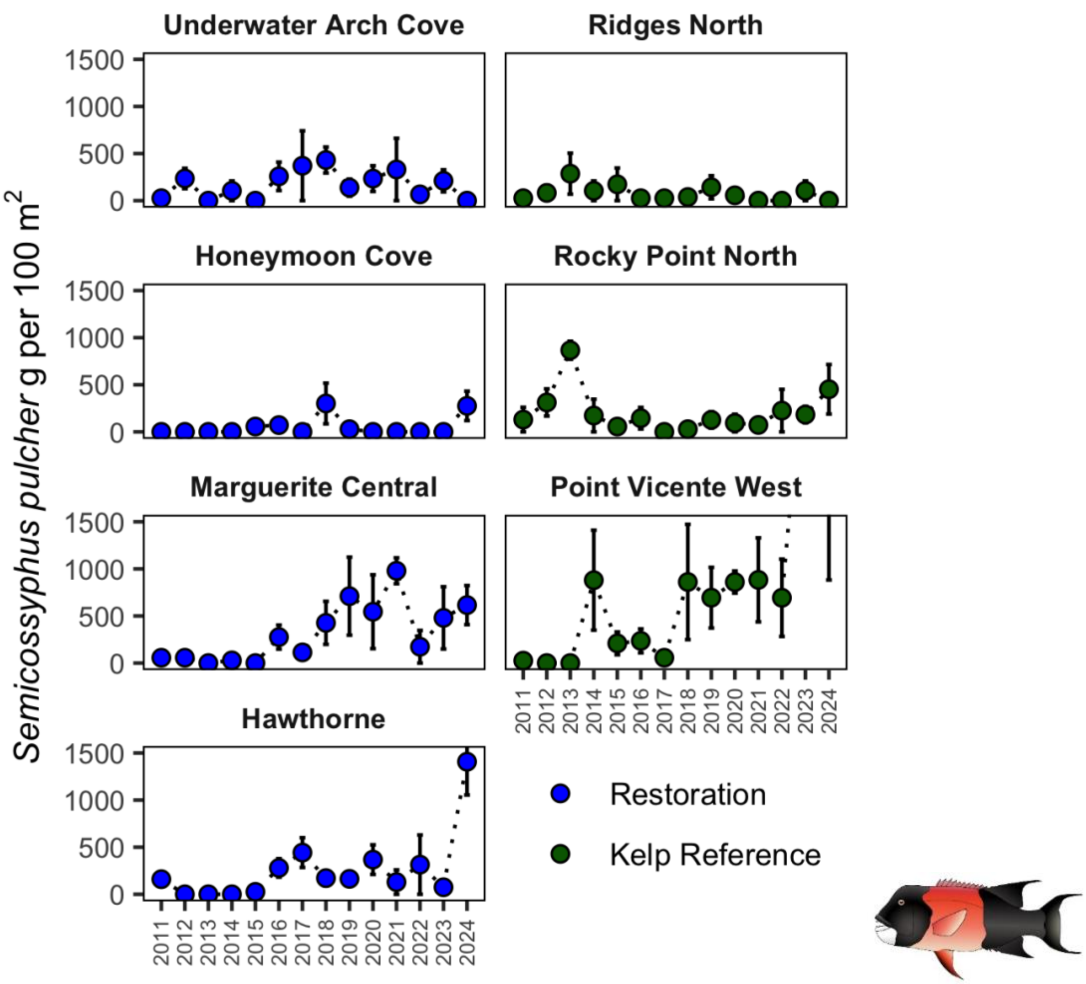


Figure 12. Biomass of *S. pulcher*, per 100 m^2, by site type: restoration and reference. Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *S. pulcher* biomass was not significantly different by site designation in 2024 ($t = -0.51$, $p = 0.652$).

Community Diversity

The Shannon-Wiener diversity index came from information theory and measures the order (or disorder) observed within a particular system. The Simpson's index of diversity accounts for both richness and proportion of each species. Both of these diversity indexes are similar in that increasing diversity is represented by values approaching zero. It has been a useful tool to terrestrial and aquatic ecologists. Both diversity measures show a rapid increase of algal/invertebrate diversity once restoration was completed in Underwater Arch, Honeymoon Cove, and Hawthorne (Figure 13). After restoration activity, diversity measures show little fluctuation, apart from Marguerite Central, as it appears diversity decreased slightly in the year after restoration was completed. period. In 2024 we continue to report no significant differences in community diversity between restoration and reference sites. The trends indicate ongoing improvement/similarity of kelp restoration and reference sites. (Figure 13 & 14).

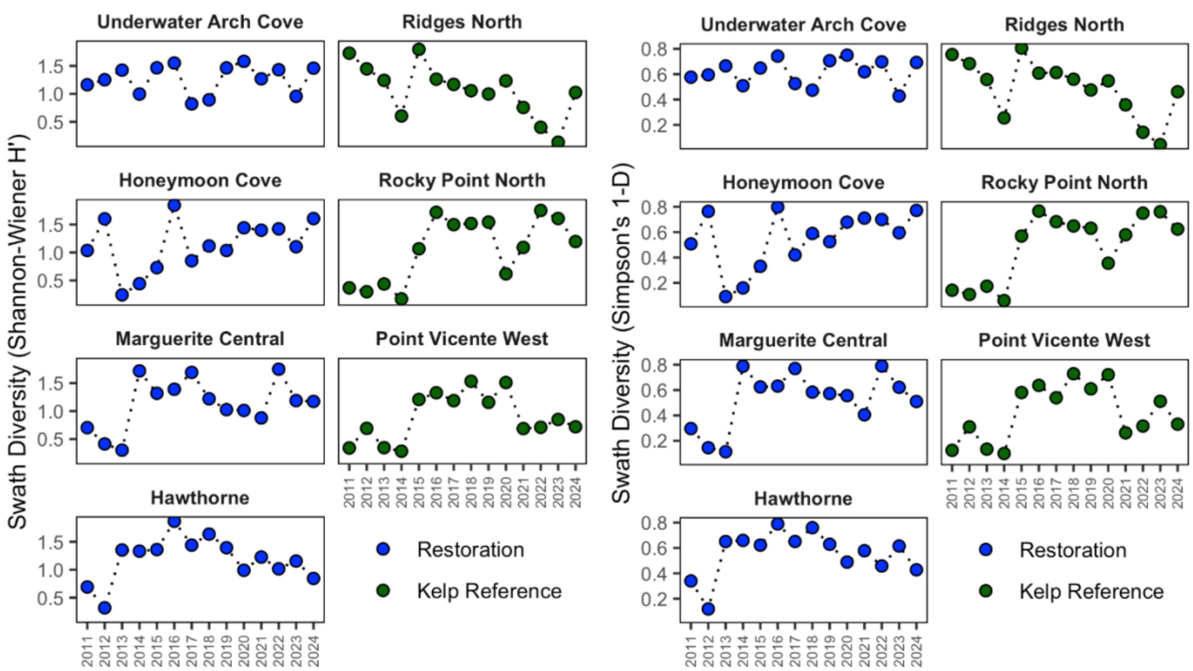


Figure 13. Algal and invertebrate diversity at restoration sites (Underwater Arch, Honeymoon Cove, Marguerite Central and Hawthorne) and reference sites (Ridges North, Rocky Point North, and Point Vicente West). Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. Both diversity measures used, Simpson's Diversity (t= 1.11, p= 0.323) (Left) and Shannon-Wiener (t= 1.33, p= 0.241) (Right), were not significantly different by site designation in 2024.

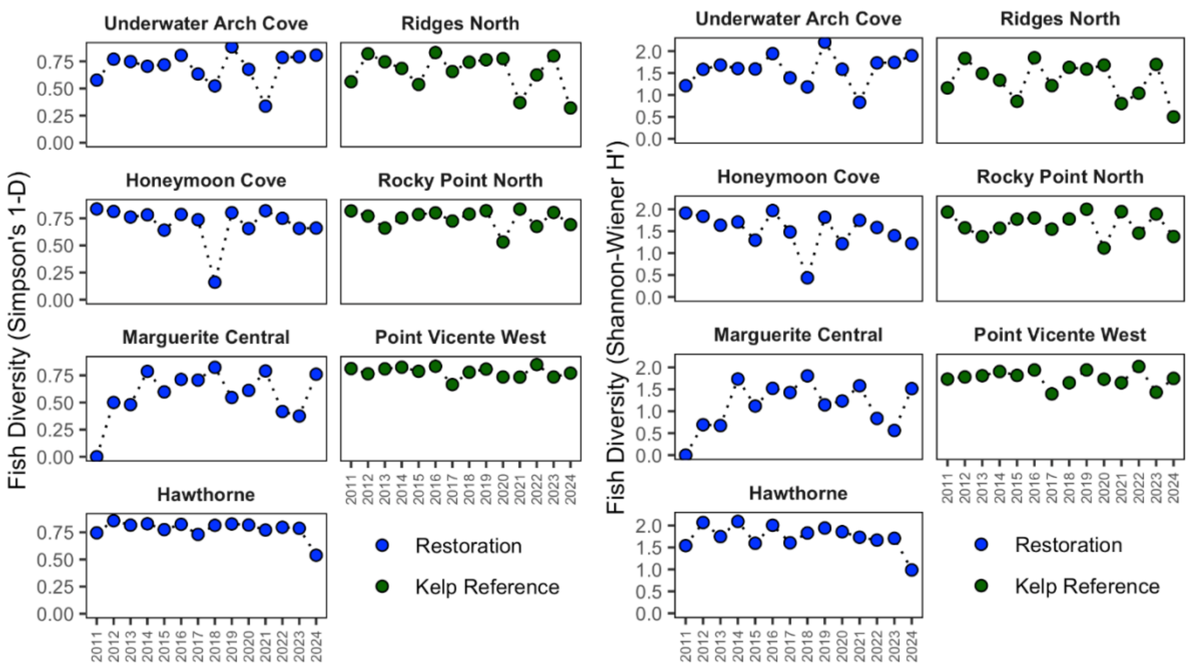


Figure 14. Fish diversity at restoration sites (Underwater Arch, Honeymoon Cove, Marguerite Central and Hawthorne) and reference sites (Ridges North, Rocky Point North, and Point Vicente West). Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. Both diversity measures used, Shannon-Wiener (t= -0.47, p= 0.67) (Right) and Simpson's Diversity (t= 0.65, p= 0.568) (Left), were not significantly different by site designation in 2024.

vi. Gonadosomatic indices of *M. franciscanus* and *S. purpuratus*

The measurement of gonad development in *M. franciscanus* and *S. purpuratus* is an important indicator of secondary production in the kelp forest ecosystem and is used to inform adaptive management of the restoration project and research related to kelp forests and associated fisheries. The gonadosomatic index is the ratio of the weight of the gonad to the overall weight of the animal.

No urchins were collected for the years 8, 9, 10, and 11annual reports. In order to process urchins in a timely manner (to reduce stress and water loss from their gonads), collection and dissection requires a large effort consisting of student and community volunteers. In previous years, TBF divers were able to collect urchins at one kelp reference, two restoration, and one barren control site before transporting all urchins to LMU. More than 50 student and community volunteers would then process urchins throughout the day/night. Due to COVID-19 restrictions with organizing large groups of people, as well as LMU closing lab spaces, TBF was not able to hold this event in 2020-2021.

The Bay Foundation staff co-authored *Urchin Gonad Response to Kelp Forest Restoration on the Palos Verdes Peninsula* in August 2023 in the Bulletin of the Southern California Academy of Sciences. This study describes the increase in sea urchin gonad resulting from the restoration efforts. These results are a strong signal of secondary production and in the case of *M. franciscanus,* of measurable benefit to the red sea urchin fishery, within restoration sites. The data shared in figures 4-7 demonstrates how few non cryptic urchins are present in the restoration and reference sites. The collection of sufficient numbers of urchins has become logistically difficult to continue to inform this dataset, and no efforts were undertaken in Year 11.

E) <u>Analysis of the ecosystem response to the restoration activities at the restoration sites, including species that are key indicators of a healthy and persistent kelp forest ecosystem.</u>

Community Analysis Methods

As part of the quantitative characterization of the community structure of the reefs, we examined patterns in the overall kelp forest community using fish and swath (benthic macroinvertebrates and kelps) data combined. Density metrics were square root transformed (fish and swath data). Two-dimensional, non-metric multidimensional scaling (nMDS) was used to examine patterns among kelp forest communities and fish density (Figure 15) and fish biomass (Figure 16) at sites using the ‘metaMDS’ function in the ‘vegan’ package (Oksanen et al. 2016) in R (R Core Team 2016). A similarity matrix constructed with transformed taxon-specific values (site means for each site/sampling period combination) and the Bray-Curtis similarity. To provide context to the observed relationships amongst sites, patterns of taxa densities were visualized across the nMDS ordination plots using the ‘ordisurf’ function in the R package ‘vegan’ (Oksanen et al. 2016) which fits a smooth surface using generalized additive modeling (GAM) with thin plate splines (Wood 2003, Oksanen et al. 2016). These visualizations help inform drivers of community structure as seen in nMDS plots.

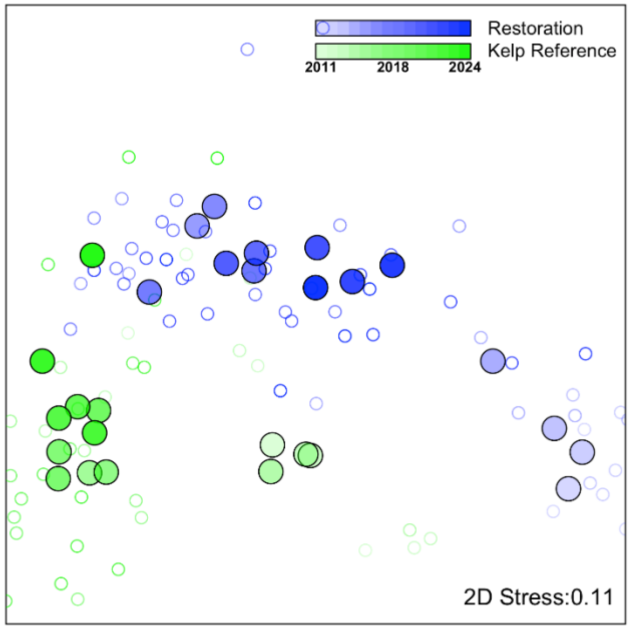
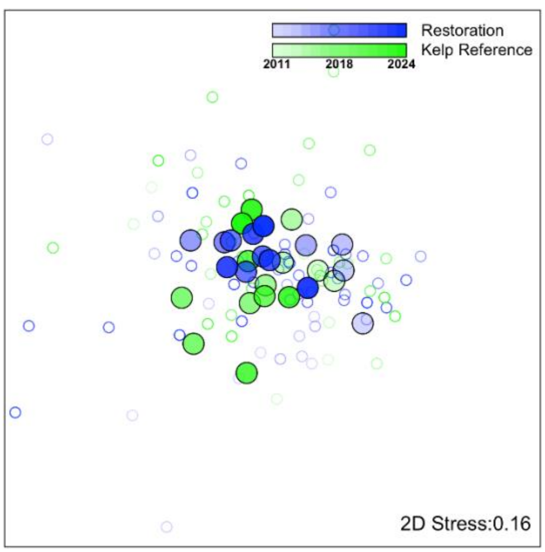


Figure 15. Two-dimensional, non-metric multidimensional ordination plot of kelp and macroinvertebrate communities using Bray-Curtis similarity based on the square-root transformed mean taxa density for each site/sampling period combination.



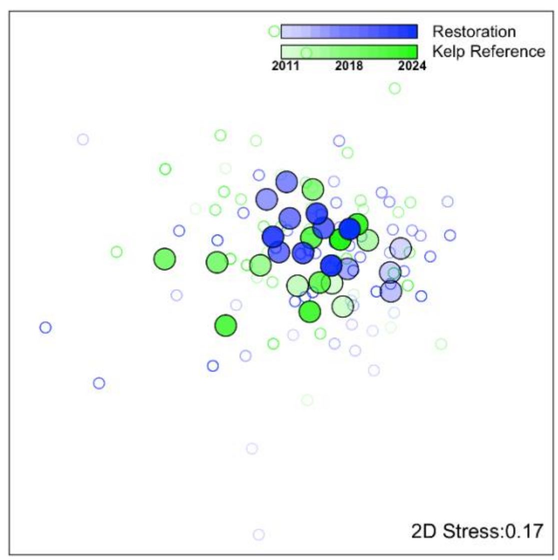


Figure 16. (Left) Two-dimensional, non-metric multidimensional ordination plot of fish biomass using Bray-Curtis similarity based on the square-root transformed mean taxa density for each site/sampling period combination. (Right) Two-dimensional nMDS plot of fish density for each site/sampling period combination. Open circles indicate every site sampled, while closed dots indicate the mean values for the site type. Fish communities depict an evolution of restoration sites, forming a large significant cluster near kelp reference sites, which are visibly differentiated from pre-restoration values.

Community Analysis Results
The three plots presented above display a convergence over time in which restoration sites begin to resemble, structurally, the reference sites after purple urchin density reduction. The earlier years depicted in these plots show that the converse was true in advance of restoration efforts; that the structure of restoration sites, pre restoration, resembled control sites (sites that contained urchin barrens for comparison early in the project).

Two restoration sites were completed near the close of 2014. The community analyses show a convergence of restoration and reference sites in 2014 as the restoration sites changed from barrens to young kelp forests. The occurrence of a mass wasting event of *M. franciscanus* and *S. purpuratus* happened with considerable severity off the Palos Verdes Peninsula impacting reference and restoration sites in 2015 into 2016. This further loss of top-down pressure from *M. franciscanus* and *S. purpuratus* on the development of *M. pyrifera* and other macroalgae and the freeing from competition, of other grazers, likely caused this progression from barren to young kelp forest to continue in 2015-2016.

These plots indicate, with confidence, that the loss of *M. franciscanus* and *S. purpuratus* i.e., a reduction in their density, allows for the growth and development of other benthic organisms that are no longer limited by the direct and indirect impacts of *M. franciscanus* and *S. purpuratus densities* and grazing. Further monitoring of these sites may, over time, detect trends that elucidate more subtle or developing relationships in community structure. Likely, these characteristics will be displayed via divergence of these site types over time, or in response to other forms of disturbance and other stressors.

The plots also support the idea that *S. purpuratus* suppression creates similar near-term changes in community structure to widespread reductions in *M. franciscanus* and *S. purpuratus* due to disease. These different causes of *M. franciscanus* and *S. purpuratus* density reduction have both driven formerly barren reef states to resemble reference sites (i.e., sites with persistent kelp and more complex community structure). These results suggest that in the near-term, *S. purpuratus* suppression is a fair mimic for natural losses in *M. franciscanus* and *S. purpuratus* populations driving kelp forest community structure on a local scale. See Williams et al. 2021, for further discussion on the community analysis depicting the convergence of structural metrics of restoration sites to resemble reference sites.

F) Evaluation of successes and failures of restoration activities for each site

Honeymoon Cove, Marguerite Central, and Hawthorne

These three sites have remained in a spatiotemporal stable kelp forest state shortly following the conclusion of restoration actions. The results of two studies cited elsewhere in this report, (Williams et al 2021 and Grime et al 2023) elucidate the extant condition of these restoration sites. Ecologically these sites present themselves as kelp forests, not as restored barrens or some other eco-type. To further our collective understanding of the long-term efficacy of this work these sites will be periodically surveyed to see if the kelp forest state persists or if other notable trends or novel observations warrant further exploration. In Year 11, these sites were characterized by CRANE based community monitoring i.e., response monitoring. TBF is invested in maintaining the continuity of the response monitoring to advance the state of the science as it relates to sea urchin density reduction as a method to enhance and restore giant kelp forests in southern California.

Underwater Arch Cove, White Point, and Point Fermin

These sites currently contain expanses of urchin barren within the site boundaries. This has been a repeat occurrence in Underwater Arch Cove. Observations suggest a few explanations 1) coinciding recruitment events of purple sea urchins, 2) incomplete initial clearing especially in cobble and boulder complexes 3) a refuge of urchins from a large neighboring tide pool. In the first case in situ crushing of purple sea urchins is ineffective when the substrate harbors 10's or 100's/m^2 of post settlement purple sea urchins roughly 2-5mm in diameter. Similar observations have been made at White Point and Point Fermin.

In addition, White Point is frequently turbid, with large and fine grain sediment moving and depositing and resuspending in the site. Surely these processes would interfere with the development of giant kelp and other substory algae. Hopefully the efforts made in Year 11 and those in the coming years will produce more permanent results. Point Fermin has its own distinctions. Firstly, it has a south facing exposure, unique among the sites. It is also a large homogeneous expanse of tabular mudstone and shale bedrock, which is quite friable. This is broken up by a few large channels roughly running perpendicular to the shoreline. Notably, cobbles and boulders accumulate in these channels. The current effort in Point Fermin has been at an accelerated rate. The strategy is that the entirety of this site may need to experience the shift from barren to kelp dominated for the desired affect within a more constrained time frame that other sites we've worked, i.e., faster.

Efforts to systematically and comprehensively address expanses or urchin barren present in White Point and Point Fermin will continue in Year 12. To increase capacity for sea urchin reduction across these three sites, i.e., Underwater Arch Cove, White Point, and Point Fermin, TBF has instituted a volunteer dive program for AAUS certified-scientific divers. These divers are trained and directly supervised by TBF staff to ensure safe and effective operations. Volunteer divers and TBF staff work as dive teams to conduct sea urchin culling, pre and post restoration monitoring, and related tasks.

TBF anticipates that the success realized at Honeymoon Cove, Marguerite Central, and Hawthorne can be replicated at Underwater Arch Cove, White Point, and Point Fermin. Ongoing annual response monitoring will inform and complement these other efforts in understanding the effects of this project's approach to kelp forest restoration.

Table 10: Community analysis monitoring data for White Point.

White Point CRANE data - September 2021-2023			
Analysis	2022	2023	2024
Coordinates:			
Latitude	33.71287	33.71287	33.71287
Longitude	-118.3159	-118.3159	-118.3159
Temperature	17.9	17.6	17.8
Fish Richness	7	11	8
Fish Diversity H	1.68	2.042	1.56
Fish Diversity 1-D	0.79	0.843	0.74
Fish Density:			
Paralabrax clathratus (/100m2)	0	4.17 ± 1.5	1.67 ± 0.96
Semicossyphus pulcher (/100m2)	1.3 ± 0.8	4.17 ± 3.78	1.67 ± 0.96
Fish Biomass:			
Paralabrax clathratus (g/100m2)	0	347.3 ± 74.63	144.87 ± 33.28
Semicossyphus pulcher (g/100m2)	917.4 ± 743.1	494.7 ± 215.7	206.25 ± 97.37
Swath Diversity H	2.56	1.615	2
Swath Diversity 1-D	0.91	0.732	0.83
Swath Density:			
Macrocystis pyrifera stipes (/100m2)	375.8 ± 144.2	-	-
Panulirus interruptus (/100m2)	9.2 ± 9.2	-	-
Mesocentrotus franciscanus (/100m2)	20 ± 5	29.17 ± 1.17	28.33 ± 18.36
Strongylocentrotus purpuratus (/100m2)	258.3 ± 45	366.38 ± 34.78	81.67 ± 31.66

Table 11. Community analysis monitoring data for Point Fermin.

Point Fermin CRANE data January 2024		
Analysis	2023	2024
Coordinates:		
Latitude	33.704,	33.704,
Longitude	-118.291	-118.291
Temperature	16.7	16.6
Fish Richness	5	5
Fish Diversity H	1.322	1.1
Fish Diversity 1-D	0.685	0.6
Fish Density:		
Paralabrax clathratus (/100m2)	1.67 ± 1.4	4.17 ± 0.83
Semicossyphus pulcher (/100m2)	5.83 ±	11.67 ± 5.52
Fish Biomass:		
Paralabrax clathratus (g/100m2)	349.51 ± 103.5	872.72 ± 206.3
Semicossyphus pulcher (g/100m2)	92.22 ± 92.1	184.60 ± 106.4
Swath Diversity H	1.302	1.58
Swath Diversity 1-D	0.584	0.709
Swath Density:		
Macrocystis pyrifera stipes (/100m2)	-	-
Panulirus interruptus (/100m2)	0.83 ± 0.4	0.53 ± 0.2
Mesocentrotus franciscanus (/100m2)	103.27 ± 6.5	359.7 ± 76.8
Strongylocentrotus purpuratus (/100m2)	705.9 ± 56.69	1403.22 ± 103.7

Note: Figure 17 below displays all the restoration sites on the same map for a comprehensive look at the scale of the project in relation to the Palos Verdes peninsula.

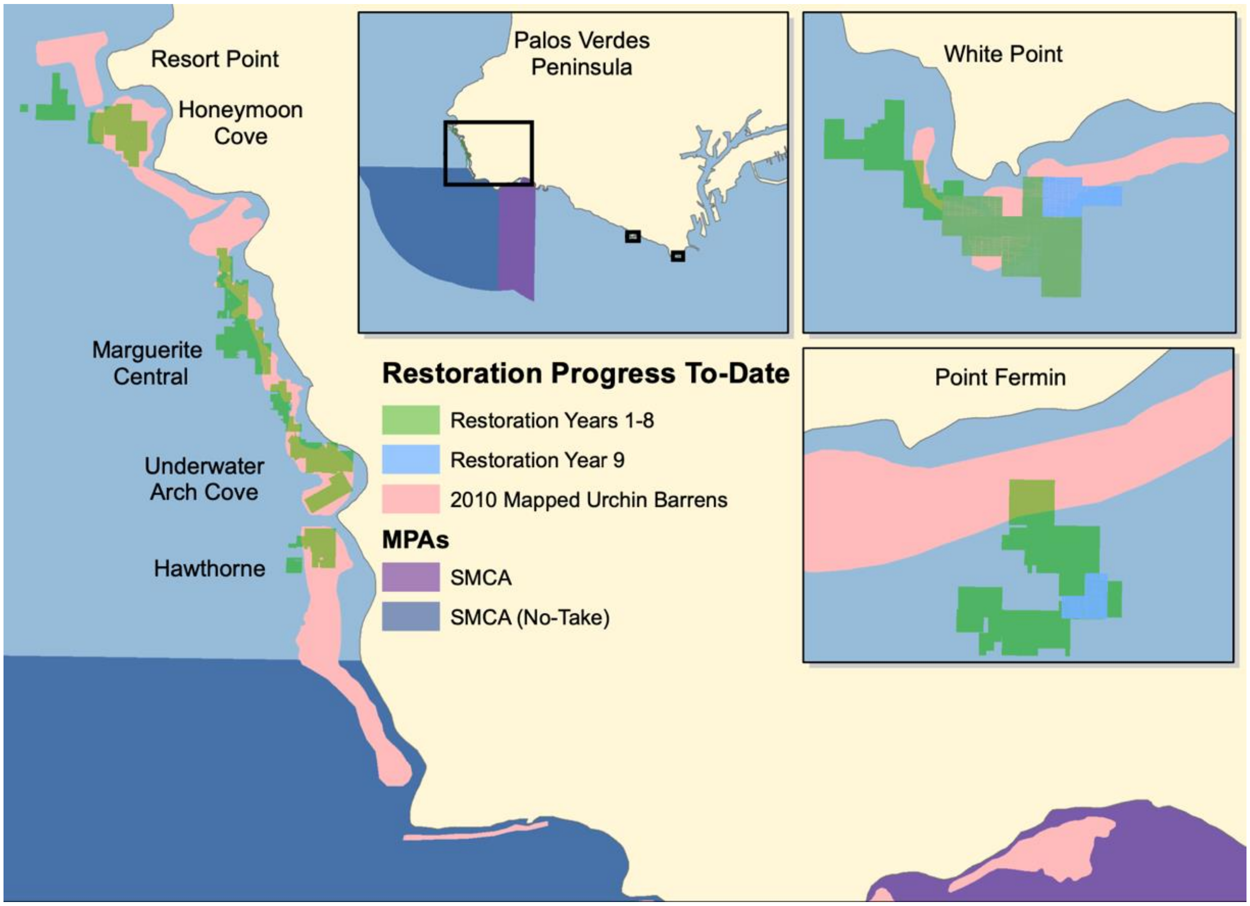


Figure 17. Urchin barrens as mapped in 2010 and areas restored, representing a possible expansion and/or shift of urchin barrens. The locations of urchin barren areas are in pink, restoration areas completed in Years 1 through 8 are green, and restoration areas completed in Year 9 are blue (ESRI 2021). Due to GIS software upgrades and data formatting incompatibility, year 10 and 11 have not been updated on this map. See Figure 2 for year 11 restoration area.

G) <u>Geo-referenced images before and after restoration activities</u>

Between July 1, 2013 and November 1, 2024, photos and videos were taken at various locations within six restoration sites both pre and post restoration efforts (excludes Resort Point extension of HMC site). The GPS coordinates and maps displaying locations of these photos and videos are listed in Appendix C.

Permanent photo points have been identified in six sites, which will be photographed over time (Table 12). These locations were chosen due to either, a unique geological feature, or frequency of diving due to other projects occurring in the area. Some sites have distinct, recognizable rock structures, but once kelp recruits back into the area these features are often obscured. Video transects were also established in each site starting from a known GPS coordinate and laying 30m transect tapes at a predetermined heading. The paths of these video transects and photo points are mapped in Appendix C. We aim to increase our efficiency by revisiting the permanent photo points and a select subset of transects for video at minimum once per year during late summer to early winter (June to November), providing an overview of the conditions and response within each site. Full video transects for 2024 have been recorded and time-lapse videos were edited together to show changes over time within each site.

Table 12. Permanent photo point selections in restoration sites.

Restoration Site	Latitude	Longitude	Notes
Honeymoon Cove - T2	33.76426	-118.4237	East-west running ridge
Honeymoon Cove - R5	33.7653	-118.4242	*Haliotis fulgens* outplant site monitored annually
Marguerite - T16	33.75756	-118.4178	Annual surveys conducted
Underwater Arch J1 - J2 - T7	33.7526	-118.4146	Original video transect, repeated annually
Hawthorne - T2	33.75064	-118.4161	Large pinnacle within block 2
Point Fermin - J7	33.70303	-118.2902	North-south running ridge
White Point - T12	33.71297	-118.3165	Large boulder 7meters 0 degrees from block 12 smile

Looking Ahead

To complete the Palos Verdes Kelp Restoration Project, TBF estimates about 28acres of sea urchin barren remain after visually mapping the entirety of our White Point and Point Fermin sites. By continuing purple sea urchin suppression, sea urchin grazing pressure will be reduced and biogenic habitat will be restored to the rocky reefs that have historically supported kelp forests. TBF will utilize its long-standing partnerships with academic researchers, commercial sea urchin harvesters, and recently launched volunteer diver program to restore 7-10 acres of rocky reef each year over the next three years off the Palos Verdes Peninsula. This project will be implemented according to previously proven methods utilized by the project. Timeline and total area cleared each year will be directly dependent upon available funding and diver support.

Annual progress will be tracked using the following metrics:

- Pre-restoration biological community analysis monitoring
- Pre-restoration urchin density monitoring
- Post-restoration biological community analysis monitoring
- Post-restoration urchin density monitoring
- Number of acres kelp forest restored
- Active volunteer dive program training 20-30 scientific divers each year
- 4-6 volunteer dive days per month
- Annual report detailing changes in urchin density, biological community (fish, invertebrates, and algae), and enhanced habitat photos

Long term project outcomes:

- Restored kelp forests will return 3-dimensional structure to the habitat providing increased richness and biomass of algae, fish, kelp canopy, and lobster.
- Resilient ecosystem providing improved water quality, wave attenuation, carbon sequestration, and spatiotemporal stability of the kelp forest.
- Increased biological production resulting in increased opportunity for recreation, commercial, sport, and sustenance fishing.

To further the scalability of nearshore monitoring and kelp forest restoration, TBF in partnership with Marauder Robotics, is trialing an integrated platform of seafloor to cloud communication, coupled with sensors and remotely operated vehicles (ROV). This work focuses on the following three objectives and is supported by funding through the Schmidt Marine Technology Partners and Paul G. Allen Family Foundation.

1. Test Marauder's ability to collect comparable baseline, biological, and compliance monitoring data. Assess the success of strategic restoration practices (collection or culling) of urchins.
2. Highlight the kelp forest management implications for reconnaissance data gathering and active restoration at remote site locations or during inclement diving conditions.
3. Demonstrate ability to scale restoration and data collection efforts with technology.

H) Literature Cited

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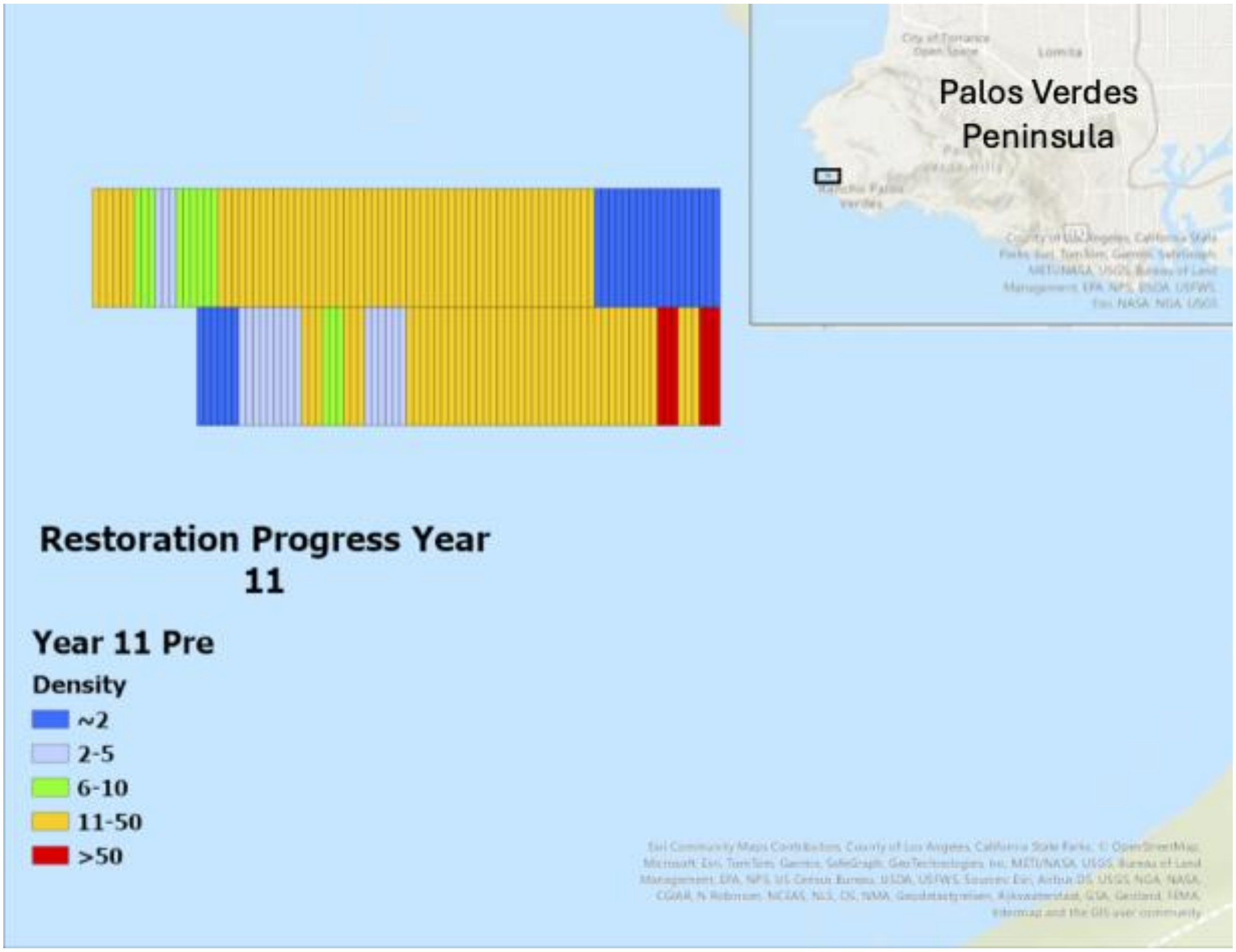
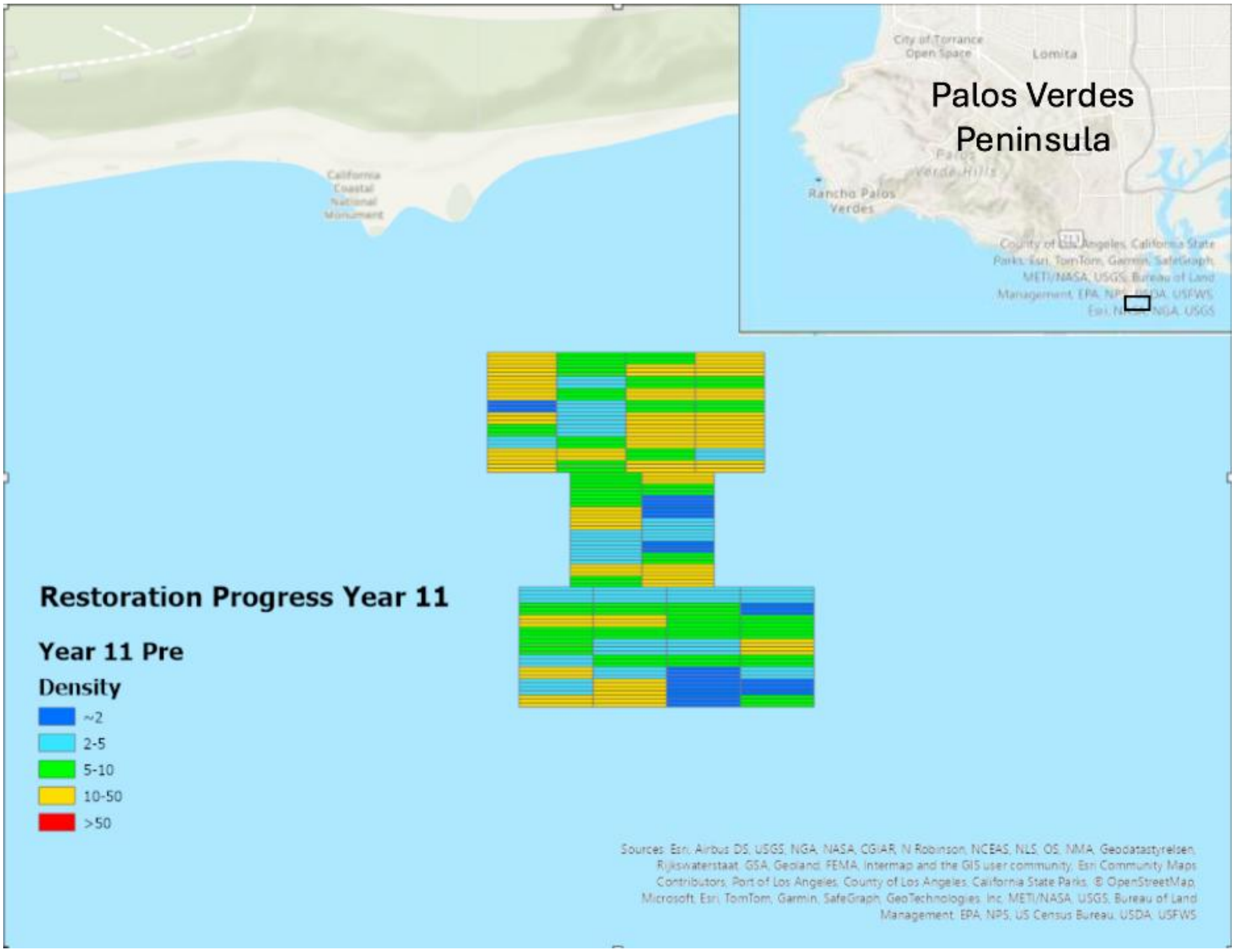
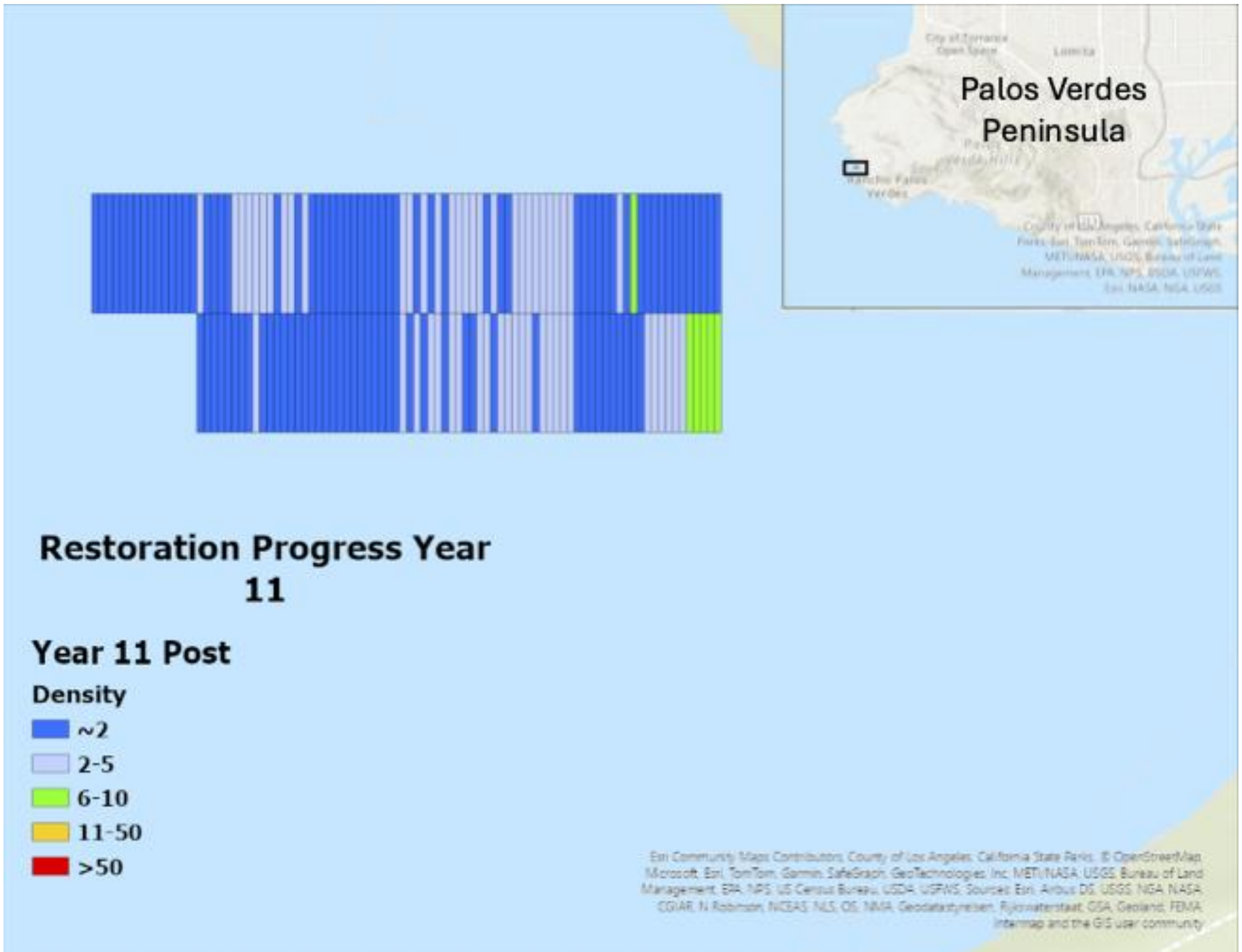
Appendix A. Palos Verdes Kelp Restoration Project Map Images



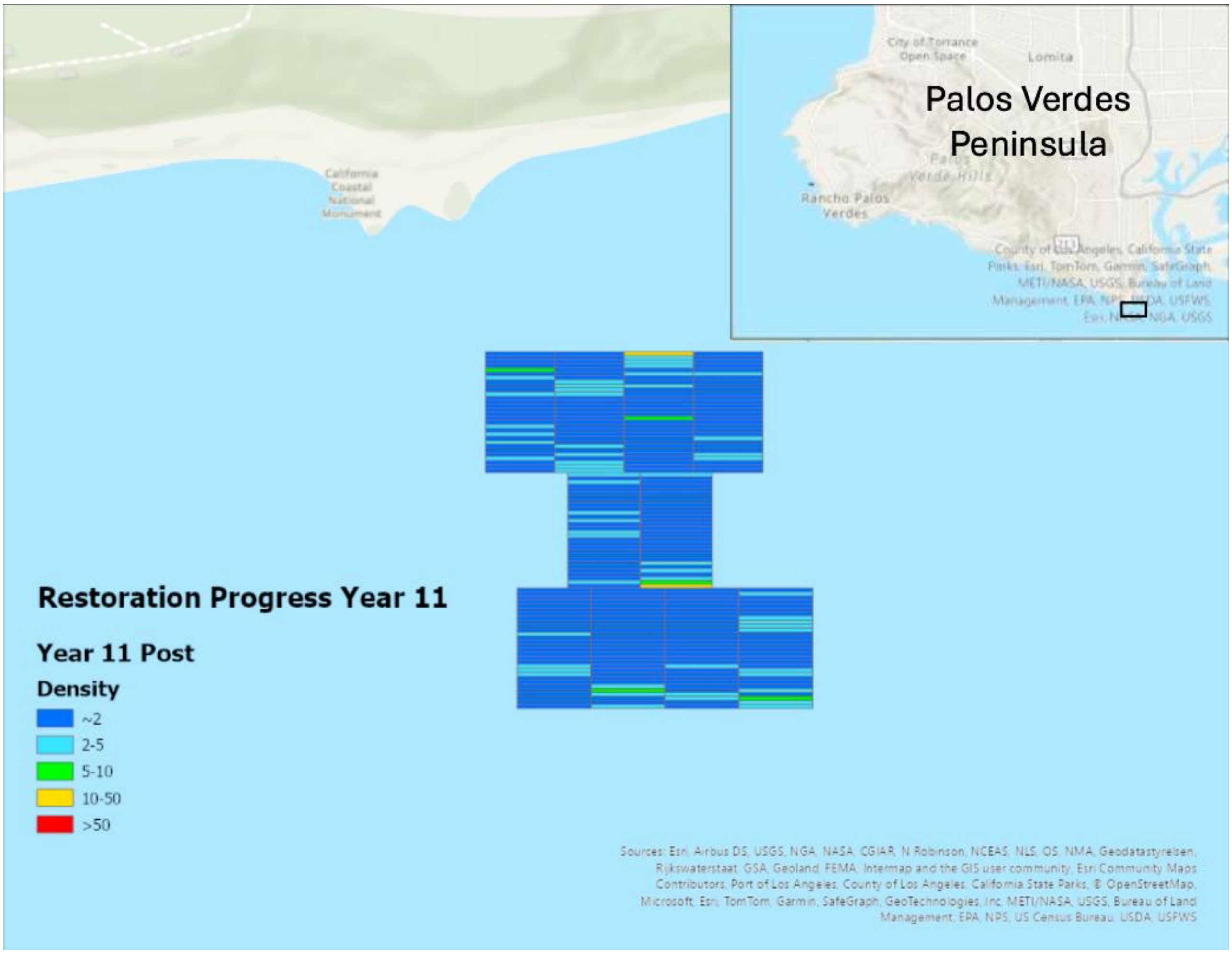
Map A1. Density of *S. purpuratus* (per m^2) pre-restoration in Underwater Arch Cove, Palos Verdes, California. Black square in the inset map indicates Underwater Arch Cove location in reference to Palos Verdes. Average *S. purpuratus* density for this site is 16.3 per m^2, with some localized areas up to 75 per m^2 (ESRI 2024)



Map A1. Density of *S. purpuratus* (per m^2) pre-restoration in Point Fermin, Palos Verdes, California. Black square in the inset map indicates Point Fermin location in reference to Palos Verdes. Average *S. purpuratus* density for this site is 16.5 per m^2, with some localized areas up to 75 per m^2 (ESRI 2024)



Map A3. Density of *S. purpuratus* (per m^2) post-restoration in Underwater Arch Cove, Palos Verdes, California. Black square in the inset map indicates Underwater Arch Cove location in reference to Palos Verdes. Average *S. purpuratus* density for this site is 2.12 per m^2 after restoration.



Map A4. Density of *S. purpuratus* (per m^2) post-restoration in Underwater Arch Cove, Palos Verdes, California. Black square in the inset map indicates Underwater Arch Cove location in reference to Palos Verdes. Average *S. purpuratus* density for this site is 1.85 per m^2 after restoration.

Appendix B: CRANE Data Tables 2011 – 2024.

Restoration began at the end of 2014 leading into 2015 at the site Marguerite Central (previously a control site) and was completed in the winter of 2016. Marguerite Central is designated as Restoration for the 2017 surveys. Hawthorne Control was added as a previous control site by Vantuna Research Group of Occidental College as this isolated reef within the cove maintained low urchin densities, high giant kelp densities, and is West facing site similar to our restoration sites included in this report.

Table B1. CRANE Survey Site Locations.

Designation	Site	Lattitude	Longitude
Restoration	Underwater Arch Cove	33.75291	-118.41499
	Honeymoon Cove	33.76459	-118.42406
	Hawthorne	33.75068	-118.41558
	Marguerite	33.75694	-118.41772
Reference	Ridges North	33.78697	-118.42065
	Rocky Point North	33.77966	-118.42739
	Point Vicente West	33.74073	-118.41283

Table B2. Fish Species Richness (total number of species).

SiteType	Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Reference	Point Vicente West	8	6	10	11	12	13	9	11	10	11	8	8	9	11
	Ridges North	6	11	7	6	5	10	5	12	8	7	5	3	8	2
	Rocky Point North	8	8	8	8	6	7	9	11	8	4	6	6	9	4
Restoration	Hawthorne	10	6	8	7	10	13	11	12	12	7	9	8	9	6
	Marguerite Central	6	10	10	9	10	10	7	9	11	9	11	12	5	10
	Underwater Arch Cove	6	9	6	12	7	8	11	9	9	8	8	8	8	4
	Honeymoon Cove	NA	2	4	8	5	12	7	8	8	5	5	6	2	7

Table B3. Density of kelp, understory algal species, and invertebrates (individuals per 100 meters squared).

			#/100 m^2 ± SE													
Species	Designation	Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Anthopleura sola	Restoration	Underwater Arch Cove	52.5 ± 5.8	115 ± 51.7	24.2 ± 10.8	18.3 ± 5	4.2 ± 2.5	29.6 ± 7.5	11.7 ± 10	2.1 ± 0.8	3.3 ± 2.4	—	0.83 ± 0.83	—	—	1.67 ± 0
		Honeymoon Cove	—	5 ± 1.7	—	1.7 ± 1.7	—	2.5 ± 1.6	—	0.8 ± 0.8	—	—	—	—	—	—
		Hawthorne	418.3 ± 408.3	43.3 ± 6.7	10 ± 8.3	1.7 ± 1.7	6.7 ± 5	4.2 ± 2.5	3.3 ± 3.3	8.3 ± 2.4	1.7 ± 1	—	0.83 ± 0.83	—	0.83 ± 0.83	0.83 ± 0.83
		Marguerite Central	79.17 ± 52.5	34.17 ± 20.8	85.83 ± 9.2	33.33 ± 10.	16.67 ± .0	36.67 ± 15.9	7.5 ± .8	—	—	—	—	1.7 ± 0	—	—
	Reference	Ridges North	—	1.7 ± 1.7	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	0.83 ± 0.83	—	—	—
		Point Vicente West	85.8 ± 4.2	155.8 ± 77.5	144.2 ± 44.2	198.3 ± 6.7	0.8 ± 0.8	5.8 ± 1.7	—	1.7 ± 1.2	0.4 ± 0.4	6.67 ± 5.0	—	2.5 ± 0.83	13.3 ± 6.67	14.17 ± 5.33
Aplysia californica	Restoration	Underwater Arch Cove	—	—	—	4.2 ± 2.5	—	0.4 ± 0.4	10.8 ± 7.5	—	0.4 ± 0.4	—	—	—	—	—
		Honeymoon Cove	—	0.8 ± 0.8	0.8 ± 0.8	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—
		Hawthorne	0.8 ± 0.8	—	0.8 ± 0.8	1.7 ± 1.7	—	2.5 ± 2.5	—	—	—	—	—	—	—	—
		Marguerite Central	4.17 ± 4.2	—	—	—	—	3.75 ± 2.7	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	0.8 ± 0.5	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Aplysia vaccaria	Restoration	Underwater Arch Cove	—	—	—	—	—	6.3 ± 4	—	0.8 ± 0.8	1.7 ± 1.7	—	2.5 ± 2.5	—	—	—
		Honeymoon Cove	—	—	—	0.8 ± 0.8	—	3.3 ± 1	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	5.8 ± 2.5	—	—	—	—	—	—	1.67 ± 1.67
		Marguerite Central	—	—	—	—	—	—	—	—	5.83 ± 5.8	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	1.3 ± 1.3	—	—	—	—	—	—	—	—
Arbacia incisa	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Centrostephanus coronatus	Restoration	Underwater Arch Cove	—	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	0.8 ± 0.8	—	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	2.08 ± 1.3	—	5.83 ± 5.8	.83 ± .8	.83 ± .8	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	0.4 ± 0.4	0.4 ± 0.4	1.67 ± .0	—	—	—	—
Crassadoma gigantea	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	2.5 ± 2.5	0.8 ± 0.5	1.7 ± 1.2	—	2.5 ± 0.8	—	0.83 ± 0.83	—
		Marguerite Central	.83 ± .8	—	—	—	—	—	.83 ± .8	1.67 ± 1.7	—	1.67 ± 1.7	6.67 ± 3.3	2.5 ± 2.5	0.83 ± 0.83	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	3.3 ± 1.7	—	0.4 ± 0.4	.83 ± .8	0.83 ± 0.8	0.83 ± 0.83	4.17 ± 2.5	3.33 ± 3.33
Desmarestia ligulata	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	1.7 ± 1.7	—	—	—	—	—	—	—
Egregia menziesii	Restoration	Underwater Arch Cove	—	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	1.3 ± 1.3	0.4 ± 0.4	—	—	—	—	—
		Hawthorne	3.3 ± 3.3	—	—	—	0.8 ± 0.8	—	—	1.3 ± 0.8	1.7 ± 1.7	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	15.0 ± 8.3	—	—	1.67 ± 1.7	—	—	—	20.83 ± 20.83
	Reference	Ridges North	—	—	—	26.7 ± 5	3.3 ± 1.7	2.5 ± 2.5	1.7 ± 0	8.8 ± 5.7	5 ± 2.3	2.5 ± .8	—	5.0 ± 5.0	10.83 ± 4.17	—
		Rocky Point North	—	—	5 ± 0	12.5 ± 5.8	29.2 ± 20.8	4.2 ± 2.5	6.7 ± 0	14.6 ± 5.2	12.5 ± 4.2	1.67 ± .0	—	3.3 ± 1.7	14.17 ± 9.17	—
		Point Vicente West	19.2 ± 12.5	13.3 ± 8.3	10 ± 10	3.3 ± 1.7	30 ± 5	15 ± 4.1	3.3 ± 0	26.3 ± 12.3	9.6 ± 4.9	—	4.2 ± 4.2	1.7 ± 1.7	—	—
Eisenia arborea	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—	—	0.83 ± 0.83	0.83 ± 0.83
		Hawthorne	9.2 ± 9.2	5.8 ± 5.8	—	0.8 ± 0.8	—	—	—	—	0.4 ± 0.4	—	—	—	—	—
		Marguerite Central	11.67 ± 11.7	3.33 ± 3.3	12.5 ± 5.8	—	—	2.08 ± 1.6	10.83 ± 9.2	2.5 ± 2.5	—	6.67 ± 6.7	—	4.2 ± 4.2	—	0.83 ± 0.83
	Reference	Ridges North	7.5 ± 4.2	1.7 ± 1.7	0.8 ± 0.8	1.7 ± 0	7.5 ± 0.8	110 ± 56.7	89.2 ± 7.5	132.5 ± 6	138.3 ± 28.4	108.33 ± 5.0	—	175 ± 48.3	178.33 ± 95	32.5 ± 5.83
		Rocky Point North	—	2.5 ± 2.5	18.3 ± 11.7	28.3 ± 6.7	21.7 ± 13.3	20 ± 5.1	55.8 ± 4.2	127.5 ± 12.1	134.2 ± 17.5	78.33 ± 15.	—	130 ± 35	120.83 ± 5.83	20.83 ± 20.83
		Point Vicente West	226.7 ± 80	253.3 ± 25	291.7 ± 8.3	39.2 ± 17.5	97.5 ± 15.8	95.4 ± 19.8	25.8 ± 9.2	39.2 ± 23.4	15 ± 6.8	8.33 ± 5.0	2.5 ± 2.5	20 ± 8.3	—	—
Felimida macfarlandi	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Flabellina iodinea	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	5.83 ± 4.'6
		Marguerite Central	—	—	—	—	—	—	—	—	3.33 ± 3.3	3.33 ± 3.3	—	14.2 ± 7.5	4.17 ± 2.5	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	2.5 ± 1.4	—	—	—	—	—
Haliotis corrugata	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	0.8 ± 0.5	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	5.83 ± 5.8	.83 ± .8	.83 ± .8	—	—	0.83 ± 0.83	—	—
	Reference	Ridges North	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Haliotis fulgens	Restoration	Underwater Arch Cove	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	0.83 ± 0.83	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	1.7 ± 1.7	—	—
	Reference	Ridges North	—	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	0.8 ± 0.8	0.4 ± 0.4	0.4 ± 0.4	—	—	0.83 ± 0.83	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	0.83 ± 0.83	—	—
Kelletia kelletii	Restoration	Underwater Arch Cove	1.7 ± 1.7	—	—	1.7 ± 0	—	3.3 ± 1.8	—	0.8 ± 0.8	1.7 ± 1.2	—	2.5 ± 2.5	5 ± 3.3	3.33 ± .0	5.83 ± 0.83
		Honeymoon Cove	2.5 ± 0.8	4.2 ± 0.8	—	2.5 ± 2.5	0.8 ± 0.8	—	0.8 ± 0.8	0.4 ± 0.4	0.8 ± 0.5	3.33 ± 1.7	—	7.5 ± 4.2	0.83 ± 0.83	15 ± 5
		Hawthorne	1.7 ± 1.7	2.5 ± 0.8	—	1.7 ± 1.7	—	—	—	1.3 ± 0.8	0.4 ± 0.4	.83 ± .8	0.83 ± 0.8	10 ± 5	—	27.5 ± 25.83
		Marguerite Central	13.33 ± 10.0	5.83 ± .8	1.67 ± 1.7	—	—	.83 ± .5	.83 ± .8	3.33 ± 1.7	3.33 ± .0	2.5 ± .8	6.7 ± 1.7	—	5 ± 3.33	—
	Reference	Ridges North	—	4.2 ± 0.8	0.8 ± 0.8	—	—	1.7 ± 0	—	—	0.4 ± 0.4	—	—	—	—	0.83 ± 0.83
		Rocky Point North	2.5 ± 2.5	4.2 ± 0.8	0.8 ± 0.8	0.8 ± 0.8	0.8 ± 0.8	—	—	—	0.4 ± 0.4	—	0.83 ± 0.8	—	—	—
		Point Vicente West	4.2 ± 4.2	3.3 ± 3.3	9.2 ± 0.8	2.5 ± 2.5	0.8 ± 0.8	0.4 ± 0.4	—	—	0.8 ± 0.5	.83 ± .8	—	—	0.83 ± 0.83	1.67 ± 1.67
Leptogorgia chilensis	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	0.83 ± 0.83	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—	—	—
Linckia columbiae	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	2.5 ± 2.5	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lytechinus pictus	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Macrocystis pyrifera	Restoration	Underwater Arch Cove	—	—	—	25 ± 0	45.8 ± 4.2	—	39.2 ± 5.8	95 ± 14.4	3.3 ± 2.3	37.5 ± .8	—	1.7 ± 0	—	60 ± 15

		Honeymoon Cove	1.7 ± 1.7	—	—	7.5 ± 7.5	118.3 ± 0	88.8 ± 40.4	110.8 ± 25.8	105.4 ± 11.3	150.4 ± 12.5	56.67 ± 1.7	—	48.3 ± 5	—	40.83 ± 0.83
		Hawthorne	3.3 ± 3.3	—	—	3.3 ± 3.3	56.7 ± 3.3	1.7 ± 1.7	158.3 ± 20	65.4 ± 7.7	30.8 ± 7.1	32.5 ± 10.8	—	50.8 ± 4.2	70.83 ± 12.5	109.17 ± 7.5
		Marguerite Central	—	—	—	10.0 ± 10.0	9.17 ± 4.2	25.0 ± 19.	95.0 ± 8.3	35.83 ± 2.5	130.0 ± 40.	38.33 ± 10.0	—	26.7 ± 5	—	140.83 ± 84.17
	Reference	Ridges North	67.5 ± 15.8	151.7 ± 13.3	69.2 ± 22.5	87.5 ± 4.2	37.5 ± 12.5	13.3 ± 3.3	78.3 ± 16.7	42.5 ± 6	117.9 ± 19.4	27.5 ± 2.5	—	20 ± 3.3	297.5 ± 29.17	240 ± 3.33
		Rocky Point North	110 ± 15	20 ± 3.3	76.7 ± 15	319.2 ± 169.2	27.5 ± 0.8	57.1 ± 35	54.2 ± 2.5	57.9 ± 7.9	87.5 ± 22.1	49.17 ± 2.5	—	25.8 ± 10.8	198.33 ± 5	105 ± 10
		Point Vicente West	28.3 ± 6.7	27.5 ± 10.8	12.5 ± 0.8	5.8 ± 2.5	13.3 ± 8.3	29.6 ± 19.7	69.2 ± 12.5	41.7 ± 7.6	105.8 ± 18.5	67.5 ± 7.5	—	52.5 ± 2.5	90 ± 3.33	58.33 ± 26.67
Macrocystis pyrifera Stipes	Restoration	Underwater Arch Cove	—	—	—	67.5 ± 2.5	183.3 ± 10	—	162.5 ± 42.5	303.8 ± 69.1	9.2 ± 6.5	166.67 ± 1.7	—	4.2 ± 0.83	604.2 ± 32.5	147.5 ± 45.83
		Honeymoon Cove	3.3 ± 3.3	—	—	25.8 ± 25.8	564.2 ± 15.8	312.5 ± 168	481.7 ± 75	680.8 ± 65	499.2 ± 47	666.67 ± 68.3	—	652.5 ± 127.5	1288 ± 71.67	236.67 ± 75
		Hawthorne	31.7 ± 31.7	—	—	6.7 ± 6.7	354.2 ± 25.8	6.7 ± 6.7	839.2 ± 232.5	612.1 ± 34.3	94.2 ± 22.6	152.5 ± 42.5	—	840 ± 117	93.25 ± 57.5	271.67 ± 6.67?
		Marguerite Central	—	—	—	28.3 ± 28.3	52.5 ± 30.8	96.67 ± 76.9	470.8 ± 137.5	335.8 ± 54.2	410.8 ± 182.5	607.5 ± 325.8	—	130 ± 56.7	236.7 ± 0	560 ± 411.67
	Reference	Ridges North	830.8 ± 315.8	590 ± 186.7	531.7 ± 70	280 ± 6.7	300 ± 55	32.5 ± 12.5	550 ± 191.7	506.3 ± 88.6	347.5 ± 61	338.33 ± 13.3	—	560 ± 112	465.8 ± 14.16	1612.5 ± 169.17
		Rocky Point North	1084.2 ± 107.5	235 ± 20	986.7 ± 196.7	1097.5 ± 619.2	157.5 ± 19.2	182.1 ± 120.5	544.2 ± 19.2	621.3 ± 131.9	315 ± 109.1	646.67 ± 38.3	—	468.3 ± 250	558.33 ± 110	786.67 ± 235.67
		Point Vicente West	449.2 ± 219.2	195 ± 36.7	136.7 ± 8.3	35 ± 18.3	159.2 ± 89.2	147.1 ± 112.5	585.8 ± 69.2	363.8 ± 59.9	388.3 ± 56.1	772.5 ± 109.2	—	1025 ± 195	—	448.33 ± 245.67
Megastraea undosa	Restoration	Underwater Arch Cove	—	—	—	0.8 ± 0.8	5 ± 5	31.3 ± 5.6	13.3 ± 13.3	66.3 ± 17.8	53.3 ± 14.7	24.17 ± 5.8	—	28.3 ± 8.3	21.67 ± 8.33	15.83 ± 4.17
		Honeymoon Cove	2.5 ± 0.8	—	0.8 ± 0.8	0.8 ± 0.8	9.2 ± 0.8	5 ± 3.9	26.7 ± 8.3	112.9 ± 24.5	15.4 ± 8.9	50.0 ± 1.7	—	125 ± 23.3	13.3 ± 1.67	41.67 ± 28.33
		Hawthorne	0.8 ± 0.8	—	—	0.8 ± 0.8	25 ± 25	15.8 ± 5.8	52.5 ± 9.2	99.2 ± 15	44.2 ± 8.3	11.67 ± 6.7	—	154.2 ± 40.8	45 ± 23.3	153.33 ± 101.67
		Marguerite Central	—	—	—	—	.83 ± .8	74.17 ± 32.9	50.83 ± 22.5	90.83 ± 32.5	57.5 ± 12.5	165.0 ± 96.7	—	80 ± 3.3	74.17 ± 4.17	12.5 ± 0.83
	Reference	Ridges North	15 ± 13.3	6.7 ± 0	6.7 ± 5	—	—	—	—	1.7 ± 1.2	1.3 ± 0.4	—	1.7 ± 1.7	2.5 ± 2.5	—	11.67 ± 8.33
		Rocky Point North	27.5 ± 9.2	25.8 ± 4.2	4.2 ± 0.8	0.8 ± 0.8	3.3 ± 0	1.3 ± 1.3	0.8 ± 0.8	2.1 ± 1.3	0.8 ± 0.5	.83 ± .8	0.83 ± 0.8	3.3 ± 3.3	—	4.17 ± 4.17
		Point Vicente West	—	—	0.8 ± 0.8	—	1.7 ± 0	0.8 ± 0.8	3.3 ± 1.7	5.4 ± 1.4	18.3 ± 5.6	47.5 ± 19.2	—	37.5 ± 20.8	89.17 ± 20.8	250 ± 193.33
Megathura crenulata	Restoration	Underwater Arch Cove	0.8 ± 0.8	2.5 ± 0.8	1.7 ± 1.7	0.8 ± 0.8	0.8 ± 0.8	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	1.7 ± 0	—	0.8 ± 0.8	—	0.8 ± 0.8	—	—	—	—	—	—	—	—
		Hawthorne	7.5 ± 0.8	5 ± 1.7	5 ± 1.7	3.3 ± 1.7	—	—	1.7 ± 1.7	—	—	—	—	—	1.7 ± 1.7	—
		Marguerite Central	1.67 ± 1.7	1.67 ± 1.7	1.67 ± 0.0	1.67 ± 1.7	.83 ± .8	2.08 ± 1.6	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—	8.33 ± 8.33
		Rocky Point North	—	2.5 ± 2.5	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	0.83 ± 0.83	—
		Point Vicente West	17.5 ± 2.5	6.7 ± 1.7	6.7 ± 5	8.3 ± 1.7	—	—	—	—	—	—	—	—	—	—
Muricea californica	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	.83 ± .83	0.83 ± 0.83	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	.83 ± .8	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	0.83 ± 0.83	0.83 ± 0.83
Neobernaya spadicea	Restoration	Underwater Arch Cove	1.7 ± 1.7	—	—	—	—	—	—	0.4 ± 0.4	0.4 ± 0.4	—	—	2.5 ± .83	—	—
		Honeymoon Cove	—	—	—	1.7 ± 1.7	—	0.8 ± 0.8	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	4.17 ± 4.17	—
		Marguerite Central	—	—	—	—	—	.42 ± .4	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	2.5 ± 2.5	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	0.4 ± 0.4	—	—	0.4 ± 0.4	—	—	—	—	—
Norrisia norrisi	Restoration	Underwater Arch Cove	0.8 ± 0.8	0.8 ± 0.8	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	2.5 ± 0.8	14.2 ± 12.5	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	—
		Point Vicente West	0.8 ± 0.8	2.5 ± 2.5	—	—	—	—	—	—	—	—	—	—	—	—
Octopus bimaculoides	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	0.4 ± 0.4	—	—	0.83 ± 0.8	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	0.8 ± 0.8	—	0.8 ± 0.5	—	—	0.83 ± 0.8	—	—	—
		Marguerite Central	—	—	—	—	.83 ± .8	—	.83 ± .8	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	0.8 ± 0.8	—	—	—	0.4 ± 0.4	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Okenia rosacea	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Panulirus interruptus	Restoration	Underwater Arch Cove	—	—	0.8 ± 0.8	—	—	0.4 ± 0.4	—	1.7 ± 1.2	0.4 ± 0.4	1.67 ± 1.7	—	0.83 ± 0.83	—	—
		Honeymoon Cove	—	—	—	—	—	0.8 ± 0.5	0.8 ± 0.8	0.4 ± 0.4	—	.83 ± .8	—	—	—	—
		Hawthorne	—	—	—	1.7 ± 1.7	—	8.3 ± 8.3	6.7 ± 5	1.7 ± 1.2	1.7 ± 1	2.5 ± .8	—	5.8 ± 5.8	—	1.67 ± 1.67
		Marguerite Central	—	—	—	—	4.2 ± 4.2	—	—	1.7 ± 1.7	—	4.17 ± 2.5	.83 ± .8	4.2 ± 2.5	—	—
	Reference	Ridges North	0.8 ± 0.8	1.7 ± 1.7	5.8 ± 5.8	0.8 ± 0.8	5 ± 5	3.3 ± 3.3	—	—	0.4 ± 0.4	—	6.7 ± 3.3	0.83 ± 0.83	—	—
		Rocky Point North	—	—	1.7 ± 1.7	2.5 ± 2.5	1.7 ± 0	—	—	—	0.4 ± 0.4	—	2.5 ± .8	1.7 ± 0	—	—
		Point Vicente West	2.5 ± 0.8	0.8 ± 0.8	1.7 ± 1.7	0.8 ± 0.8	5 ± 5	0.8 ± 0.8	5 ± 3.3	6.3 ± 4.1	3.3 ± 1.9	.83 ± .8	—	15 ± 3.3	—	8.33 ± 3.33
Parastichopus parvimensis	Restoration	Underwater Arch Cove	2.5 ± 0.8	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—	—
		Honeymoon Cove	0.8 ± 0.8	2.5 ± 0.8	1.7 ± 1.7	1.7 ± 1.7	—	—	—	—	—	—	—	—	—	—
		Hawthorne	0.8 ± 0.8	1.7 ± 0	2.5 ± 2.5	4.2 ± 2.5	—	—	0.8 ± 0.8	0.4 ± 0.4	—	.83 ± .8	—	—	—	—
		Marguerite Central	4.17 ± 2.5	5.83 ± 4.2	.83 ± .8	—	—	.42 ± .4	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	0.8 ± 0.8	1.7 ± 1.7	0.8 ± 0.8	—	—	—	—	0.4 ± 0.4	—	—	—	—	—
Patiria miniata	Restoration	Underwater Arch Cove	10.8 ± 2.5	21.7 ± 1.7	—	—	—	0.4 ± 0.4	—	0.4 ± 0.4	—	—	—	0.83 ± 0.83	2.5 ± 2.5	3.33 ± 1.67
		Honeymoon Cove	35 ± 10	8.3 ± 0	20 ± 5	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	1.7 ± 1.7	0.8 ± 0.8	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	1.7 ± 1.7	—
		Marguerite Central	1.67 ± 1.7	13.33 ± 6.7	.83 ± .8	—	—	—	—	—	—	—	—	—	0.83 ± 0.83	0.83 ± 0.83
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	0.8 ± 0.8	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—
Pisaster giganteus	Restoration	Underwater Arch Cove	6.7 ± 1.7	15.8 ± 2.5	—	—	—	—	—	—	—	—	—	5 ± 3.3	—	—
		Honeymoon Cove	6.7 ± 1.7	3.3 ± 0	1.7 ± 0	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	6.7 ± 0	6.7 ± 1.7	7.5 ± 4.2	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	29.17 ± 14.2	20.0 ± 1.7	26.67 ± 10.0	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	2.5 ± 0.8	4.2 ± 2.5	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	1.7 ± 1.7	—	1.7 ± 1.7	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	21.7 ± 8.3	8.3 ± 3.3	—	—	—	—	—	—	—	—	—	—	—	—
Pisaster ochraceus	Restoration	Underwater Arch Cove	20.8 ± 5.8	12.5 ± 2.5	1.7 ± 0	—	—	—	—	0.8 ± 0.5	—	—	—	3.3 ± 1.6	—	—
		Honeymoon Cove	9.2 ± 4.2	3.3 ± 1.7	1.7 ± 1.7	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	5 ± 1.7	9.2 ± 0.8	5 ± 0	—	—	0.8 ± 0.8	—	0.4 ± 0.4	—	—	—	—	—	—
		Marguerite Central	23.33 ± 6.7	8.33 ± 0.0	10.83 ± 5.8	.83 ± .8	—	—	—	.83 ± .8	—	—	—	0.83 ± 0.83	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	23.3 ± 6.7	8.3 ± 3.3	5 ± 1.7	—	—	—	—	—	—	—	—	—	—	—
Pterygophora californica	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	3.33 ± 3.33
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	0.83 ± 0.8	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	0.83 ± 0.8	—	1.7 ± 1.7	15.83 ± 5.83
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	111.7 ± 81.7	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	4.17 ± 4.17	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	0.83 ± 0.8	—	36.67 ± 16.67	11.67 ± 11.67
		Point Vicente West	—	—	0.8 ± 0.8	—	—	—	0.8 ± 0.8	—	—	—	—	—	6.67 ± 6.67	13.33 ± 6.67
Sargassum horneri	Restoration	Underwater Arch Cove	—	—	—	—	—	14.2 ± 14.2	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	45 ± 33.5	0.8 ± 0.8	3.3 ± 1.8	—	7.5 ± 7.5	—	—	—	—
		Hawthorne	—	—	—	—	164.2 ± 19.2	0.8 ± 0.8	—	—	—	—	13.3 ± 13.3	—	—	—
		Marguerite Central	—	—	—	—	118.33 ± 38.3	17.92 ± 11.3	—	7.5 ± 4.2	4.17 ± 2.5	—	—	1.7 ± 1.7	—	—
	Reference	Ridges North	—	—	—	—	—	27.5 ± 22.5	—	—	—	—	1.67 ± 1.6	—	—	—
		Rocky Point North	—	—	—	—	5 ± 1.7	46.7 ± 24.7	2.5 ± 2.5	—	2.5 ± 2	6.67 ± 5.0	41.67 ± 2.5	—	—	—
		Point Vicente West	—	—	—	—	—	1.3 ± 0.8	—	—	1.7 ± 1	—	—	—	—	3.33 ± 3.33
Sargassum muticum	Restoration	Underwater Arch Cove	—	—	—	—	—	6.3 ± 6.3	—	10.4 ± 8.3	0.4 ± 0.4	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	3.75 ± 2.8	—	—	.83 ± .8	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	5 ± 2.5	—	—	0.4 ± 0.4	.83 ± .8	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sargassum sp	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	—

		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Stephanocystis dioica	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	13.33 ± .0	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	73.8 ± 54.3	5.83 ± 4.2	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	3.33 ± 3.3	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	6.7 ± 3.6	—	—	—	—	—
Stephanocystis osmundacea	Restoration	Underwater Arch Cove	—	—	11.7 ± 1.7	10.8 ± 4.2	22.5 ± 22.5	0.4 ± 0.4	3.3 ± 3.3	9.2 ± 7	27.1 ± 10.1	—	—	20.8 ± 15.8	—	7.5 ± 2.5
		Honeymoon Cove	2.5 ± 2.5	—	—	—	0.8 ± 0.8	—	2.5 ± 2.5	8.8 ± 2.6	47.9 ± 6.1	20.83 ± 14.2	—	12.5 ± 5.8	—	34.17 ± 4.17
		Hawthorne	6.7 ± 6.7	3.3 ± 3.3	—	3.3 ± 1.7	9.2 ± 9.2	—	0.8 ± 0.8	9.6 ± 4.7	5.8 ± 2.9	2.5 ± .8	—	18.3 ± 15	—	0.83 ± 0.83
		Marguerite Central	—	.83 ± .8	—	—	—	80.83 ± 73.8	6.67 ± 1.7	4.17 ± 2.5	12.5 ± .8	3.33 ± 1.7	—	1.7 ± 0	—	—
	Reference	Ridges North	—	—	—	—	10 ± 8.3	40 ± 6.7	3.3 ± 1.7	7.1 ± 4.5	12.9 ± 4.4	—	—	1.7 ± 1.7	—	—
		Rocky Point North	—	—	—	2.5 ± 0.8	17.5 ± 17.5	21.7 ± 12.8	4.2 ± 0.8	10 ± 2.7	20 ± 5	—	2.5 ± 2.5	10.8 ± 5.8	—	—
		Point Vicente West	0.8 ± 0.8	—	—	—	1.7 ± 1.7	—	0.8 ± 0.8	6.7 ± 6.1	—	—	—	5 ± 3.3	—	—
Strongylocentrotus franciscanus	Restoration	Underwater Arch Cove	54.2 ± 17.5	33.3 ± 13.3	23.3 ± 18.3	42.5 ± 7.5	2.5 ± 0.8	1.3 ± 0.4	5.8 ± 0.8	10 ± 2.5	2.9 ± 1.4	2.5 ± 2.5	—	16.7 ± 8.3	—	—
		Honeymoon Cove	63.3 ± 1.7	44.2 ± 0.8	34.2 ± 4.2	11.7 ± 1.7	7.5 ± 2.5	1.3 ± 0.8	0.8 ± 0.8	2.1 ± 1	2.1 ± 0.8	3.33 ± .0	0.83 ± 0.8	19.2 ± 7.5	—	—
		Hawthorne	110.8 ± 85.8	106.7 ± 6.7	51.7 ± 0	37.5 ± 10.8	2.5 ± 0.8	0.8 ± 0.8	9.2 ± 4.2	6.7 ± 3.6	6.7 ± 5.6	1.67 ± .0	—	15 ± 1.7	—	—
		Marguerite Central	45.0 ± 16.7	58.3 ± 30.0	12.5 ± 0.8	8.3 ± 3.3	2.5 ± 2.5	1.25 ± .8	—	2.5 ± 0.8	3.3 ± 3.3	—	1.67 ± 0	8.3 ± 0	—	—
	Reference	Ridges North	2.5 ± 0.8	37.5 ± 37.5	7.5 ± 0.8	4.2 ± 0.8	0.8 ± 0.8	—	—	—	0.4 ± 0.4	.83 ± .8	—	—	—	—
		Rocky Point North	5 ± 5	9.2 ± 9.2	1.7 ± 1.7	0.8 ± 0.8	—	—	—	—	—	—	—	1.7 ± 1.7	—	—
		Point Vicente West	31.7 ± 10	55.8 ± 27.5	32.5 ± 4.2	26.7 ± 10	2.5 ± 0.8	2.1 ± 0.8	—	—	2.5 ± 1.4	1.67 ± .0	0.83 ± 0.8	—	—	—
Strongylocentrotus purpuratus	Restoration	Underwater Arch Cove	2195.8 ± 470.8	939.2 ± 349.2	1008.3 ± 465	24.2 ± 10.8	1.7 ± 0	2.1 ± 1.6	13.3 ± 5	299.6 ± 141.4	221.7 ± 115.4	177.5 ± 4.2	—	1075 ± 163.3	1678 ± 370.8	278.33 ± 215.67
		Honeymoon Cove	1541.7 ± 141.7	1222.5 ± 215.8	1223.3 ± 303.3	325 ± 298.3	9.2 ± 0.8	11.7 ± 7.7	6.7 ± 1.7	5 ± 1.5	13.3 ± 2.5	20.83 ± 19.2	20.8 ± 17.5	56.7 ± 1.7	8.3 ± 5	10.83 ± 7.5
		Hawthorne	2283.3 ± 1133.3	2812.5 ± 104.2	1100 ± 108.3	1113.3 ± 75	6.7 ± 5	6.7 ± 3.3	4.2 ± 2.5	68.3 ± 5.7	131.7 ± 83.1	33.33 ± 10.0	—	153.3 ± 85	465 ± 190	303.33 ± 23.33
		Marguerite Central	2450.0 ± 900.0	1920.83 ± 509.2	1499.2 ± 80.8	1705.8 ± 302.5	193.3 ± 50	112.92 ± 41.6	0.8 ± 0.8	9.17 ± 2.5	13.3 ± 3.3	24.17 ± 7.5	8.3 ± 1.7	48.3 ± 35	51.7 ± 3.33	161.67 ± 63.33
	Reference	Ridges North	16.7 ± 3.3	46.7 ± 45	49.2 ± 0.8	10.8 ± 5.8	0.8 ± 0.8	1.7 ± 0	—	—	0.8 ± 0.5	—	4.17 ± 0.8	8.3 ± 1.7	—	—
		Rocky Point North	15.8 ± 7.5	30.8 ± 12.5	10 ± 8.3	3.3 ± 0	5.8 ± 5.8	0.4 ± 0.4	0.8 ± 0.8	—	—	.83 ± .8	—	3.3 ± 1.7	—	—
		Point Vicente West	247.5 ± 75.8	491.7 ± 370	535.8 ± 47.5	185.8 ± 5.8	16.7 ± 5	15.8 ± 5.5	15 ± 3.3	2.9 ± 2	12.5 ± 5.9	11.67 ± 8.3	—	25 ± 6.7	2.5 ± 2.5	9.17 ± 2.5
Tegula regina	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	0.8 ± 0.8	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—	—	—
Tethya californiana	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	.42 ± .4	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—	0.83 ± 0.83
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—

Table B4. Fish Density (individuals per 100 meters squared).

Species	Designation	Site	#/100 m^2 ± SE													
			2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Anisotremus davidsonii	Restoration	Underwater Arch Cove	—	—	—	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	0.4 ± 0.3	2.5 ± 2.5	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	0.8 ± 0.8	5.8 ± 4.2	—	0.2 ± 0.2	0.2 ± 0.2	—	—	—	—	—
		Marguerite Central	—	—	—	—	27.9±20.9	.6±.6	1.3±1.3	—	—	.8±.8	—	8.75 ± 8.2	—	—
	Reference	Ridges North	—	—	—	—	—	0.4 ± 0.4	—	9.4 ± 6	0.2 ± 0.2	—	9.17 ± 8.1	—	—	—
		Rocky Point North	—	—	—	—	—	—	5.4 ± 4.9	8.8 ± 6	0.2 ± 0.2	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Atherinopsidae	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	54.6 ± 47.6	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	5.4±5.4	—	.4±.4	—	22.9±15.7	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	0.2 ± 0.2	—	—	—	—	—	—	—	—
Brachyistius frenatus	Restoration	Underwater Arch Cove	—	—	—	1.3 ± 1.3	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	0.8 ± 0.8	0.2 ± 0.2	—	—	0.8 ± 0.5	3.6 ± 2.2	1.25 ± 0.4	—
		Hawthorne	—	—	—	—	—	—	—	2.7 ± 1.5	—	—	1.25 ± 0.8	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	12.1±10.0	—	1.7±.7	7.5 ± 6.9	14.2 ± 2.4	—	—
	Reference	Ridges North	0.4 ± 0.4	0.4 ± 0.4	—	—	—	—	—	—	—	2.5±1.1	—	0.83 ± 0.83	0.4 ± 0.4	—
		Rocky Point North	1.7 ± 0.7	0.4 ± 0.4	0.8 ± 0.8	0.4 ± 0.4	—	—	0.4 ± 0.4	2.5 ± 0.8	0.2 ± 0.2	.4±.4	0.8 ± 0.5	—	—	—
		Point Vicente West	0.4 ± 0.4	2.5 ± 1.6	0.8 ± 0.5	—	14.2 ± 5.9	0.8 ± 0.8	33.8 ± 16.9	29.6 ± 17.9	—	.4±.4	44.6 ± 33.2	2.9 ± 2.0	—	—
Chromis punctipinnis	Restoration	Underwater Arch Cove	1.3 ± 1.3	1.3 ± 1.3	0.4 ± 0.4	2.1 ± 0.8	—	10.6 ± 5.6	2.5 ± 2.5	0.6 ± 0.3	0.4 ± 0.3	—	0.42 ± 0.4	—	—	—
		Honeymoon Cove	—	—	—	—	—	1.3 ± 1.3	—	—	—	—	—	—	—	—
		Hawthorne	0.4 ± 0.4	—	—	—	—	10.4 ± 10.4	—	—	0.4 ± 0.3	—	2.9 ± 2.9	—	—	0.08 ± 0.08
		Marguerite Central	.8±.8	—	6.3±5.2	—	—	—	—	—	20.4±18.3	—	41.7 ± 41.7	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	1.7±1.7	—	—	2.5 ± 2.5	—
		Rocky Point North	0.4 ± 0.4	—	—	—	—	—	—	0.4 ± 0.4	—		—	—	0.4 ± 0.4	—
		Point Vicente West	—	—	—	8.3 ± 5.5	—	12.7 ± 10.6	—	0.2 ± 0.2	1.7 ± 0.8	41.3±15.5	1.25 ± 0.8	—	—	0.03 ± 0.03
Damalichthys vacca	Restoration	Underwater Arch Cove	—	—	—	0.4 ± 0.4	—	—	—	0.2 ± 0.2	—	—	0.42 ± 0.4	—	—	—
		Honeymoon Cove	—	—	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—	—	—
		Marguerite Central	.8±.5	.8±.5	—	3.3±3.3	—	—	—	—	—	—	1.25 ± 1.25	—	—	—
	Reference	Ridges North	—	—	—	0.4 ± 0.4	—	—	—	—	—	.4±.4	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	0.8 ± 0.5	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—
Embiotoca jacksoni	Restoration	Underwater Arch Cove	2.9 ± 2.4	0.4 ± 0.4	0.4 ± 0.4	0.8 ± 0.8	0.8 ± 0.5	0.2 ± 0.2	0.4 ± 0.4	3.1 ± 0.7	0.6 ± 0.4	1.3±.4	0.8 ± 0.5	0.42 ± 0.42	—	
		Honeymoon Cove	—	0.4 ± 0.4	—	—	—	0.4 ± 0.3	—	1 ± 0.5	0.2 ± 0.2	.4±.4	0.4 ± 0.4	—	—	—
		Hawthorne	3.8 ± 0.4	2.5 ± 1.1	2.1 ± 0.4	2.9 ± 1.3	8.3 ± 8.3	1.3 ± 1.3	2.5 ± 1.1	—	2.9 ± 1.7	2.1±1.6	0.4 ± 0.4	0.42 ± 0.42	2.1±1	—
		Marguerite Central	.4±.4	2.1±.8	1.7±.7	2.1±1.3	1.3±.8	.8±.3	2.1±1.3	—	3.3±1.5	1.7±1.0	1.25 ± 0.4	6.3 ± 2.3	1.7±0.6	—
	Reference	Ridges North	0.4 ± 0.4	—	—	—	—	0.4 ± 0.4	—	0.4 ± 0.3	0.8 ± 0.5	—	—	0.42 ± 0.42	0.83 ± 1.7	—
		Rocky Point North	2.9 ± 1.4	3.8 ± 1.7	0.4 ± 0.4	0.8 ± 0.5	0.8 ± 0.5	1.7 ± 1.4	—	0.8 ± 0.4	0.6 ± 0.3	—	—	0.83 ± 0.83	—	—
		Point Vicente West	1.7 ± 0.7	0.4 ± 0.4	6.3 ± 0.8	2.5 ± 1.1	1.3 ± 0.8	1.7 ± 0.8	—	0.2 ± 0.2	1.9 ± 0.6	7.5±6.4	0.8 ± 0.5	7.1 ± 3.8	5 ± 1.7	0.03 ± 0.01
Gibbonsia elegans	Restoration	Underwater Arch Cove	—	—	—	—	—	—	0.4 ± 0.4	—	—	—		—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—		—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—		—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—		—	—	—
	Reference	Ridges North	—	0.4 ± 0.4	—	—	—	—	—	—	—	—		—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—		—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—		—	—	—
Girella nigricans	Restoration	Underwater Arch Cove	4.2 ± 3.6	0.4 ± 0.4	—	0.4 ± 0.4	—	0.2 ± 0.2	0.8 ± 0.5	0.8 ± 0.3	—	—	—	—	3.75±3.75	—
		Honeymoon Cove	—	—	—	—	0.8 ± 0.8	0.6 ± 0.4	—	—	—	—	—	—	—	—
		Hawthorne	2.1 ± 0.8	2.5 ± 1.6	0.8 ± 0.5	—	1.7 ± 1.7	0.4 ± 0.4	1.7 ± 1.2	—	1.9 ± 1.6	—	—	—	1.7±0.6	—
		Marguerite Central	—	1.7±1.7	—	.4±.4	20 ±13.1	18.5±8.1	.4±.4	.8±.8	3.8±1.7	1.3±1.3	15 ± 9.3	21.7 ± 17.2	0.4±0.4	0.07 ± 0.07
	Reference	Ridges North	—	—	—	—	—	—	—	0.4 ± 0.3	0.2 ± 0.2	—	—	—	1.3±0.4	—
		Rocky Point North	—	0.8 ± 0.8	—	1.7 ± 1	1.3 ± 0.8	2.1 ± 1.2	—	—	0.2 ± 0.2	—	—	—	5±3.3	—
		Point Vicente West	—	—	1.3 ± 0.8	1.7 ± 1.2	0.4 ± 0.4	0.8 ± 0.3	1.3 ± 0.8	0.8 ± 0.6	1.3 ± 0.5	2.1±1.3	—	—	11.7±4.6	0.12 ± 0.02
Gobiidae	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	2.9 ± 2.9	2.9 ± 2.9	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	4.2 ± 4.2	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	12.5 ± 8.8	—	—	—	—	—	—	—	—
Haemulon californiensis	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	7.7 ± 7.2	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	8.3 ± 8.3	224 ± 84.5	—	—	0.8 ± 0.5	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Halichoeres semicinctus	Restoration	Underwater Arch Cove	0.8 ± 0.5	—	0.4 ± 0.4	0.8 ± 0.8	2.1 ± 0.8	1.9 ± 0.7	16.3 ± 11.8	3.1 ± 1	1.7 ± 0.7	1.7±.7	—	0.42 ± 0.42	—	—
		Honeymoon Cove	—	—	—	2.9 ± 1.7	—	4.8 ± 0.7	6.7 ± 1.2	2.3 ± 0.9	4.4 ± 1.5	.8±.8	0.83 ± 0.5	—	—	0.01 ± 0.01
		Hawthorne	0.8 ± 0.8	—	—	—	3.3 ± 1.6	8.8 ± 4.2	16.7 ± 11	3.5 ± 0.8	4.4 ± 1.1	5.8±3.8	1.25 ± 0.8	2.1 ± 0.8	1.7± 1.2	—
		Marguerite Central	—	—	—	—	7.5±1.6	18.1±7.2	—	7.1±2.4	2.1±1.0	1.3±.4	1.6 ± 0.9	0.42 ± 0.42	—	—
	Reference	Ridges North	—	1.3 ± 0.8	1.3 ± 0.8	—	4.2 ± 0.5	2.1 ± 0.8	0.4 ± 0.4	0.6 ± 0.3	0.6 ± 0.3	1.3±.8	—	—	—	—
		Rocky Point North	2.1 ± 1.6	—	5 ± 2.4	0.4 ± 0.4	8.3 ± 2	1.9 ± 0.9	4.2 ± 1.6	2.5 ± 1.1	1 ± 0.6	—	0.42 ± 0.4	0.42 ± 0.42	—	—
		Point Vicente West	0.4 ± 0.4	—	0.4 ± 0.4	—	1.3 ± 0.4	3.3 ± 0.3	1.3 ± 0.4	1.3 ± 0.5	1.3 ± 0.5	3.8±1.3	—	0.42 ± 0.43	0.4 ± 0.4	—
Hermosilla azurea	Restoration	Underwater Arch Cove	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	1.3±.8	11.5±7.5	—	1.3±.8	—	—	—	9.6 ± 7.9	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	.4±.4	0.4 ± 0.4	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	0.4 ± 0.4	0.4 ± 0.3	0.8 ± 0.5	—	1.3 ± 0.8	.4±.4	—	—	—	—
Heterodontus francisci	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	0.2 ± 0.2	—	—	—	—	—
		Hawthorne	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	0.4 ± 0.4	—	0.2 ± 0.2	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	0.2 ± 0.2	—	—	0.2 ± 0.2	—	—	—	—	—
Heterostichus rostratus	Restoration	Underwater Arch Cove	—	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	0.42 ± 0.42	—	—
		Hawthorne	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	.4±.4	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	0.4 ± 0.4	—	—	—	—	0.4 ± 0.4	—	0.2 ± 0.2	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	0.2 ± 0.2	—	—	—	—	—	—
Hypsurus caryi	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	0.2 ± 0.2	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	1.7 ± 1.7	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	0.4 ± 0.4	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	0.83 ± 0.48	—	—
Hypsypops rubicundus	Restoration	Underwater Arch Cove	1.3 ± 0.8	0.8 ± 0.8	0.4 ± 0.4	3.3 ± 1.5	3.3 ± 1.9	3.8 ± 0.9	6.3 ± 3.8	4.8 ± 0.7	1.5 ± 0.7	2.5±1.1	1.2 ± 0.8	1.7 ± 0.7	1.7 ± 1	1.7 ± 1
		Honeymoon Cove	—	—	—	—	—	1.3 ± 0.8	0.8 ± 0.8	1.5 ± 0.6	0.2 ± 0.2	.4±.4	—	—	—	—
		Hawthorne	1.7 ± 0.7	2.9 ± 0.4	6.7 ± 0.7	4.6 ± 0.4	10.8 ± 2	18.8 ± 3.6	21.3 ± 8.8	6.7 ± 1.3	6.9 ± 1	6.3±2.1	5.4 ± 1.3	5.8 ± 1.1	6.3 ± 0.4	0.07 ± 0.01
		Marguerite Central	—	5.8±2.2	4.2±1.1	6.3±2.3	7.1±4.4	9.4±4.5	5.4±3.8	12.1±2.6	8.8±3.6	10.4±3.8	19.6 ± 8.1	9.6 ± 1.6	2.1 ± 0.8	2.1 ± 0.8
	Reference	Ridges North	—	0.4 ± 0.4	1.7 ± 1.7	1.7 ± 1.7	—	2.1 ± 0.4	0.8 ± 0.8	1.5 ± 0.7	1.5 ± 0.4	—	0.4 ± 0.4	—	0.4 ± 0.4	—
		Rocky Point North	1.7 ± 0.7	2.1 ± 1	1.7 ± 0.7	—	0.8 ± 0.5	0.8 ± 0.3	—	2.7 ± 1	1.7 ± 0.5	.8±.5	0.8 ± 0.8	0.83 ± 0.48	0.4 ± 0.4	—
		Point Vicente West	5 ± 1.7	2.1 ± 0.8	5.4 ± 1.8	7.9 ± 3	7.9 ± 2.3	5.4 ± 0.6	5 ± 1.7	4.8 ± 1.5	1.7 ± 0.7	8.8±3.2	2.1 ± 1	7.5 ± 2.5	1.7 ± 3.1	0.12 ± 0.03
Labrisomus xanti	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	0.4 ± 0.4	—	0.2 ± 0.2	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—

		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lythrypnus dalli	Restoration	Underwater Arch Cove	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Medialuna californiensis	Restoration	Underwater Arch Cove	—	—	—	—	2.5 ± 1.4	—	—	—	—	—	—	—	0.8 ± 0.8	—
		Honeymoon Cove	—	—	—	—	—	0.2 ± 0.2	—	—	—	—	—	—	—	—
		Hawthorne	0.4 ± 0.4	—	—	—	4.6 ± 2.3	1.3 ± 0.4	—	0.4 ± 0.3	0.2 ± 0.2	—	—	—	0.4 ± 0.4	—
		Marguerite Central	—	.4±.4	—	—	4.2±2.5	.2±.2	—	—	.8±.5	.4±.4	0.4 ± 0.4	0.42 ± 0.42	—	0.4 ± 0.4
	Reference	Ridges North	—	—	—	—	—	2.1 ± 1.3	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	0.6 ± 0.6	—	—	—	—	—	—	—	—
		Point Vicente West	0.4 ± 0.4	—	—	—	2.5 ± 0.8	1 ± 0.5	0.8 ± 0.8	—	—	.4±.4	—	—	—	—
Oxyjulis californica	Restoration	Underwater Arch Cove	—	0.4 ± 0.4	0.8 ± 0.8	1.7 ± 1.2	—	—	—	—	1 ± 0.8	1.7±1.7	2.1 ± 2.1	—	0.4 ± 0.4	—
		Honeymoon Cove	—	—	—	0.8 ± 0.8	2.9 ± 1.3	0.2 ± 0.2	12.1 ± 5.6	—	—	—	—	0.42 ± 0.42	—	1.6 ± 0.6
		Hawthorne	5 ± 3.4	1.3 ± 0.8	1.7 ± 1.2	2.1 ± 1.6	1.7 ± 0.7	2.9 ± 1	—	0.2 ± 0.2	0.6 ± 0.4	31.3±30.7	2.1 ± 1.2	0.42 ± 0.42	2.1 ± 0.4	2.1 ± 0.4
		Marguerite Central	—	.8±.8	2.9±1.8	3.8±2.2	5.4±4.9	1.5±.9	—	.4±.4	7.1±3.3	—	0.8 ± 0.8	13.3 ± 5.2	—	1.6 ± 1.6
	Reference	Ridges North	—	—	—	0.8 ± 0.8	—	—	—	0.2 ± 0.2	—	—	—	—	—	—
		Rocky Point North	0.4 ± 0.4	0.8 ± 0.5	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	0.8 ± 0.4	0.8 ± 0.4
		Point Vicente West	13.3 ± 6.7	2.1 ± 1	1.3 ± 0.4	23.3 ± 7.9	—	—	8.8 ± 8.2	—	0.6 ± 0.4	2.5±1.4	1.67 ± 1.2	1.3 ± 0.8	9.1 ± 3.2	2.1 ± 0.4
Oxylebius pictus	Restoration	Underwater Arch Cove	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	0.4 ± 0.4	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	0.4 ± 0.4	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	.4±.4	—	2.9±1.7	.4±.4	—	—	—	—	.4±.4	—	—	—	—	0.4 ± 0.4
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	0.4 ± 0.4	0.4 ± 0.4	—	1.3 ± 0.4	—	—	—	—	—	—	—	—	0.4 ± 0.4	0.4 ± 0.4
Paralabrax clathratus	Restoration	Underwater Arch Cove	—	0.4 ± 0.4	0.4 ± 0.4	6.7 ± 4.5	4.2 ± 2.2	3.8 ± 0.8	17.1 ± 8.3	5.6 ± 1.4	2.7 ± 0.7	3.8±1	5.4 ± 2.1	1.3 ± 0.42	2.1 ± 1	0.4 ± 0.4
		Honeymoon Cove	—	—	0.8 ± 0.5	1.3 ± 0.4	0.8 ± 0.8	1.3 ± 0.4	4.2 ± 3.6	1.9 ± 0.6	1.5 ± 0.7	2.9±1.4	0.83 ± 0.8	—	—	0.8 ± 0.4
		Hawthorne	—	—	0.8 ± 0.5	0.8 ± 0.5	0.8 ± 0.5	5.4 ± 1.3	6.7 ± 3.2	3.8 ± 0.4	1.3 ± 0.5	.4±.4	4.2 ± 0.8	1.3 ± 0.8	0.8 ± 0.5	1.2 ± 1.2
		Marguerite Central	—	1.3 ± 1.3	1.7 ± 1.2	3.3 ± 0.7	5.0 ± 3.0	7.1 ± 3.8	11.3 ± 0.8	9.2 ± 1.0	6.7 ± 0.7	2.9±1.3	3.8 ± 0.8	2.9 ± 1.7	0.4 ± 0.4	2.9 ± 1.4
	Reference	Ridges North	2.9 ± 0.8	0.4 ± 0.4	2.1 ± 0.4	2.9 ± 0.8	2.9 ± 1.4	1.7 ± 1.2	1.7 ± 1.2	4.6 ± 1.2	—	.4±.4	0.8 ± 0.5	0.42 ± 0.42	0.8 ± 0.5	1.6 ± 0.6
		Rocky Point North	1.7 ± 0.7	2.5 ± 1.4	6.7 ± 1.9	2.1 ± 0.8	4.2 ± 1.6	1.5 ± 0.8	2.5 ± 1.6	2.7 ± 0.5	0.4 ± 0.3	1.7±.7	0.8 ± 0.5	2.1 ± 0.42	0.8 ± 0.5	2.0 ± 0.1
		Point Vicente West	—	—	0.8 ± 0.5	—	2.9 ± 0.4	2.9 ± 1.1	7.5 ± 1.1	5.2 ± 1.2	1.9 ± 0.5	7.5±2.0	1.7 ± 0.5	3.3 ± 1.2	3.3 ± 1.6	0.4 ± 0.4
Paralabrax maculatofasciatus	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	0.4 ± 0.4	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Paralabrax nebulifer	Restoration	Underwater Arch Cove	—	—	—	1.3 ± 0.8	—	0.4 ± 0.3	1.3 ± 0.8	0.2 ± 0.2	0.4 ± 0.4	.4±.4	2.5 ± 1.6	1.3 ± 0.42	0.4 ± 0.4	0.4 ± 0.4
		Honeymoon Cove	—	—	—	0.8 ± 0.5	—	—	—	1.5 ± 0.6	0.2 ± 0.2	.4±.4	0.8 ± 0.8	0.42 ± 0.42	0.4 ± 0.4	—
		Hawthorne	—	0.4 ± 0.4	—	0.8 ± 0.5	—	0.4 ± 0.4	2.1 ± 0.8	0.6 ± 0.4	0.4 ± 0.3	.4±.4	—	0.42 ± 0.43	—	—
		Marguerite Central	.4±.4	—	.4±.4	1.3±.8	—	1.5±.7	.8±.5	—	.8±.8	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	0.4 ± 0.3	—	—	0.4 ± 0.4	—	—	—
Rhacochilus toxotes	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	.4±.4	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—	—
Rhinogobiops nicholsii	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	1.3 ± 0.8	1.3 ± 0.8	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	.4±.4	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Scomber japonicus	Restoration	Underwater Arch Cove	—	—	—	—	4.2 ± 4.2	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sebastes atrovirens	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	0.4 ± 0.4	—	0.2 ± 0.2	—	—	—	—	—	—	—	—
Sebastes auriculatus	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sebastes carnatus	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—
Sebastes chrysomelas	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	0.8 ± 0.5	—	—	—	—	—	—	—	—	—	—
Sebastes rastrelliger	Restoration	Underwater Arch Cove	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—	—
Sebastes serranoides	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	0.2 ± 0.2	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Semicossyphus pulcher	Restoration	Underwater Arch Cove	0.4 ± 0.4	1.3 ± 0.4	—	0.4 ± 0.4	—	1.9 ± 1	1.7 ± 1.7	2.3 ± 0.6	0.6 ± 0.4	.8±.5	0.83 ± 0.8	1.7 ± 0.7	1.7 ± 0.7	—
		Honeymoon Cove	—	—	—	—	0.4 ± 0.4	0.6 ± 0.4	—	0.8 ± 0.4	0.2 ± 0.2	—	—	—	—	—
		Hawthorne	1.7 ± 0.7	—	—	—	0.4 ± 0.4	3.3 ± 0.7	2.5 ± 1.1	1.3 ± 0.5	0.8 ± 0.3	1.3±.4	0.4 ± 0.4	0.83 ± 0.83	1.7 ± 0.7	5.0 ± 1.7
		Marguerite Central	0.4 ± 0.4	0.4 ± 0.4	—	0.8 ± 0.5	—	2.9 ± 1.8	0.8 ± 0.5	1.3 ± 0.4	2.9 ± 1.7	1.7±1.2	2.5 ± 0.5	0.42 ± 0.42	1.3 ± 0.8	2.5 ± 1.1
	Reference	Ridges North	0.4 ± 0.4	0.8 ± 0.8	1.3 ± 0.8	0.4 ± 0.4	0.4 ± 0.4	0.4 ± 0.4	0.4 ± 0.4	0.6 ± 0.3	0.6 ± 0.4	.4±.4	—	—	0.4 ± 0.4	—
		Rocky Point North	0.8 ± 0.8	1.7 ± 0.7	3.8 ± 0.4	0.4 ± 0.4	0.4 ± 0.4	0.6 ± 0.4	—	0.2 ± 0.2	0.6 ± 0.4	.4±.4	0.4 ± 0.4	0.42 ± 0.42	1.3±.4	0.8 ± 0.4
		Point Vicente West	0.4 ± 0.4	—	—	1.3 ± 0.8	0.8 ± 0.5	1.9 ± 0.8	0.4 ± 0.4	1.3 ± 0.5	1.9 ± 0.8	2.5±.5	2.5 ± 1.1	1.3 ± 0.42	0.4 ± 1	3.75 ± 2.19

Syngnathus californiensis	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	0.4 ± 0.4	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Urobatis halleri	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	0.2 ± 0.2	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	0.2 ± 0.2	—	—	—	—	—	—

Table B5. Fish Biomass (individuals per 100 meters squared).

g/100 m² ± SE

Species	Designation	Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2025	2026
Anisotremus davidsonii	Restoration	Underwater Arch Cove	—	—	—	—	50.5 ± 50.5	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	19.9 ± 13	119.4 ± 119.4	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	101 ± 101	115.7 ± 126.8	—	10 ± 10	7.8 ± 7.8	—	—	—	—	—
		Marguerite Central	—	—	—	—	11117.8±6614	—	25.8±25.8	—	—	235.5±235.5	—	2855.67 ± 2502.44	—	—
	Reference	Ridges North	—	—	—	—	—	5.3 ± 5.3	—	502.2 ± 301.3	18 ± 18	—	1272 ± 1115	—	—	—
		Rocky Point North	—	—	—	—	—	—	1166.1 ± 1127.7	873.8 ± 821	6.8 ± 6.8	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Atherinopsidae	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	998.2 ± 980.8	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	130.2±130.2	78.8±78.8	96.8±96.8	—	388.8±378.1	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	4.1 ± 4.1	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	12.7 ± 12.7	—	—	—	8±8	—	—	—	—
Brachyistius frenatus	Restoration	Underwater Arch Cove	—	—	—	31.9 ± 31.9	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	3.6 ± 2.2	5.3 ± 5.3	—	—	10.4 ± 15.8	21.86 ± 15.29	—	1.7 ± 1.7
		Hawthorne	—	—	—	—	—	—	—	15.1 ± 9.7	—	—	18.6 ± 12	0.36 ± 0.36	11 ± 5.7	—
		Marguerite Central	—	—	—	—	—	—	—	57.4±47.3	—	8.2±4.2	64.8±51.3	162.67 ± 57.12	—	—
	Reference	Ridges North	5.1 ± 6.1	5 ± 6	—	—	—	—	—	—	—	178.4±134.2	—	25.5 ± 25.5	4.3 ± 4.3	—
		Rocky Point North	40.9 ± 15.5	13.7 ± 13.7	12.4 ± 12.4	10.6 ± 10.6	—	—	1.2 ± 1.2	19.6 ± 4.2	1 ± 1	8 ± 6.0	14 ± 5.3	5.97 ± 4.38	1.2 ± 0.8	—
		Point Vicente West	10.6 ± 10.6	20.8 ± 17.1	11 ± 7.6	—	135.3 ± 62.5	29.3 ± 29.3	217.8 ± 120.9	177.8 ± 107.7	—	8.1±6.1	261.3 ± 205	59.48 ± 59.25	—	—
Chromis punctipinnis	Restoration	Underwater Arch Cove	60.3 ± 60.3	39.1 ± 39.1	13 ± 13	79.7 ± 39.7	8.6 ± 8.6	248.6 ± 138.6	120.6 ± 120.6	28.2 ± 13	16.6 ± 11.2	—	10.2 ± 10.2	—	—	118.13 ± 118.13
		Honeymoon Cove	—	—	—	—	—	49.4 ± 49.4	—	—	—	—	—	—	—	1.7 ± 1.7
		Hawthorne	20.1 ± 20.1	—	8 ± 5.7	—	27.3 ± 27.3	262.9 ± 247.7	5.1 ± 5.1	—	13.3 ± 8	—	64.4 ± 64.4	—	57.9 ± 51.3	159.11 ± 156.67
		Marguerite Central	20.5±20.5	3.8±3.8	194.9±193.7	—	—	—	—	—	604.4±601.5	—	1305 ± 1305	30.83 ± 23.17	—	4.73 ± 4.73
	Reference	Ridges North	—	—	—	—	—	37.3 ± 33.2	—	—	—	88.4±88.8	—	—	8831.7 ± 7888	—
		Rocky Point North	10.2 ± 10.2	—	—	—	—	—	—	19.2 ± 10.2	—	—	—	—	17.4 ± 9.6	—
		Point Vicente West	—	—	75.4 ± 75.4	280.4 ± 195.3	9.4 ± 7.4	373.9 ± 349.4	—	3 ± 3	44.7 ± 25.2	1048.5±498.5	54.8 ± 42.2	—	—	48.82 ± 17.55
Damalichthys vacca	Restoration	Underwater Arch Cove	—	—	—	56.6 ± 56.6	—	—	—	28.3 ± 28.3	—	—	24.3 ± 24.3	—	—	—
		Honeymoon Cove	—	—	—	86.6 ± 86.6	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	56.8 ± 56.8	—	—	—	—	—	—	—
		Marguerite Central	113.2±65.4	106.9±952.4	—	810.8±810.8	—	—	—	—	—	—	658.7 ± 658.7	—	—	—
	Reference	Ridges North	—	—	—	56.6 ± 56.6	—	—	—	—	—	12.6±12.6	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	165.4 ± 105.8	—	109 ± 109	—	—	—	—	—	—	—	—	—	—
Embiotoca jacksoni	Restoration	Underwater Arch Cove	450.2 ± 371.9	14.7 ± 14.7	24.2 ± 24.2	83.8 ± 83.8	42.5 ± 27.8	4.3 ± 4.3	24.2 ± 24.2	270.2 ± 48.4	24.3 ± 17.4	105.1±45.3	44.9 ± 20.8	14.77 ± 14.77	—	—
		Honeymoon Cove	—	64.7 ± 64.7	—	2.7 ± 2.7	—	16.2 ± 13	6.3 ± 5.1	66.2 ± 41.6	27.2 ± 27.2	45.2±45.2	70.5 ± 65.2	0.86 ± 0.86	—	—
		Hawthorne	173.3 ± 46.6	91.6 ± 34.1	266.2 ± 116.2	216.9 ± 136.7	1256.8 ± 1256.8	88.8 ± 88.8	126.8 ± 60.3	3.8 ± 0.8	282.4 ± 216.1	206 ± 177.8	40.2 ± 40.2	11.2 ± 11.2	128.4 ± 68.8	—
		Marguerite Central	24.2±24.2	102.6±113.1	251.4±114.7	151.2±102	136.1±130.3	59.6±52.2	97.1±52.9	2.7±2.7	294±65.8	218.9±128.2	100.2 ± 54.3	621.4 ± 309.88	156 ± 58.6	—
	Reference	Ridges North	26.8 ± 20.4	1.7 ± 1.7	—	—	—	64.7 ± 64.7	—	13 ± 8.6	111.8 ± 80	—	—	24.21 ± 24.21	76.1 ± 62	—
		Rocky Point North	313.2 ± 179	360.8 ± 150.2	138.3 ± 138.3	83.8 ± 61.1	40.2 ± 25.3	55.1 ± 51.8	—	61.1 ± 40.8	38.5 ± 23.4	—	—	65.84 ± 65.84	0.4 ± 0.2	—
		Point Vicente West	79.4 ± 43.8	64.7 ± 64.7	671.7 ± 183.7	476.8 ± 160.9	79.8 ± 61.6	107.5 ± 58.3	—	71.3 ± 70.4	158.8 ± 60.6	1471.8±897.5	32.6 ± 22.6	490.89 ± 172.64	950.8 ± 540.3	—
Gibbonsia elegans	Restoration	Underwater Arch Cove	—	—	—	—	—	—	5.8 ± 5.8	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	4680.3±3168.8	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	5.5 ± 5.5	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Girella nigricans	Restoration	Underwater Arch Cove	255.7 ± 251.1	16.9 ± 16.9	—	26.1 ± 26.1	—	61.8 ± 61.8	52.2 ± 30.1	42.6 ± 16.5	—	—	—	4.07 ± 4.07	225.7 ± 225.7	—
		Honeymoon Cove	—	—	—	—	166.6 ± 166.6	27.7 ± 21.2	—	—	—	—	—	—	—	—
		Hawthorne	338.1 ± 117.7	100.7 ± 59.3	186.6 ± 118.7	—	663.9 ± 663.9	218 ± 218	901.4 ± 649.3	—	272.7 ± 249.7	—	—	—	105.7 ± 52.1	—
		Marguerite Central	—	238.8±238.8	—	62.7±62.7	1161.6±966.6	—	97.7±62.7	125.8±125.8	488.4±329.7	374.8±374.8	1038.4 ± 3218	3944.42 ± 2718.33	37.4 ± 31.4	1729.07 ± 1729.07
	Reference	Ridges North	—	3.6 ± 3.6	—	—	—	—	—	31.8 ± 14.9	31.4 ± 31.4	—	—	—	479.1 ± 431.9	—
		Rocky Point North	—	125.5 ± 125.5	—	434.3 ± 265.7	465.7 ± 289	340.4 ± 185.2	—	—	25.8 ± 25.8	—	—	—	1029.3 ± 530.5	—
		Point Vicente West	—	—	460.7 ± 259	771.8 ± 534.9	62.7 ± 62.7	181.3 ± 104.8	777.5 ± 500.2	119.4 ± 79.2	771.2 ± 350.4	718.2±425.8	—	—	2302.2 ± 1427.4	3424.16 ± 481.09
Gobiidae	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	0.12 ± 0.12	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	5.6 ± 5.6	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	0.9 ± 0.5	—	—	—	—	—	—	—	—
Haemulon californiensis	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	72 ± 67.5	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	166.2 ± 166.2	4906.8 ± 1887.8	—	—	16.2 ± 8.3	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Halichoeres semicinctus	Restoration	Underwater Arch Cove	70 ± 48.4	—	85 ± 35	46.4 ± 46.4	65.2 ± 21	60.5 ± 40	1129.7 ± 774.4	150.4 ± 50.5	154.2 ± 75.5	114.4±55.9	—	17.33 ± 17.33	—	—
		Honeymoon Cove	—	—	—	128 ± 78.7	5.1 ± 3.8	151.5 ± 92.8	1100.6 ± 328.8	129.2 ± 51.9	178.4 ± 60.7	29.9±29.9	58.2 ± 28	—	—	11.89 ± 11.89
		Hawthorne	78 ± 70	—	—	—	110.8 ± 63.1	308.8 ± 133.4	829.8 ± 438.8	176.8 ± 45.1	278.9 ± 73.7	383.9±200	81.1 ± 47.7	177.29 ± 73.84	168 ± 96.9	24.81 ± 24.81
		Marguerite Central	—	—	—	—	221.3±59.4	109.2±586.8	—	547.9±858.5	184 ± 83.2	114.8±59.2	86.8 ± 58	20.88 ± 29.88	—	—
	Reference	Ridges North	—	17.5 ± 10.7	76.1 ± 44.7	4.2 ± 2.7	55.5 ± 17.9	44.3 ± 20.8	11.3 ± 11.3	8.8 ± 4.5	45.5 ± 23.9	135.7±87.9	—	—	—	—
		Rocky Point North	154.2 ± 136	—	99.9 ± 55.4	35 ± 35	188.3 ± 40.9	52.8 ± 35.8	473.9 ± 178.3	82.5 ± 40.1	73 ± 47.1	—	5.3 ± 5.3	22.82 ± 20.42	1.3 ± 1.3	—
		Point Vicente West	38 ± 35	—	38 ± 38	—	37.2 ± 13.3	163.1 ± 56.6	138 ± 38	90.2 ± 38.4	98.8 ± 42.7	228.6±71.4	—	38.38 ± 38.38	47.4 ± 47.4	12.19 ± 12.19
Hermosilla azurea	Restoration	Underwater Arch Cove	—	—	—	—	—	—	73.1 ± 73.1	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	480.1±480.1	874.6±822	—	488.7±386.4	—	—	—	1896.18 ± 829.97	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	14.2±14.2	151.2 ± 151.2	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	149.6 ± 149.6	208.9 ± 149.9	1114.4 ± 871.4	—	292.4 ± 195.2	149.6±149.6	—	—	—	312.43 ± 152.57
Heterodontus francisci	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	711.6 ± 711.6	—	—	10.48 ± 10.48	—	—
		Hawthorne	1423.2 ± 1423.2	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	1423.2 ± 1423.2	—	1316.8 ± 1316.8	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	980.8 ± 980.8	—	—	711.6 ± 711.6	—	—	—	—	—
Heterostichus rostratus	Restoration	Underwater Arch Cove	—	—	—	—	—	—	40.4 ± 40.4	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	10.48 ± 10.48	—	—
		Hawthorne	—	—	—	—	—	8.5 ± 8.5	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	8.5±8.5	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	21.3 ± 21.3	1.1 ± 1.1	—	—	—	43.4 ± 43.4	0.1 ± 0.1	2.1 ± 2.1	0.2 ± 0.2	—	—	—	—	—
		Rocky Point North	—	—	—	1.2 ± 1.2	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	1.7 ± 1.7	—	—	3.4 ± 3.4	—	—	—	—	—	9.15 ± 9.15
Hypsurus caryi	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	6.6 ± 6.6	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	168 ± 168	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	47.4 ± 47.4	—	—	—	39.4 ± 39.4	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	17.65 ± 10.37	—	—
Hypsypops rubicundus	Restoration	Underwater Arch Cove	241.3 ± 143.3	141.1 ± 141.1	41 ± 41	745.2 ± 565.5	571 ± 412	600.5 ± 291.9	1925.8 ± 1252.2	1151 ± 384.5	347.9 ± 151.9	587.6±257.9	114.2 ± 125.7	95.67 ± 40.52	193.2 ± 119.3	211.83 ± 71.61
		Honeymoon Cove	—	—	—	—	—	195.4 ± 90.7	300.7 ± 300.7	209.3 ± 102.8	16.5 ± 16.5	41±41	—	—	—	—
		Hawthorne	223 ± 128.2	348.8 ± 82.5	1628.2 ± 214.7	1160 ± 388	3898.8 ± 678.1	3418.2 ± 966.5	3458.8 ± 2321.4	852.6 ± 265.3	1211.4 ± 218.7	1836.8±781.1	1008.8 ± 118.7	1114.62 ± 286	1083.6 ± 168.4	663.73 ± 123.68
		Marguerite Central	—	1656.8±797.8	1128.9±283.9	2026.8±840.8	1991.7±1318.8	2068.6±1668.8	1188.7±863.3	4016.6±1087	2608.8±1097.8	2984.6±1107.2	4086.1 ± 2333	2310.94 ± 658.81	282.8 ± 91.8	1888.28 ± 783.84
	Reference	Ridges North	—	20.5 ± 20.5	271.4 ± 271.4	465.5 ± 395.8	0.1 ± 0.1	297.9 ± 115.7	300.7 ± 300.7	81.5 ± 54.1	222.4 ± 55.9	—	41 ± 41	—	100.4 ± 100.4	52.81 ± 52.81
		Rocky Point North	400.7 ± 160.6	427 ± 272	891.9 ± 483.1	—	38.2 ± 16.5	236.4 ± 74.2	—	550.4 ± 318.7	347 ± 137	251.3±145.9	141.3 ± 141.3	91.19 ± 50.17	50.2 ± 50.2	31.60 ± 31.60
		Point Vicente West	1800.1 ± 827.1	881.8 ± 396	1663.9 ± 644.3	3197.1 ± 1226	2469.2 ± 788.1	1600.1 ± 1104	1467.3 ± 688.8	1403.4 ± 673.7	867.8 ± 372.6	4081.6±1238.8	277.8 ± 126.7	1677.28 ± 866.24	8413.1 ± 1507.8	1863.93 ± 718.48
Labrisomus xanti	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	16.7 ± 16.7	—	6.8 ± 6.8	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lythrypnus dalli	Restoration	Underwater Arch Cove	—	6.7 ± 6.7	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Medialuna californiensis	Restoration	Underwater Arch Cove	—	—	—	—	239.2 ± 186.7	—	—	—	—	—	—	—	49.8 ± 49.8	—
		Honeymoon Cove	—	—	—	—	—	12.4 ± 12.4	—	—	—	—	—	—	—	—
		Hawthorne	58.3 ± 55.5	—	—	—	645 ± 483.7	74.5 ± 34.9	—	29.8 ± 15.9	29.2 ± 29.2	—	—	—	58.5 ± 58.5	—
		Marguerite Central	—	24.9±24.9	—	—	404.5±249.8	97.6±97.8	—	—	20.6±19.8	16.3±10.3	30.1 ± 30.1	42.76 ± 42.76	—	46.42 ± 46.42
	Reference	Ridges North	—	—	—	—	—	102.4 ± 59.2	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	30.7 ± 30.7	—	—	—	—	—	—	—	—
		Point Vicente West	11.9 ± 11.9	—	—	—	98.2 ± 18.6	94.3 ± 47.4	171.3 ± 171.3	—	—	16.3±16.3	—	—	—	—
Oxyjulis californica	Restoration	Underwater Arch Cove	—	14.1 ± 14.1	10.9 ± 10.9	231.3 ± 195.2	—	—	—	—	65 ± 62.8	313.1±313.1	128.2 ± 124.8	0.34 ± 0.34	12.8 ± 8.4	12.8 ± 8.4
		Honeymoon Cove	—	—	26.1 ± 26.1	20.2 ± 20.2	57 ± 18.6	7.1 ± 5.6	536.3 ± 528.8	—	9.6 ± 8	41±41	—	11.37 ± 11.37	—	23.97 ± 5.85
		Hawthorne	142.7 ± 98.1	30.3 ± 21.1	40.6 ± 31.9	43.6 ± 46.6	140.1 ± 87.3	137.1 ± 83.1	11.6 ± 11.6	5.7 ± 5.7	28.1 ± 15.8	488.4±482.5	86.3 ± 61.1	38.73 ± 29.47	42.7 ± 10.8	308.21 ± 158.48
		Marguerite Central	—	28.2±28.2	63.1±36.6	147.8±76.6	287.8±250.5	57.1±35.2	—	15.4±15.4	547.2±157.1	—	25.1 ± 25.1	601.86 ± 308.8	—	29.46 ± 29.46
	Reference	Ridges North	—	0.4 ± 0.4	1.3 ± 1.3	10.6 ± 10.6	1.4 ± 1.2	—	—	7.1 ± 7.1	—	—	—	—	—	—
		Rocky Point North	3.9 ± 3.9	31.1 ± 13.5	—	11.4 ± 5.3	—	—	1.3 ± 1.3	—	—	—	—	—	21.2 ± 13.8	16.83 ± 8.41
		Point Vicente West	862.9 ± 609.9	61.3 ± 42.8	181.6 ± 76.1	793.9 ± 289.7	9.2 ± 2.6	—	86.4 ± 71.9	—	40 ± 28.5	109.1±68.2	79.3 ± 62	40.27 ± 30.48	458.3 ± 168.8	38.87 ± 16.61
Oxylebius pictus	Restoration	Underwater Arch Cove	—	14.9 ± 14.9	—	—	—	—	—	—	—	—	—	—	2.2 ± 2.2	—
		Honeymoon Cove	—	18.7 ± 18.7	—	18.7 ± 18.7	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	18.7 ± 18.7	38.1 ± 38.1	—	—	2.2 ± 2.2	—	—	—	—	—	—	—
		Marguerite Central	23.2±23.2	—	163.8±86.6	23.2±23.2	—	—	—	—	14.9±14.9	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	3.99 ± 3.99
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	23.2 ± 23.2	23.2 ± 23.2	—	48 ± 17.7	—	—	—	—	—	—	—	—	14.9 ± 14.9	8.3 ± 8.3
Paralabrax clathratus	Restoration	Underwater Arch Cove	—	17.7 ± 17.7	42.3 ± 42.3	692.8 ± 465.5	352.9 ± 316.9	228.6 ± 76.4	1075.2 ± 684.4	602.7 ± 151.7	858.4 ± 128.8	616.2±127.7	107.6 ± 151.6	30.88 ± 17.98	127.4 ± 73.4	64.09 ± 64.09
		Honeymoon Cove	—	—	22.6 ± 16.7	232.6 ± 137.8	62.8 ± 59.1	63.7 ± 22.2	630.7 ± 609.9	164 ± 51.1	158.5 ± 68.4	387±176	10.5 ± 10.5	5.74 ± 5.74	—	51.55 ± 53.38
		Hawthorne	—	—	11.9 ± 18.4	35.3 ± 35.4	97.5 ± 78.5	460.2 ± 115.5	681.7 ± 288.2	391.7 ± 78.1	133.8 ± 76.4	38.2±30.2	117.5 ± 350.7	314.48 ± 182.73	39.5 ± 20.4	197.23 ± 197.23
		Marguerite Central	—	310.6 ± 310.6	373.1 ± 318.2	480.7 ± 182.3	615.8 ± 285.3	1220.7 ± 472.8	2009.3 ± 303.8	2326.8 ± 1177.2	1135.8 ± 192.8	320.8±115.3	1017.3 ± 197.7	1368.28 ± 664.64	11.8 ± 11.8	423.38 ± 268.23
	Reference	Ridges North	286.8 ± 86.6	10.4 ± 8.6	83.6 ± 49.5	169.7 ± 86.7	116.8 ± 72.8	66 ± 66.6	79.4 ± 47.8	390.1 ± 107.9	—	28.3±20.3	38.3 ± 30.6	38.28 ± 36.28	35.4 ± 11.9	80.99 ± 64.93
		Rocky Point North	183.8 ± 114.9	555.8 ± 355.5	634.4 ± 316.7	103.3 ± 47.5	299.5 ± 157.9	97.5 ± 70.6	353.4 ± 275.8	245.1 ± 86.1	57.6 ± 46.5	86.4±55.3	310.5 ± 186.3	285.21 ± 159.47	47.7 ± 34.2	317.65 ± 186.29
		Point Vicente West	—	—	227.5 ± 140.5	—	328.2 ± 193.4	1116 ± 813.2	4262 ± 1664.5	1927.4 ± 528.4	961 ± 405.4	3778.7±974.5	232.2 ± 309.4	1019.87 ± 285.58	3097.8 ± 140.3	977.2 ± 497.34
Paralabrax maculatofasciatus	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	32.4 ± 32.4	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Paralabrax nebulifer	Restoration	Underwater Arch Cove	—	—	—	234.7 ± 169.4	—	67.8 ± 47.2	389.8 ± 227.7	22.8 ± 22.8	69.9 ± 69.9	45.7±45.7	364.8 ± 306.8	84.46 ± 38.1	50 ± 50	58.43 ± 58.43
		Honeymoon Cove	—	—	—	36.1 ± 23	—	—	—	380.2 ± 186.7	7.7 ± 7.7	128.6±128.6	387.6 ± 387.6	69.77 ± 69.77	306.4 ± 306.4	—
		Hawthorne	—	45.7 ± 45.7	—	27.8 ± 16.2	—	15.4 ± 15.4	282.8 ± 94.7	41.8 ± 27.8	195.8 ± 138.3	45.7±45.7	—	12.34 ± 12.34	—	—

		Marguerite Central	59.5±59.5	—	45.7±45.7	83.8±48.6	—	518.9±200.9	400.9±242.8	—	342.7±342.7	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	306 ± 269.4	—	—	79.2 ± 79.2	—	—	—
Rhacochilus toxotes	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	216±216	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	347.3 ± 347.3	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	123.2 ± 123.2	—	—	—	—	—	—	—	—	—	—	—
Rhinogobiops nicholsii	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	9.1 ± 5.2	7.5 ± 5	—	—	—	0.2 ± 0.1	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	0.8 ± 0.9	—	—	—	—	—	—
		Marguerite Central	—	—	6.1±6.1	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	1.5 ± 1	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	4 ± 2.6	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Scomber japonicus	Restoration	Underwater Arch Cove	—	—	—	—	876.4 ± 876.4	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sebastes atrovirens	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	0.81 ± 0.81
		Hawthorne	23.1 ± 23.1	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	0.5 ± 0.5	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	1.1 ± 1.1	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	90.6 ± 90.6	—	26.3 ± 26.3	—	—	—	—	—	—	52.8 ± 52.8	—
Sebastes auriculatus	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	10.1 ± 10.1	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sebastes caurinus	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	64.6 ± 64.6	—	—	—	—	—	—	—	—	—	—
Sebastes chrysomelas	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	273.7 ± 158	—	—	—	—	—	—	—	—	—	—
Sebastes mystinus	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	3.8 ± 2.8	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	3.5 ± 3.3	2 ± 2	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	2 ± 2	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	1.8 ± 1.0	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sebastes rastrelliger	Restoration	Underwater Arch Cove	—	—	—	77.4 ± 77.4	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	38.7 ± 38.7	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	38.7 ± 38.7	—	—	—	—	—	—	—	—	—	—	—
Sebastes serranoides	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	0.5 ± 0.3	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	0.6 ± 0.6	21.8 ± 21.8	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Semicossyphus pulcher	Restoration	Underwater Arch Cove	25.7 ± 25.7	235.1 ± 105.1	—	104.7 ± 104.7	—	256.2 ± 151	370.6 ± 370.6	431.5 ± 158.1	136.3 ± 90.9	234.1±156.7	331 ± 331	66.9 ± 52.2	211.1 ± 117.5	—
		Honeymoon Cove	—	—	—	—	56.6 ± 56.6	71.8 ± 52.3	—	301.3 ± 216.1	28.3 ± 28.3	—	—	—	—	165.96 ± 93.05
		Hawthorne	100.3 ± 68.5	—	—	—	25.7 ± 25.7	280 ± 98.2	442.6 ± 150	171.8 ± 81.3	153.8 ± 64.7	368 ±157.1	129.5 ± 129.5	315.36 ± 315.36	74.7 ± 30.3	644.41 ± 211.92
		Marguerite Central	56.6 ± 56.6	56.6 ± 56.6	—	28.5 ± 17.2	—	412.7 ± 237.8	113.2 ± 65.4	416.8 ± 222.4	692.8 ± 406.8	558.3±350.1	960 ± 137.8	173.61 ± 173.61	480.8 ± 331.2	368.4 ± 124.8
	Reference	Ridges North	25.7 ± 25.7	62.3 ± 62.3	286.5 ± 217.6	104.7 ± 104.7	173.3 ± 173.3	25.7 ± 25.7	25.7 ± 25.7	56.6 ± 15.8	142 ± 122.6	56.6±56.6	—	—	104.9 ± 104.9	—
		Rocky Point North	130.4 ± 130.4	312.2 ± 144.4	990.5 ± 95.8	173.3 ± 173.3	56.6 ± 56.6	144.8 ± 114.8	—	28.3 ± 28.3	127.4 ± 87.3	93.5±93.5	73.6 ± 73.6	226.85 ± 226.85	180.7 ± 87.1	271.33 ± 157.75
		Point Vicente West	25.7 ± 25.7	—	—	880.1 ± 530.8	209.4 ± 120.8	225.7 ± 120.8	56.6 ± 56.6	890.9 ± 612	694.1 ± 322	558.1±117.3	883.4 ± 446	694.81 ± 411.48	3401.8 ± 12221.7	1532.68 ± 1863.32
Syngnathus californiensis	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	10.7 ± 10.7	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Urobatis halleri	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	38.7 ± 38.7	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—	—	191.6 ± 191.6
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	25.6 ± 25.6	—	—	—	—	—	—

Table B6. White Point CRANE survey data for Years 8-11.

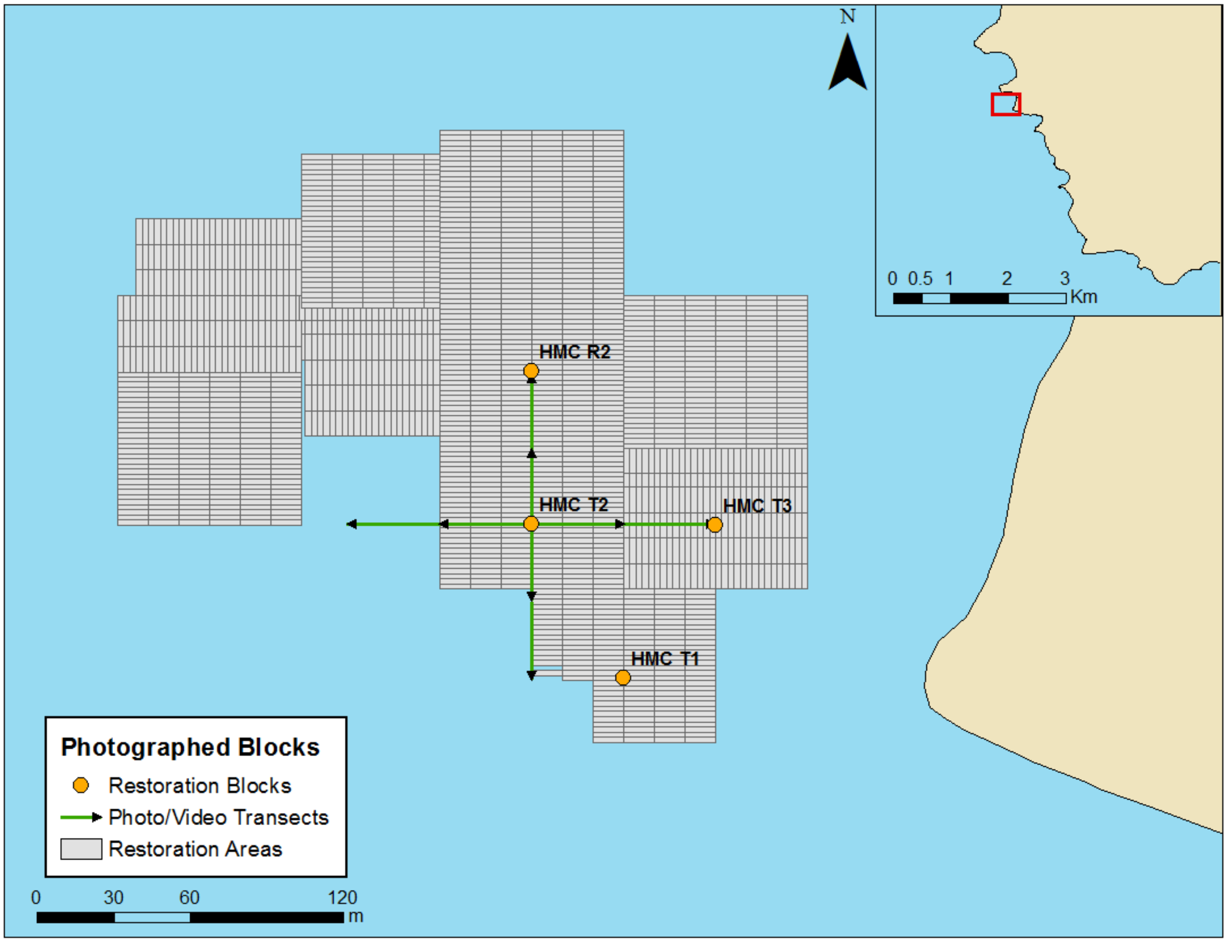
White Point CRANE data - September 2021-2023			
Analysis	2022	2023	2024
Coordinates:			
Latitude	33.71287	33.71287	33.71287
Longitude	-118.3159	-118.3159	-118.3159
Temperature	17.9	17.6	17.8
Fish Richness	7	11	8
Fish Diversity H	1.68	2.042	1.56
Fish Diversity 1-D	0.79	0.843	0.74
Fish Density:			
Paralabrax clathratus (/100m2)	0	4.17 ± 1.5	1.67 ± 0.96
Semicossyphus pulcher (/100m2)	1.3 ± 0.8	4.17 ± 3.78	1.67 ± 0.96
Fish Biomass:			
Paralabrax clathratus (g/100m2)	0	347.3 ± 74.63	144.87 ± 33.28
Semicossyphus pulcher (g/100m2)	917.4 ± 743.1	494.7 ± 215.7	206.25 ± 97.37
Swath Diversity H	2.56	1.615	2
Swath Diversity 1-D	0.91	0.732	0.83
Swath Density:			
Macrocystis pyrifera stipes (/100m2)	375.8 ± 144.2	-	-
Panulirus interruptus (/100m2)	9.2 ± 9.2	-	-
Mesocentrotus franciscanus (/100m2)	20 ± 5	29.17 ± 1.17	28.33 ± 18.36
Strongylocentrotus purpuratus (/100m2)	258.3 ± 45	366.38 ± 34.78	81.67 ± 31.66

Table B7. Point Fermin CRANE survey data for Year 11.

Point Fermin CRANE data January 2024		
Analysis	2023	2024
Coordinates:		
Latitude	33.704,	33.704,
Longitude	-118.291	-118.291
Temperature	16.7	16.6
Fish Richness	5	5
Fish Diversity H	1.322	1.1
Fish Diversity 1-D	0.685	0.6
Fish Density:		
Paralabrax clathratus (/100m2)	1.67 ± 1.4	4.17 ± 0.83
Semicossyphus pulcher (/100m2)	5.83 ±	11.67 ± 5.52
Fish Biomass:		
Paralabrax clathratus (g/100m2)	349.51 ± 103.5	872.72 ± 206.3
Semicossyphus pulcher (g/100m2)	92.22 ± 92.1	184.60 ± 106.4
Swath Diversity H	1.302	1.58
Swath Diversity 1-D	0.584	0.709
Swath Density:		
Macrocystis pyrifera stipes (/100m2)	-	-
Panulirus interruptus (/100m2)	0.83 ± 0.4	0.53 ± 0.2
Mesocentrotus franciscanus (/100m2)	103.27 ± 6.5	359.7 ± 76.8
Strongylocentrotus purpuratus (/100m2)	705.9 ± 56.69	1403.22 ± 103.7

Appendix C: Permanent Photo Point and Video Transects

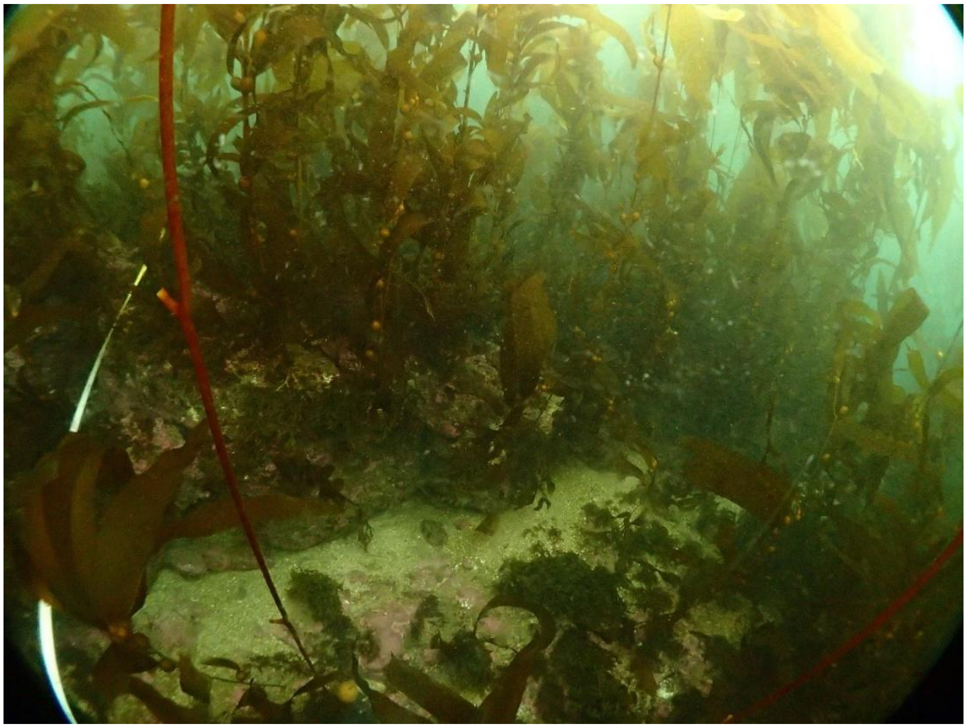
Honeymoon Cove



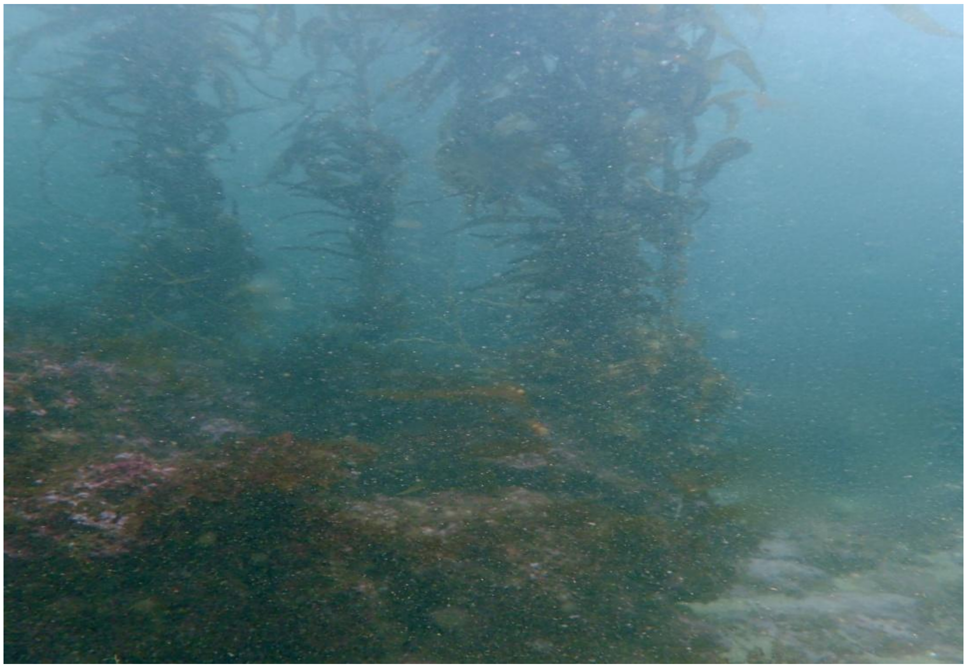
Honeymoon Cove Block T2 (HMC T2) east-west running ridge is a large distinguishable feature easily found by divers. This block was restored in March 2014. GPS: 33.764260, -118.423734


HMC T2 07/29/16

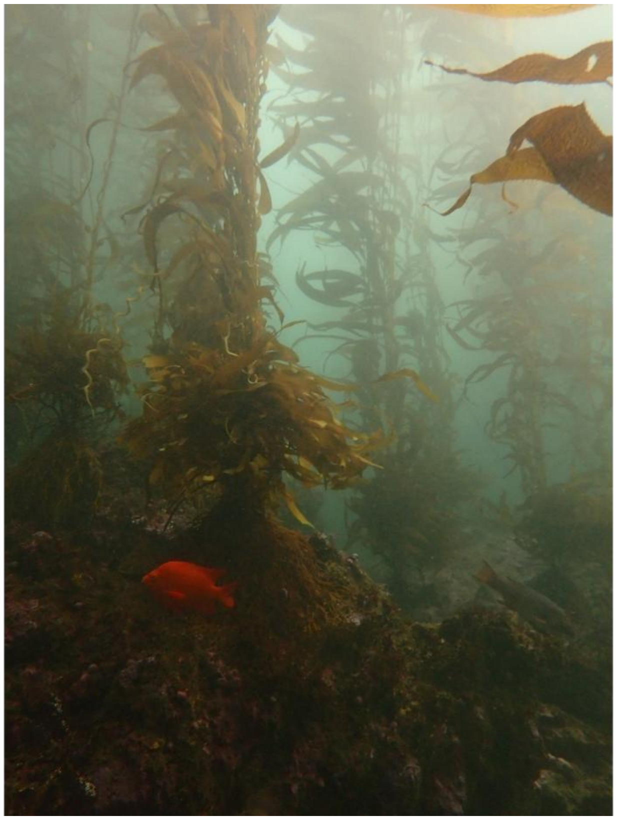

HMC T2 08/07/17


HMC T2 07/18/18

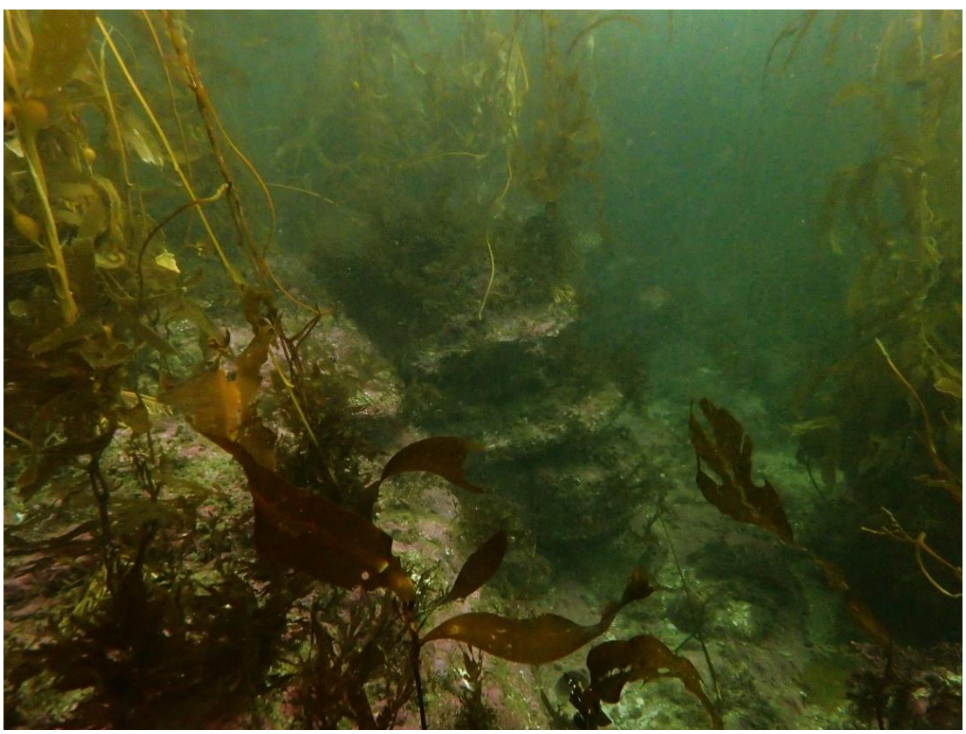

HMC T2 07/18/19


HMC T2 07/17/2020

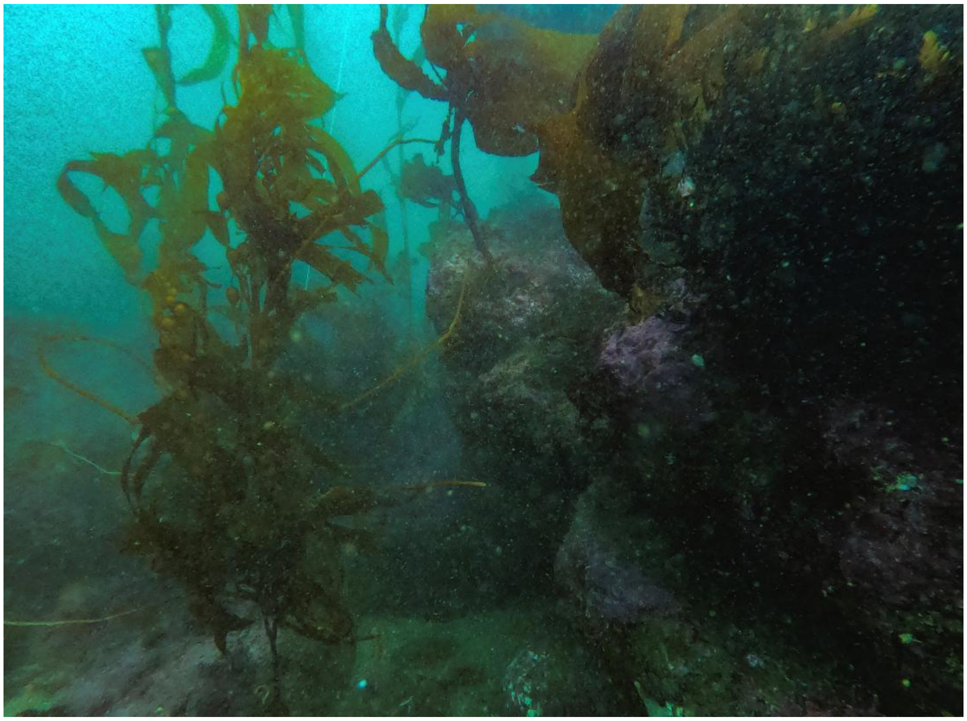
HMC T2 08/31/21



HMC T2 08/16/22



HMC T2 10/6/23

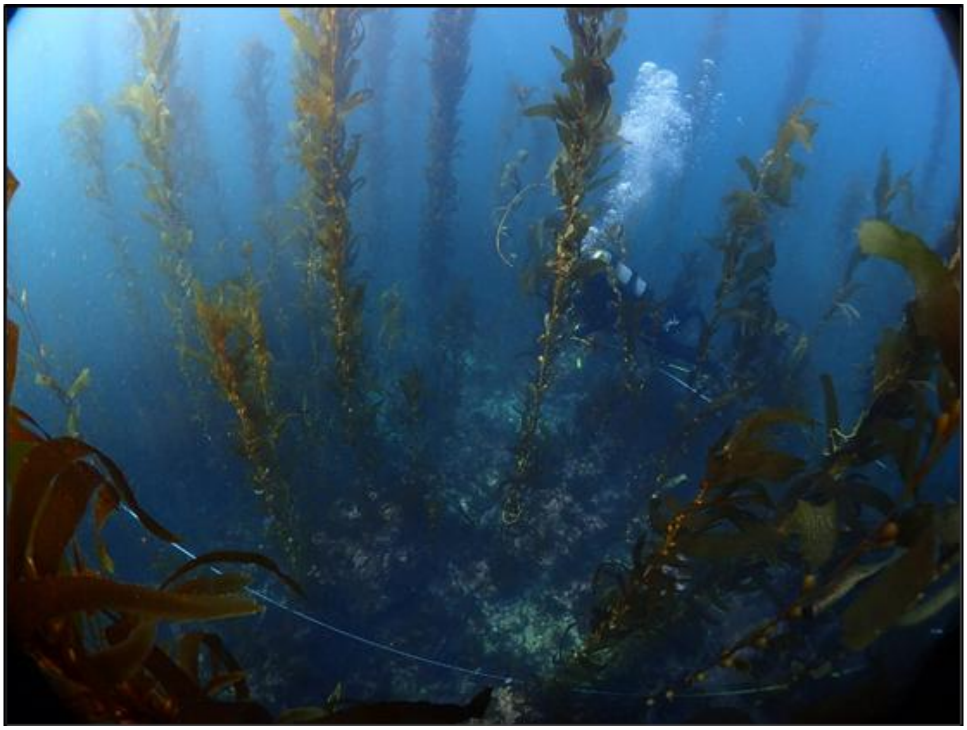


HMC T2 11/01/24**Honeymoon Cove Block R5** (HMC R5) is the site of another TBF project with ongoing monitoring. Divers visit this area annually to conduct subtidal surveys allowing the opportunity to collect photos over time. This block was restored in November 2014. GPS: 33.765297, -118.424221

HMC R5 06/22/15


HMC R5 09/24/15


HMC R5 11/12/15


HMC R5 02/10/16

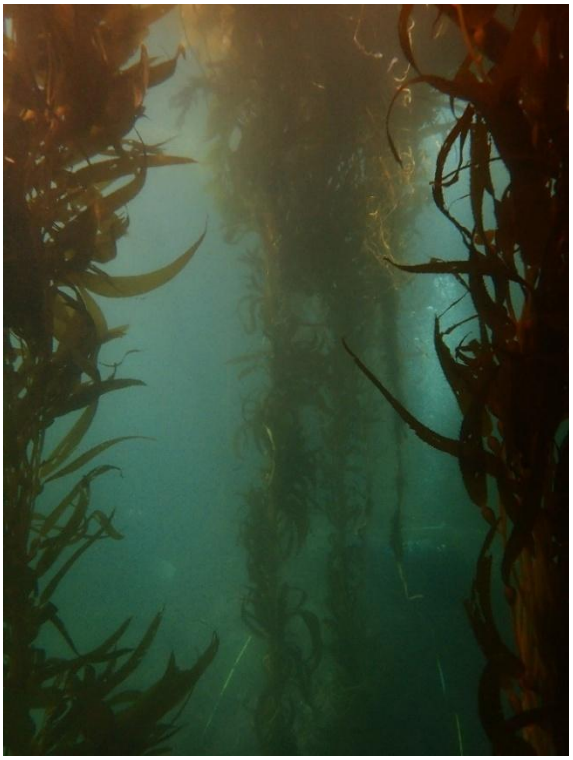

HMC R5 08/3/17

HMC R5 07/3/18

HMC R5 07/18/19

HMC R5 07/17/20

HMC R5 08/31/21

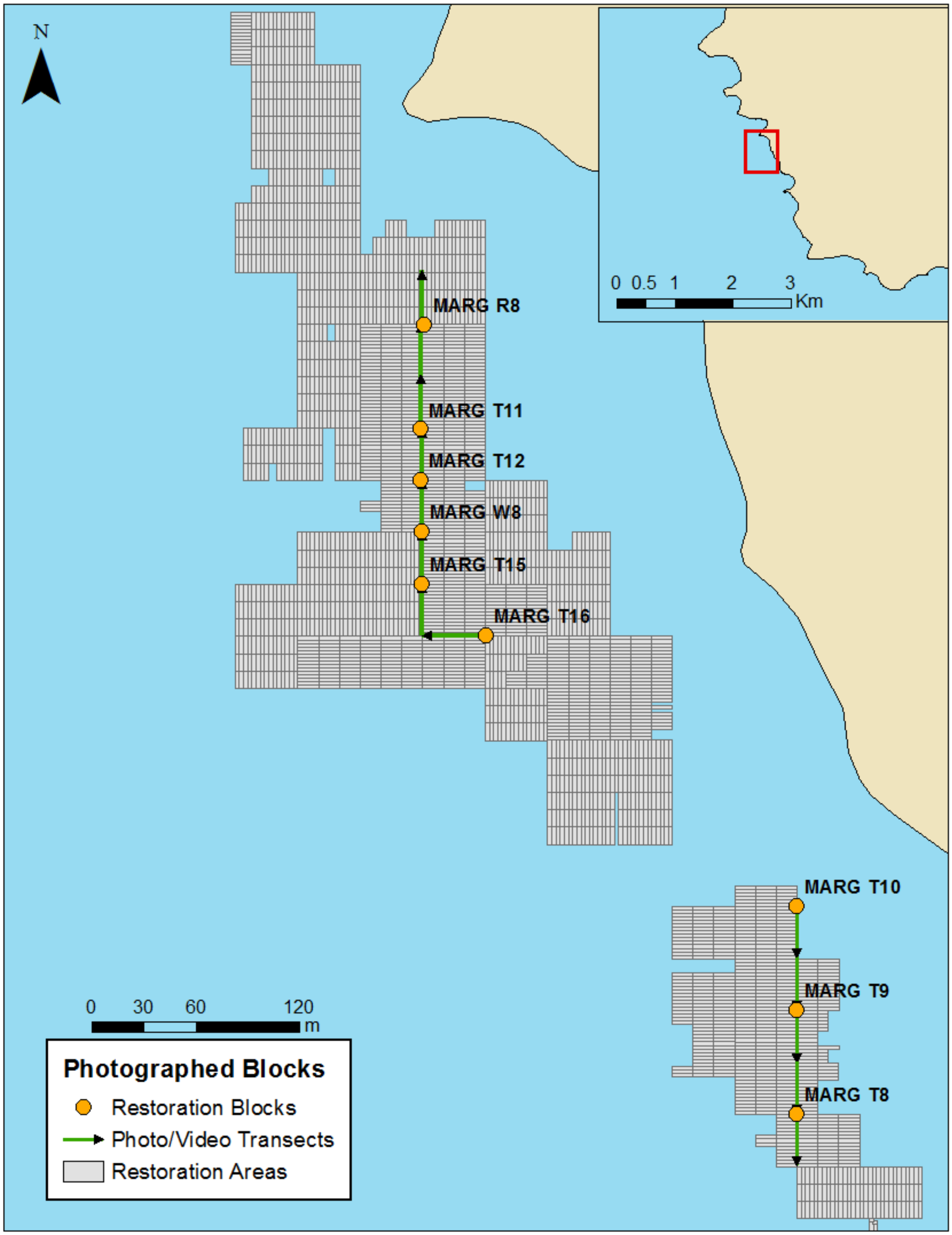


HMC R5 08/18/22

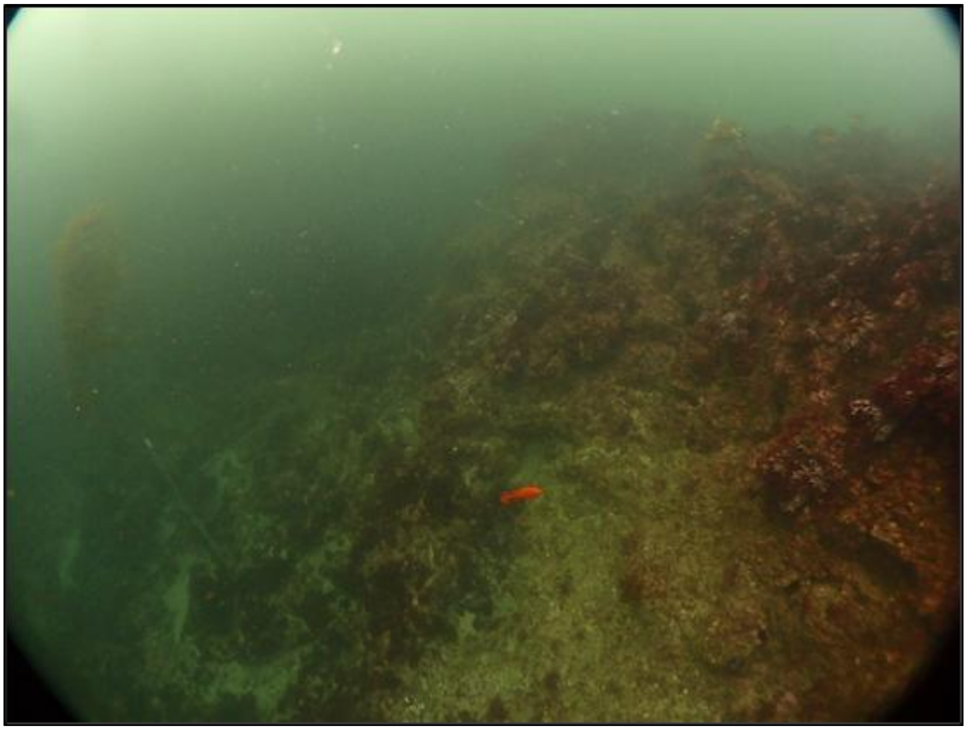
HMC R5 08/30/23

HMC R5 11/01/2024

Marguerite



Marguerite Block T16 (MARG T16) was monitored monthly by TBF divers for 2 years starting in 2016 for a wave attenuation study. This block was restored in September 2016. Subsequent photo/videos occur annually. GPS: 33.757561, -118.41782



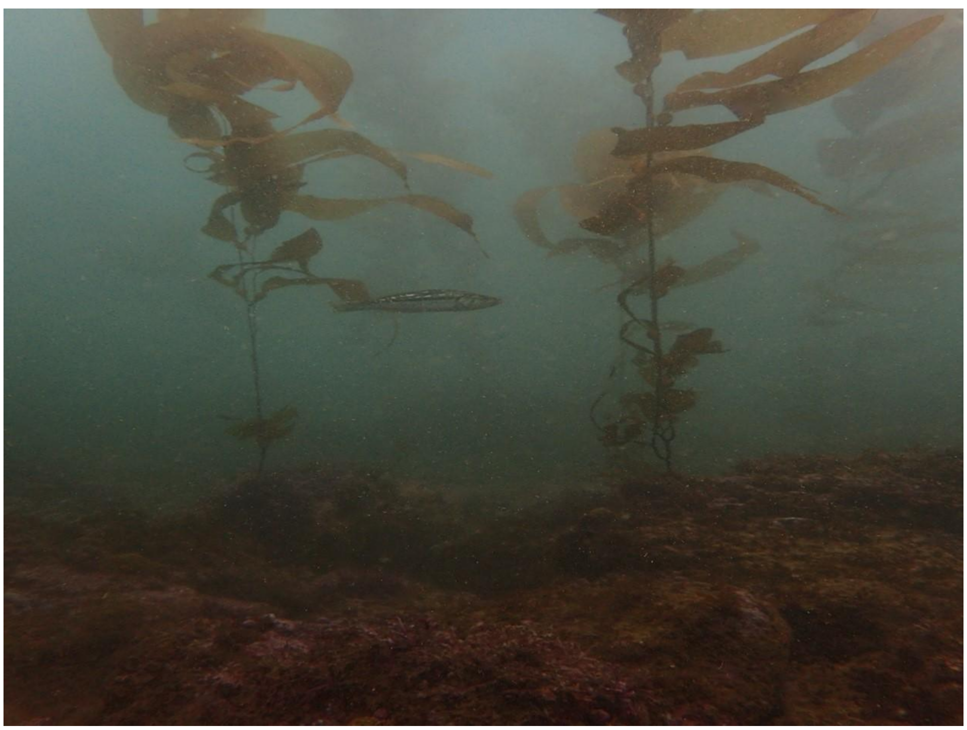
MARG T16 08/10/16

MARG T16 08/3/17

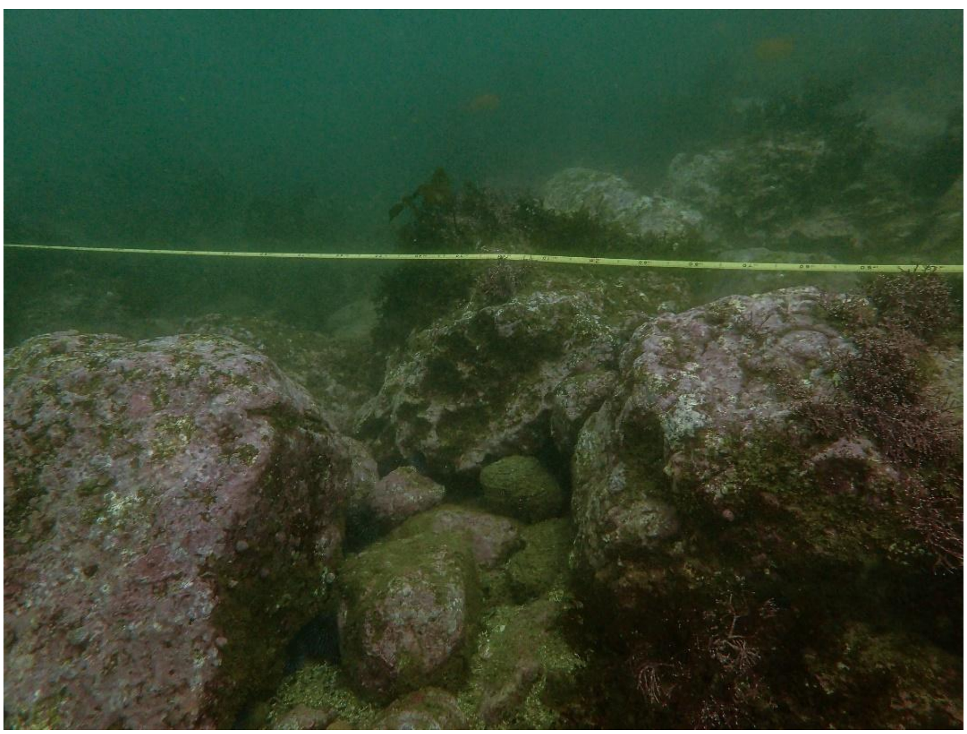
MARG T16 07/20/18

MARG T16 06/21/19

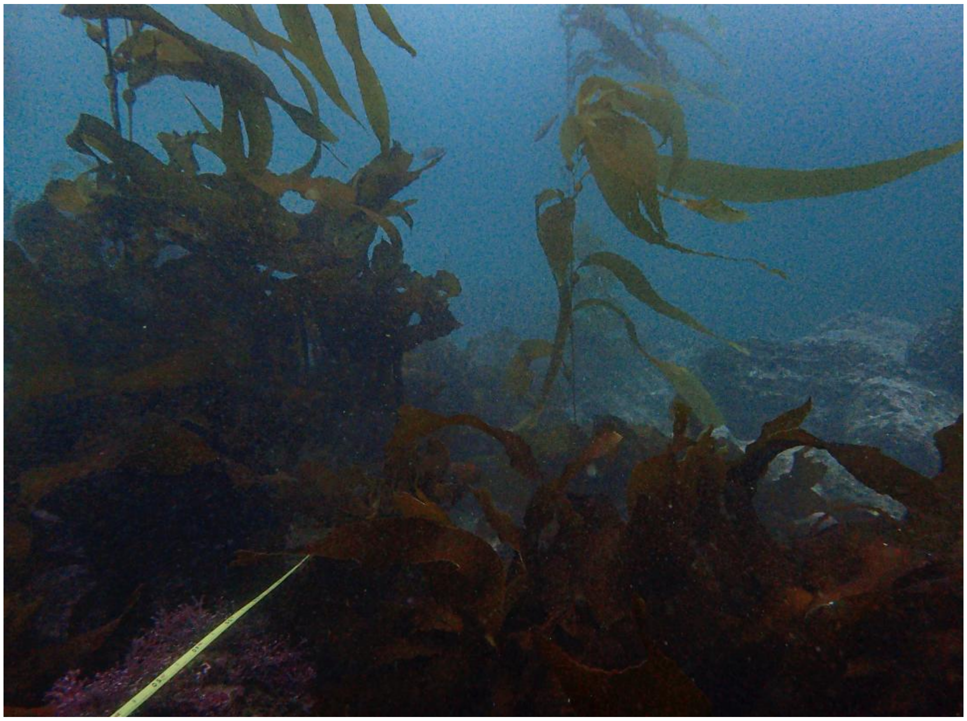
MARG T16 08/12/20


MARG T16 07/09/21

MARG T16 08/18/22

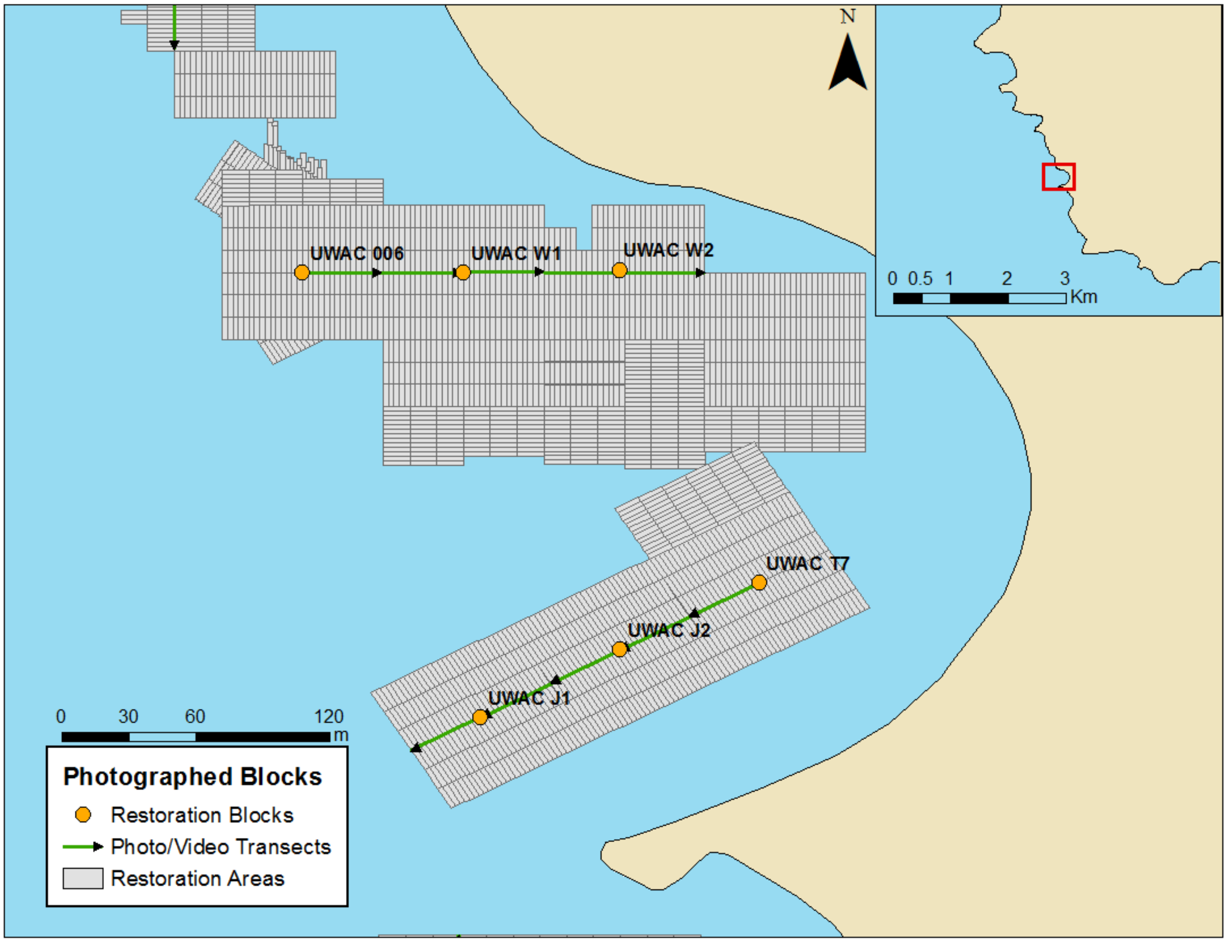


MARG T16 10/06/23



MARG T16 09/23/24

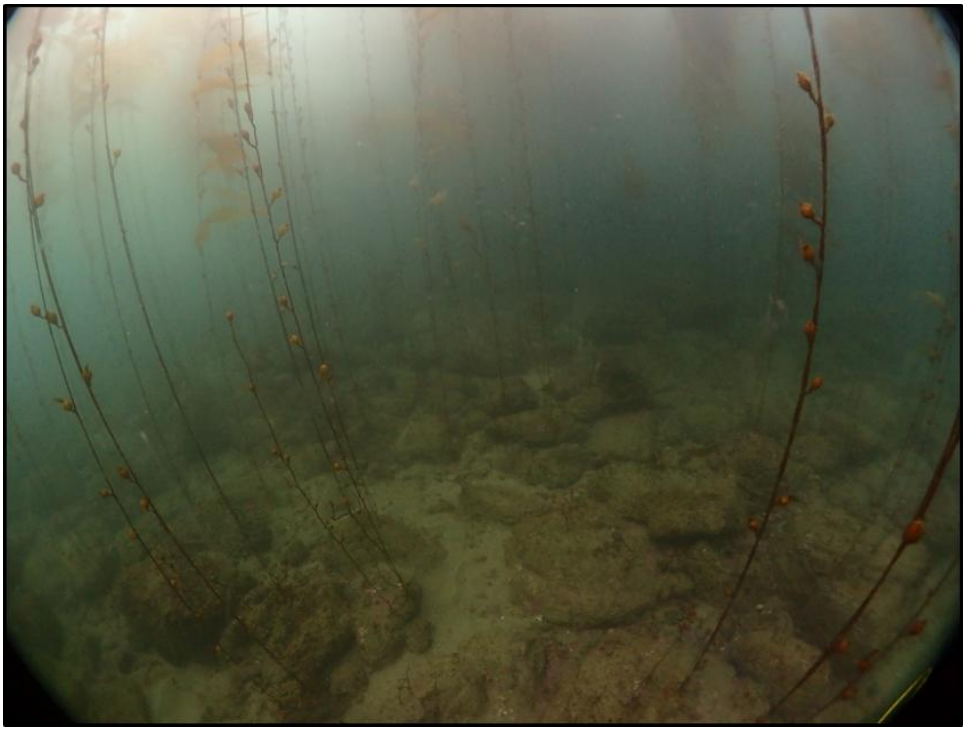
Underwater Arch Cove



Underwater Arch Cove Blocks (UWAC) J1, J2 and T7 were the locations of our first transect video shot in 2014. In 2016 and 2017, this video transect was recorded again and photos from both dates have been archived. Divers will continue to revisit this area annually for video and photography. GPS: 33.7526, -118.4146

UWAC J1 restoration was complete in November 2013. GPS: 33.75205979, -118.4156861

UWAC J1 08/14/14

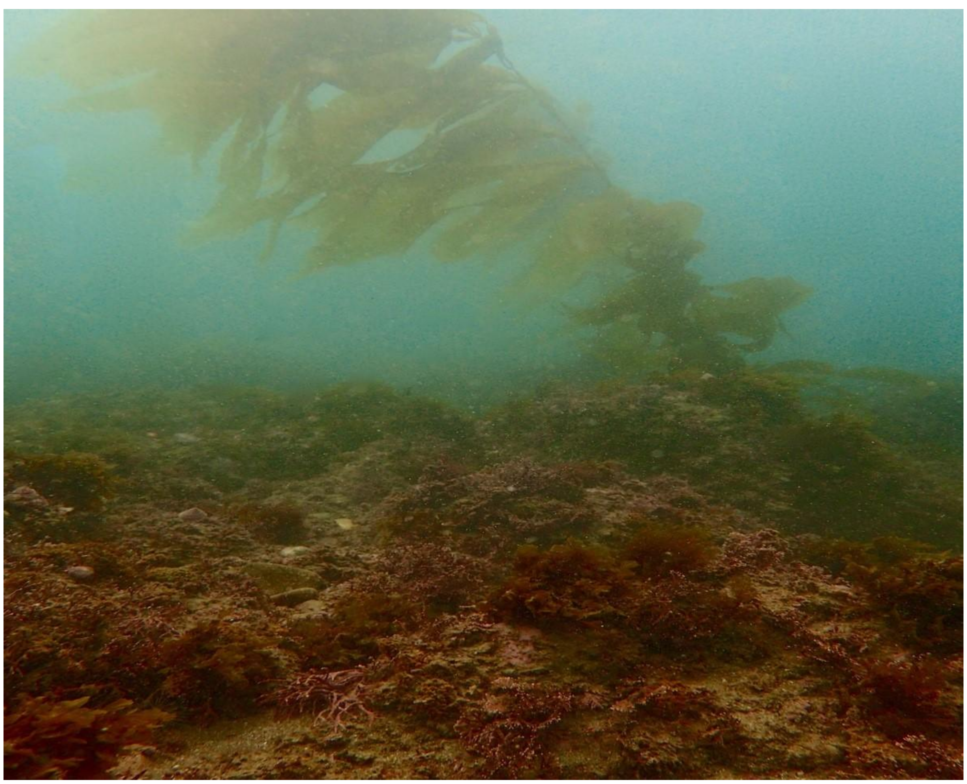

UWAC J1 07/07/16


UWAC J1 07/27/17

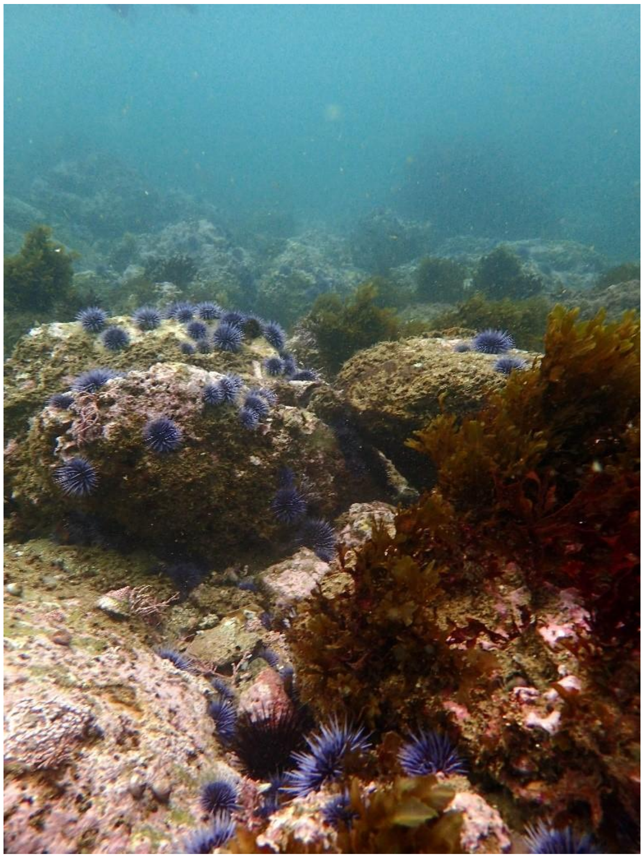

UWAC J1 07/18/18


UWAC J1 06/21/19

UWAC J1 07/24/20



UWAC J1 07/13/21


UWAC J1 08/18/22

UWAC J1 01/15/24

UWAC J1 09/23/24

UWAC J2 was restored in July 2014. GPS: 33.7523302, -118.4151245

UWAC J2 PRE-RESTORATION 07/12/14

UWAC J2 08/14/14

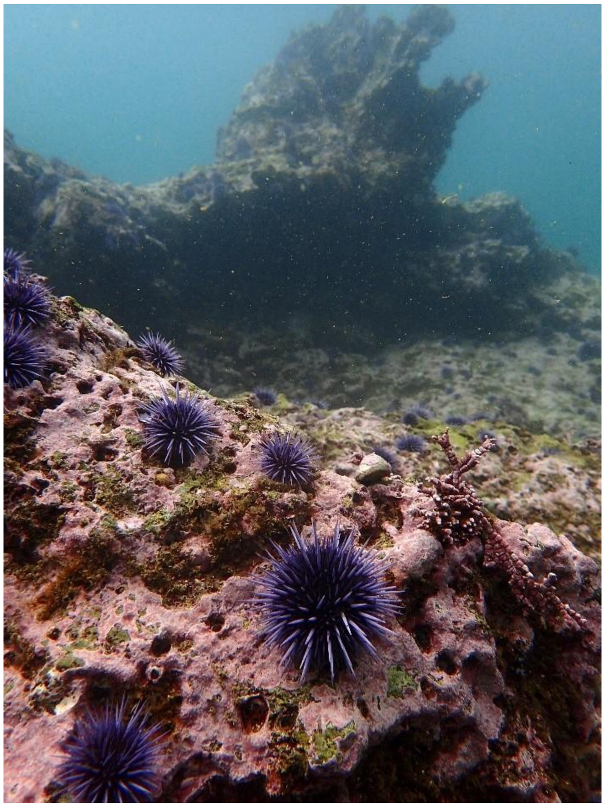
UWAC J2 07/27/17


UWAC J2 07/18/18

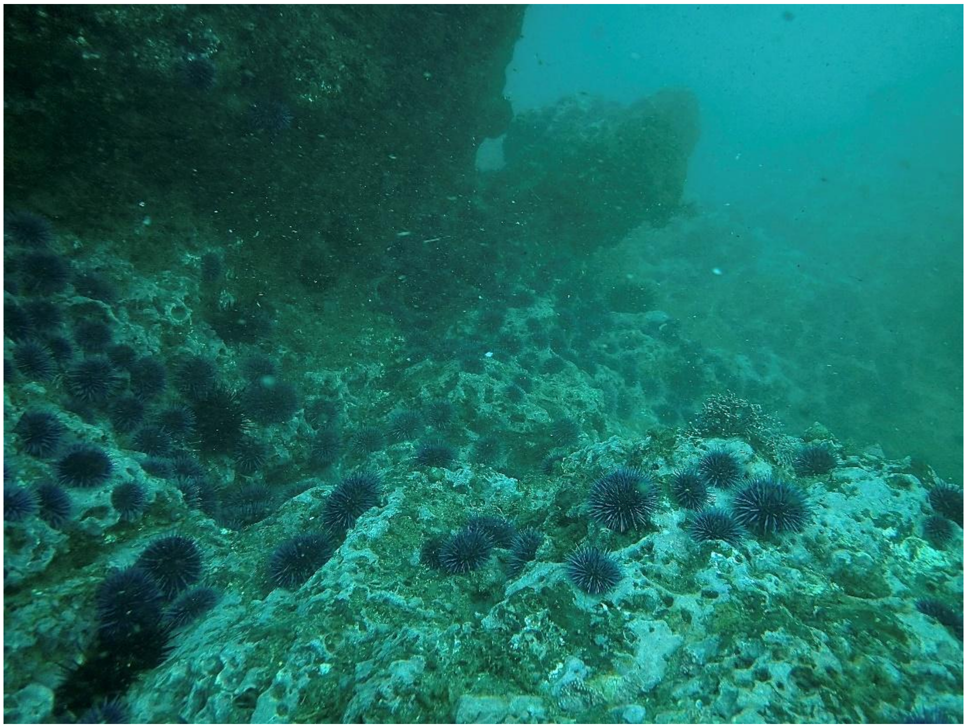
UWAC J2 06/21/19

UWAC J2 07/24/20

UWAC J2 07/13/21



UWAC J2 08/18/22

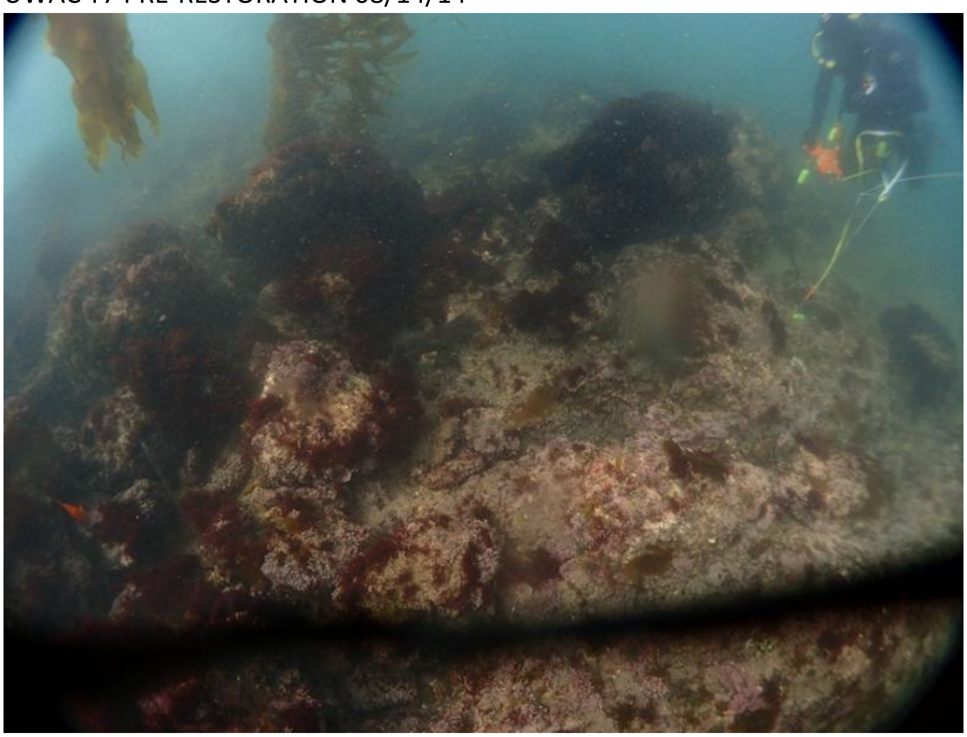


UWAC J2 01/15/24

UWAC J2 09/23/24

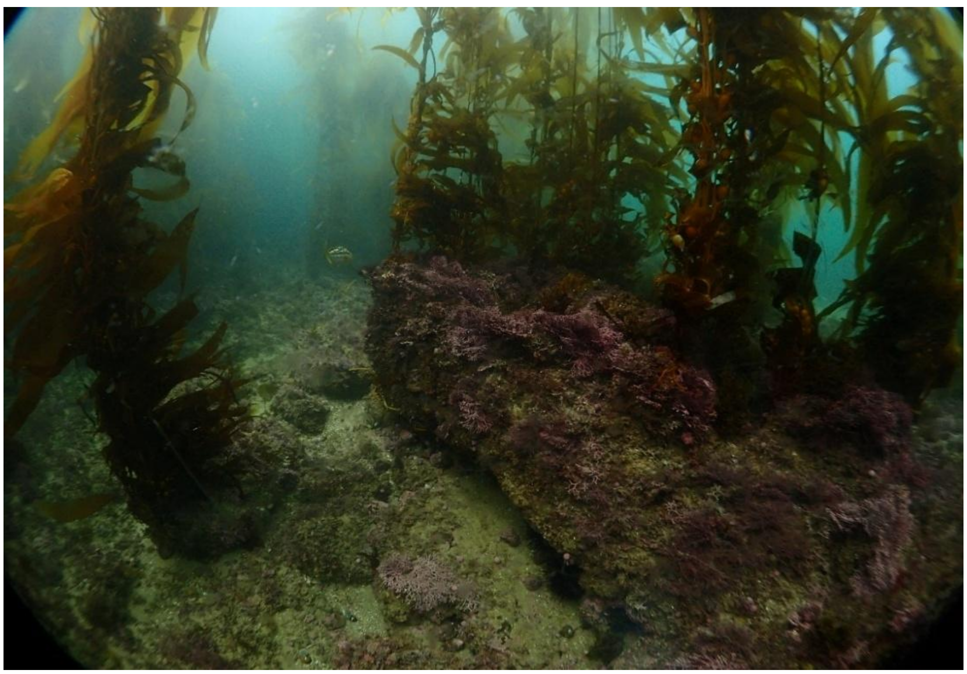
UWAC T7 was restored in September 2014. GPS: 33.7526, -118.414563

UWAC T7 PRE-RESTORATION 08/14/14



UWAC T7 07/07/16

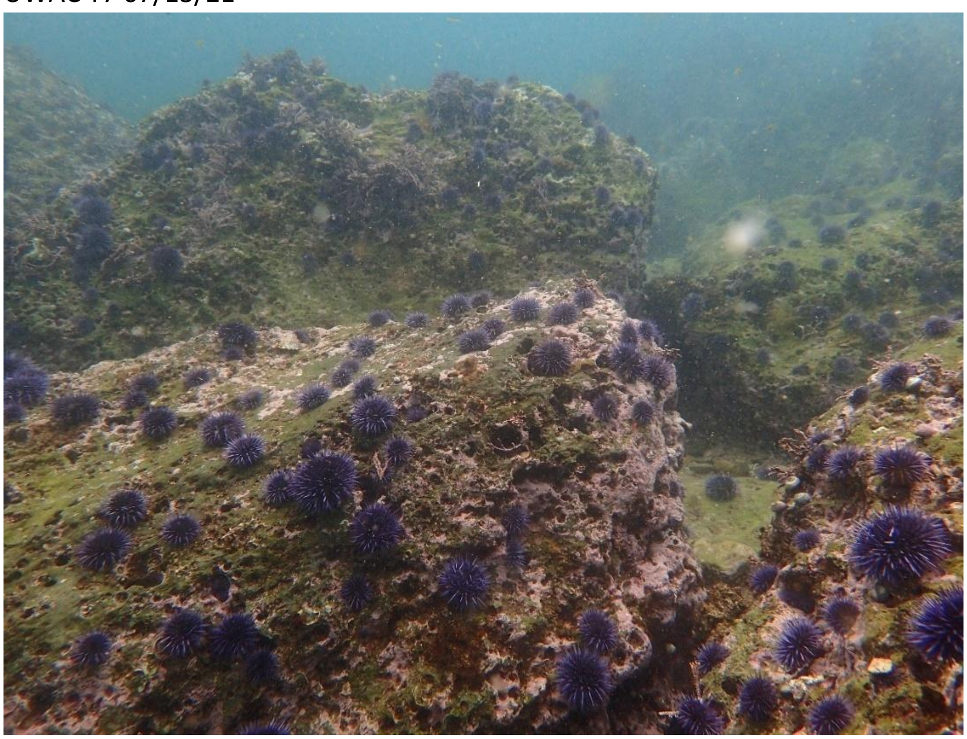

UWAC T7 07/27/17


UWAC T7 07/18/18


UWAC T7 06/21/19

UWAC T7 07/24/20

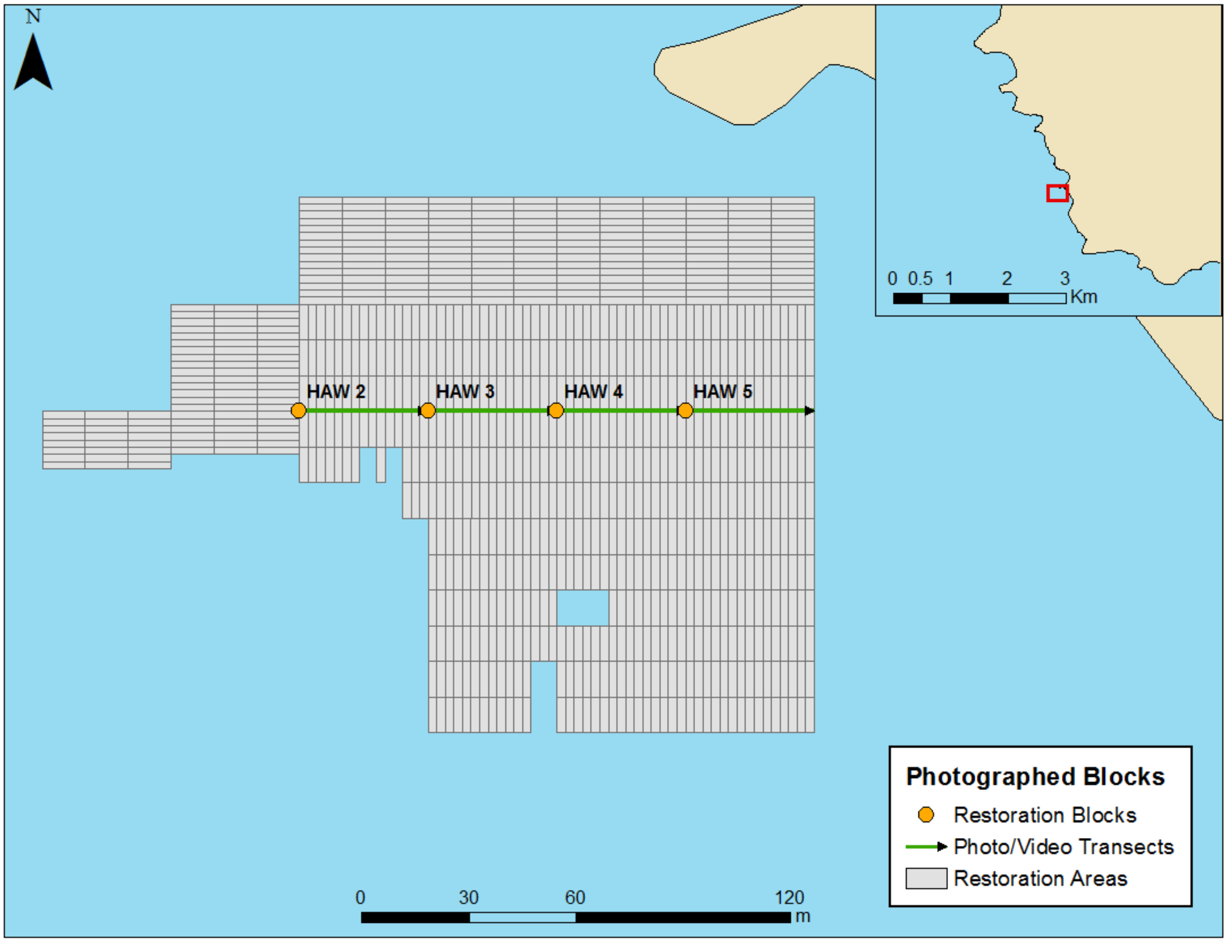

UWAC T7 07/13/21


UWAC T7 08/18/22

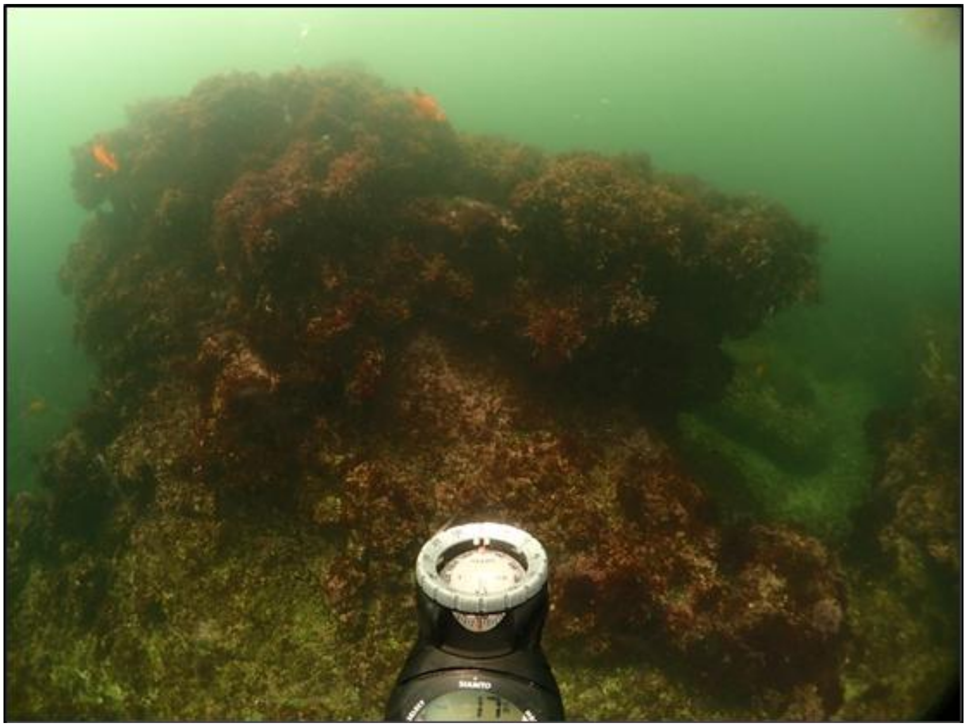

UWAC T7 01/15/24


UWAC T7 09/23/24

Hawthorne



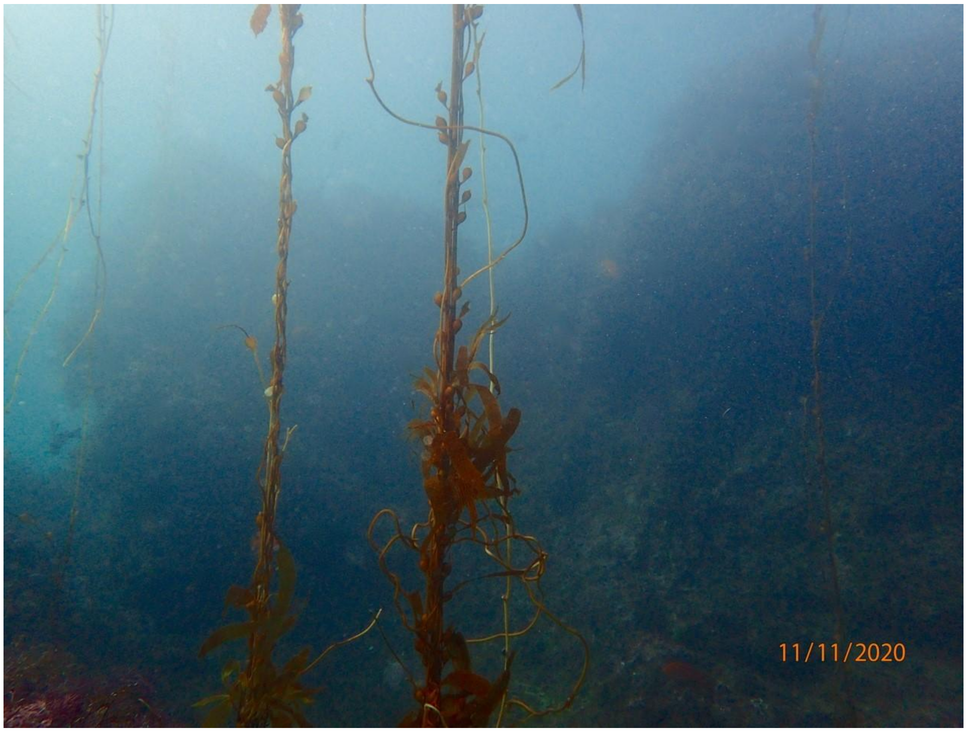
Hawthorne Block 2 (HAW 2) is a large pinnacle easily found by divers and will serve as the starting point for video transects and photos of the site. The photos below show the pinnacle at heading 180 degrees and 90 degrees. GPS: 33.75064, 118.416097


HAW 2 Heading 180 08/10/16


HAW 2 Heading 180 08/25/17


HAW 2 Heading 180 07/20/18

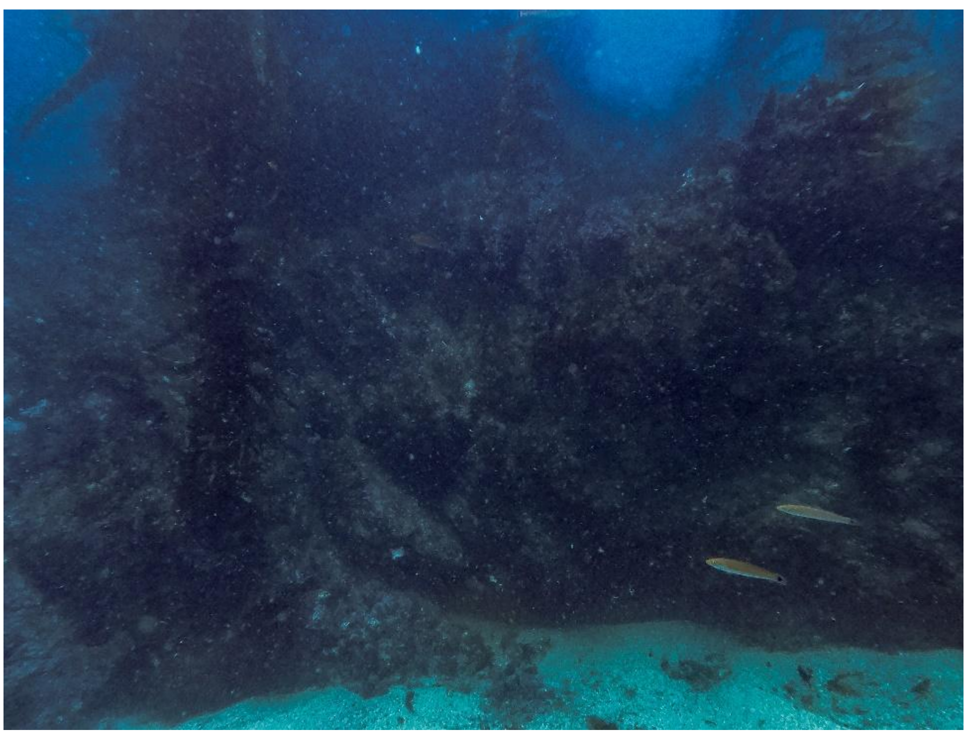

HAW 2 Heading 180 07/18/19

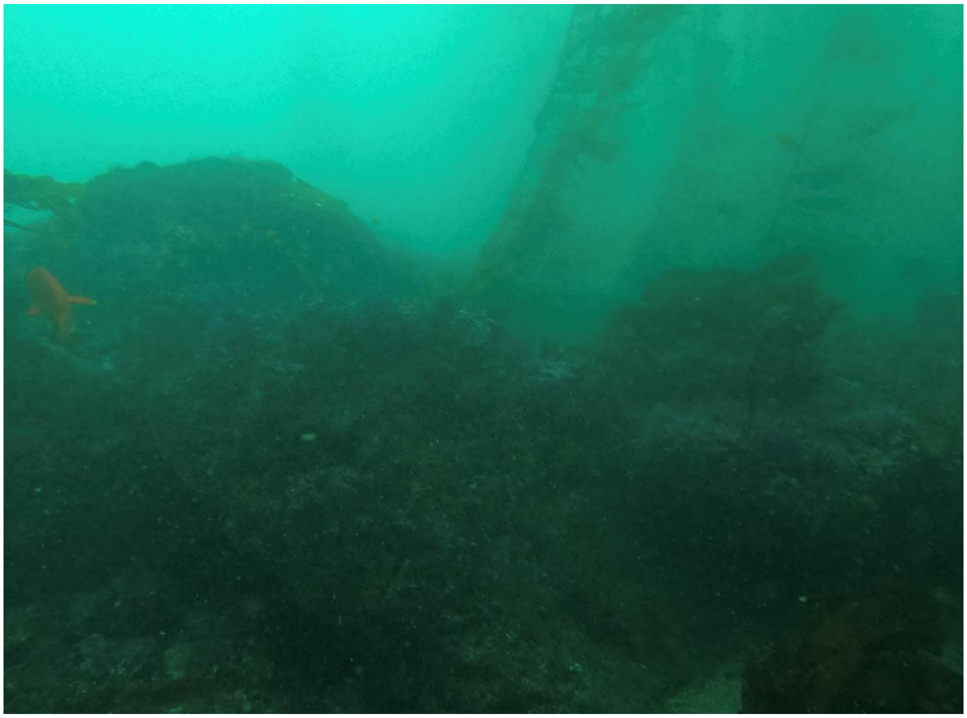


HAW 2 Heading 180 11/11/20

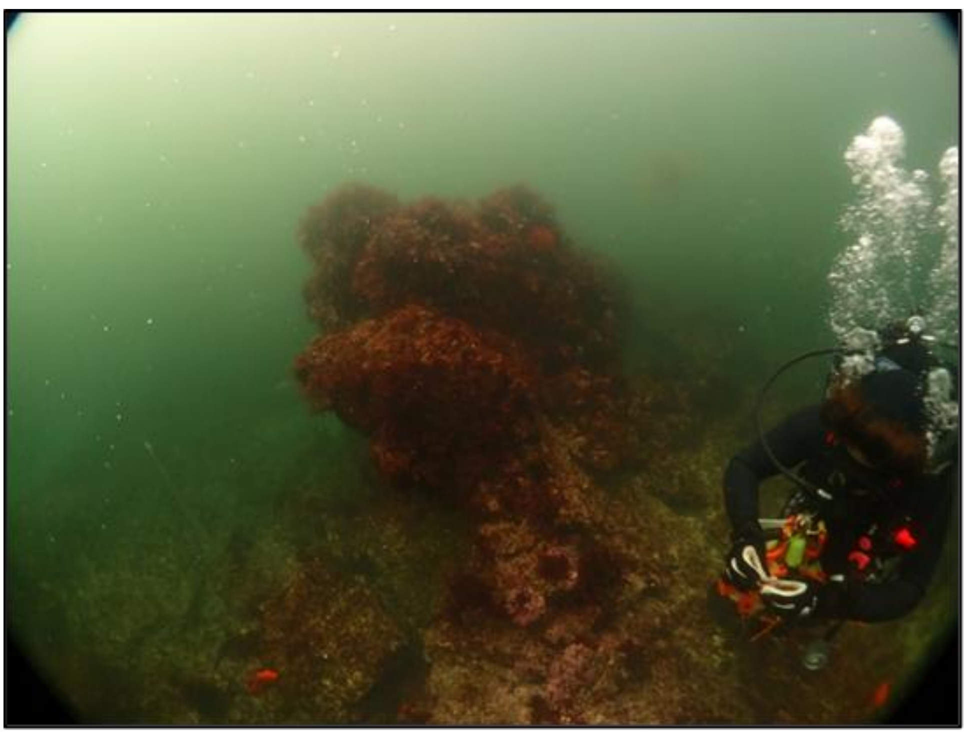

HAW 2 Heading 180 07/09/21


HAW 2 Heading 180 08/18/22


HAW 2 Heading 180 10/06/23

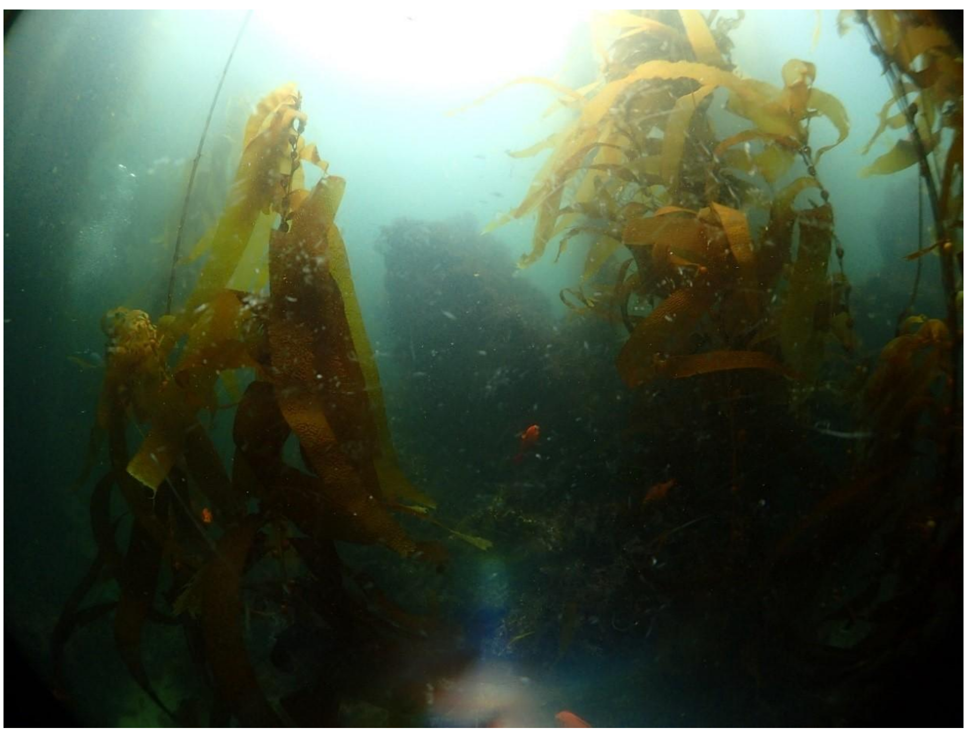


HAW 2 Heading 180 11/01/23



HAW 2 Heading 90 08/10/16

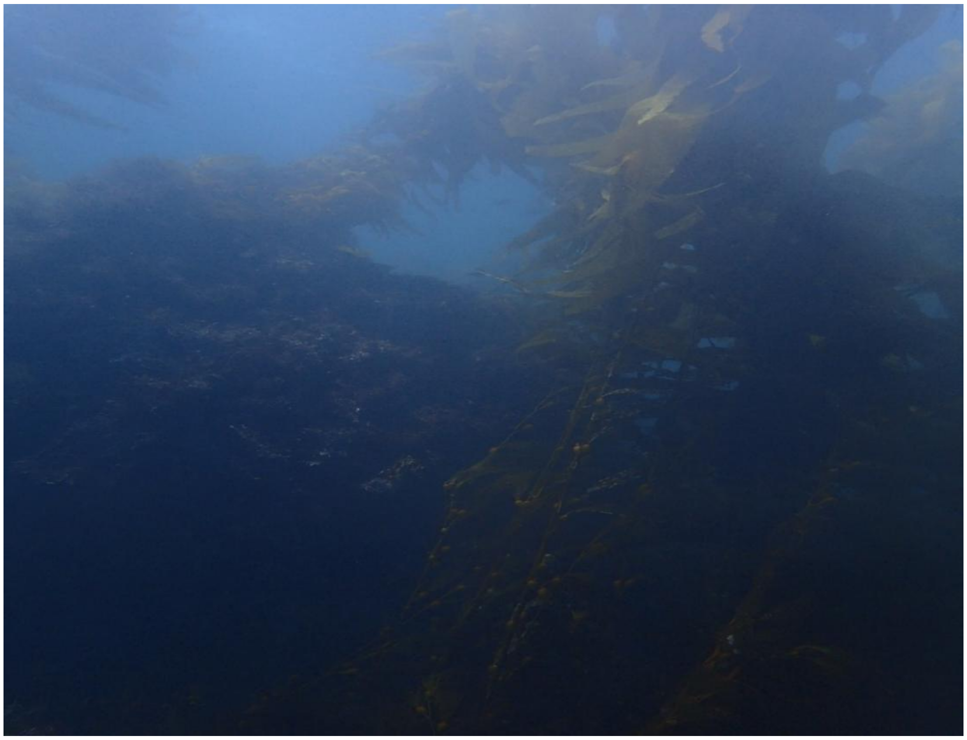
HAW 2 Heading 90 08/25/17



HAW 2 Heading 90 07/20/18

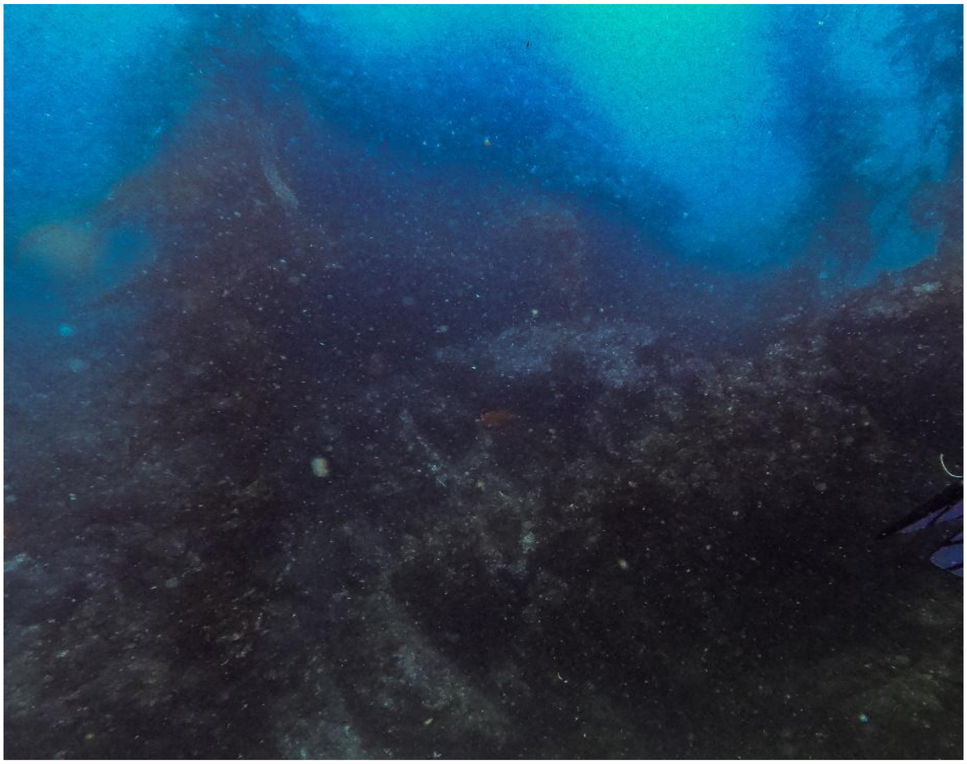
HAW 2 Heading 90 07/18/19

HAW 2 Heading 90 11/11/20



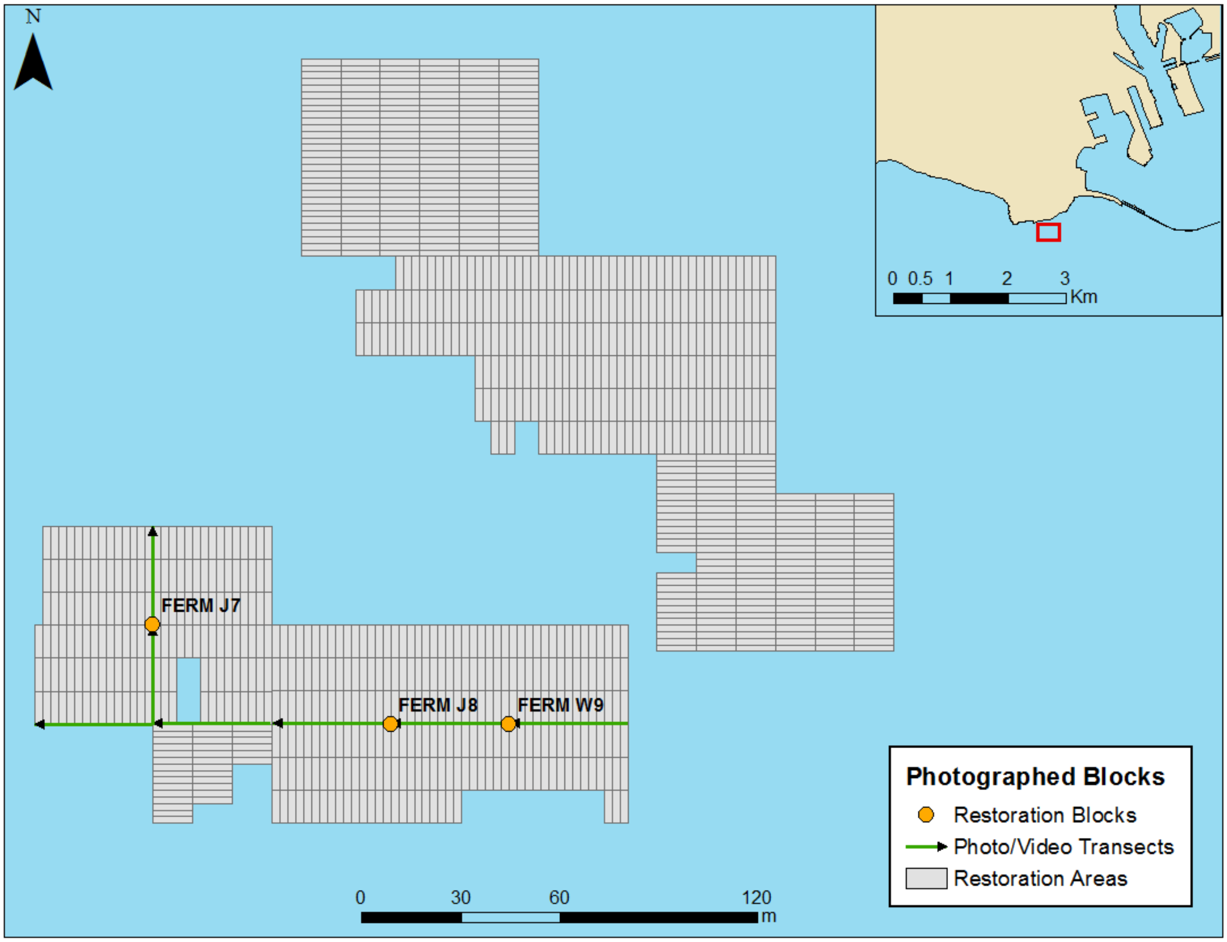
HAW 2 Heading 90 07/09/21

HAW 2 Heading 90 08/18/22

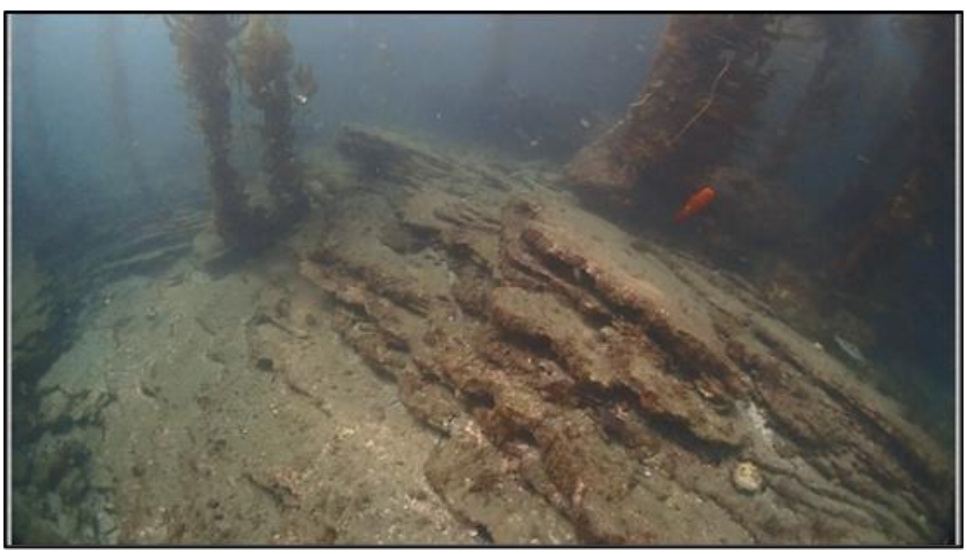

HAW 2 Heading 90 10/06/23


HAW 2 Heading 90 11/01/24

Point Fermin

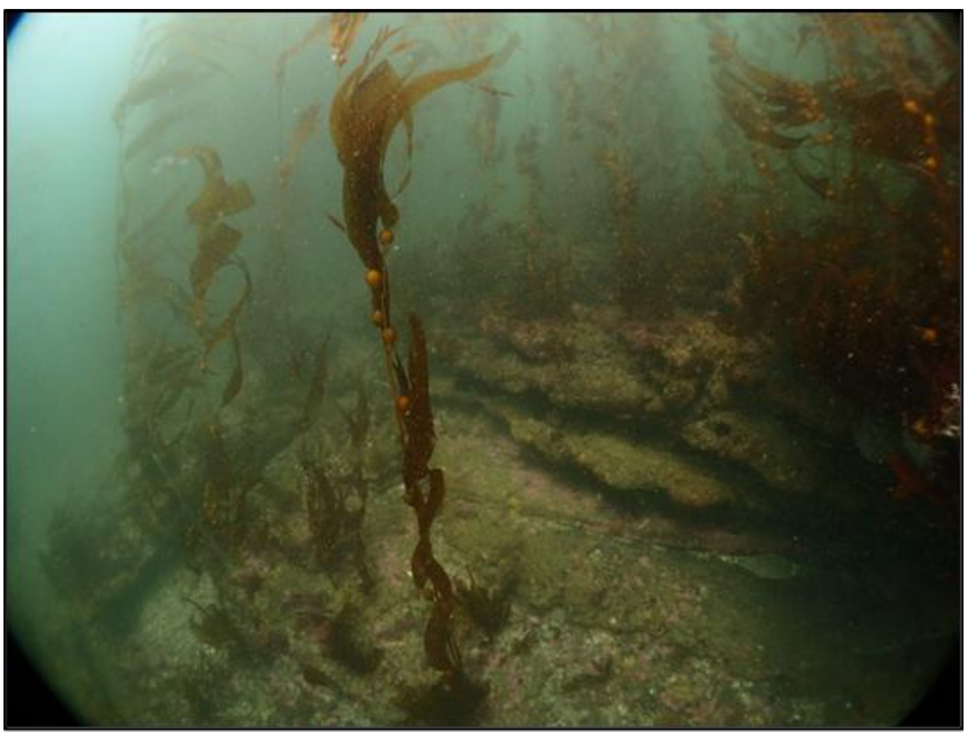


Point Fermin Block J7 (FERM J7) is a north-south running ridge that has been well documented with video footage pre and post restoration. GPS: 33.703028, -118.290167



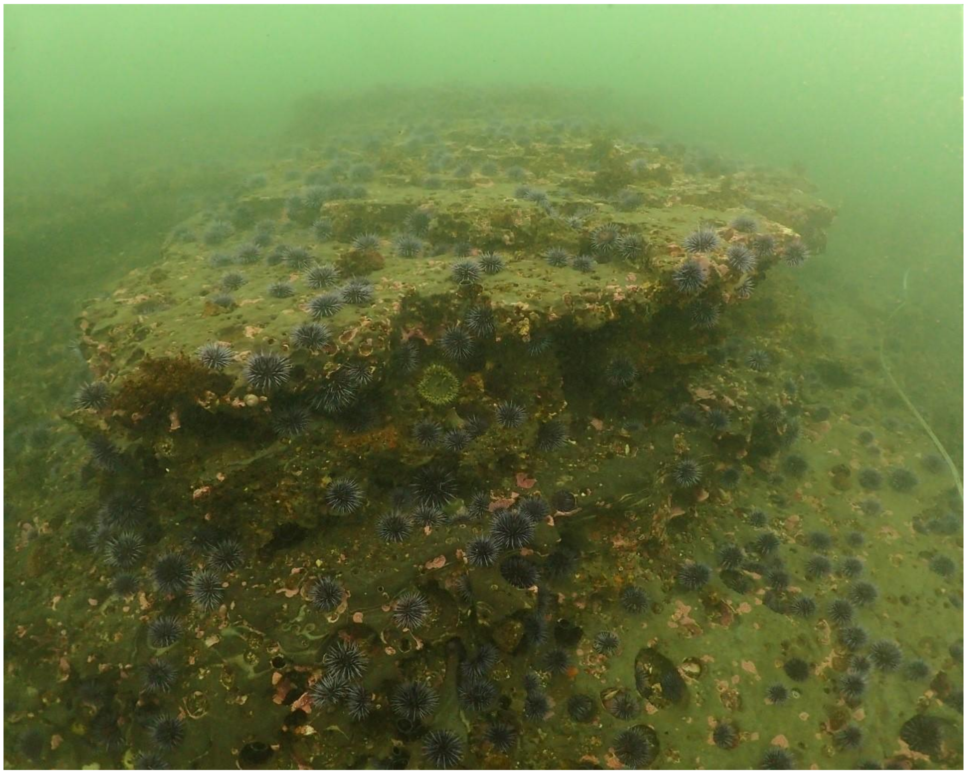
FERM J7 9/25/15

FERM J7 8/10/16



FERM J7 7/7/17

FERM J7 7/17/18



FERM J7 08/07/19

FERM J7 07/29/20

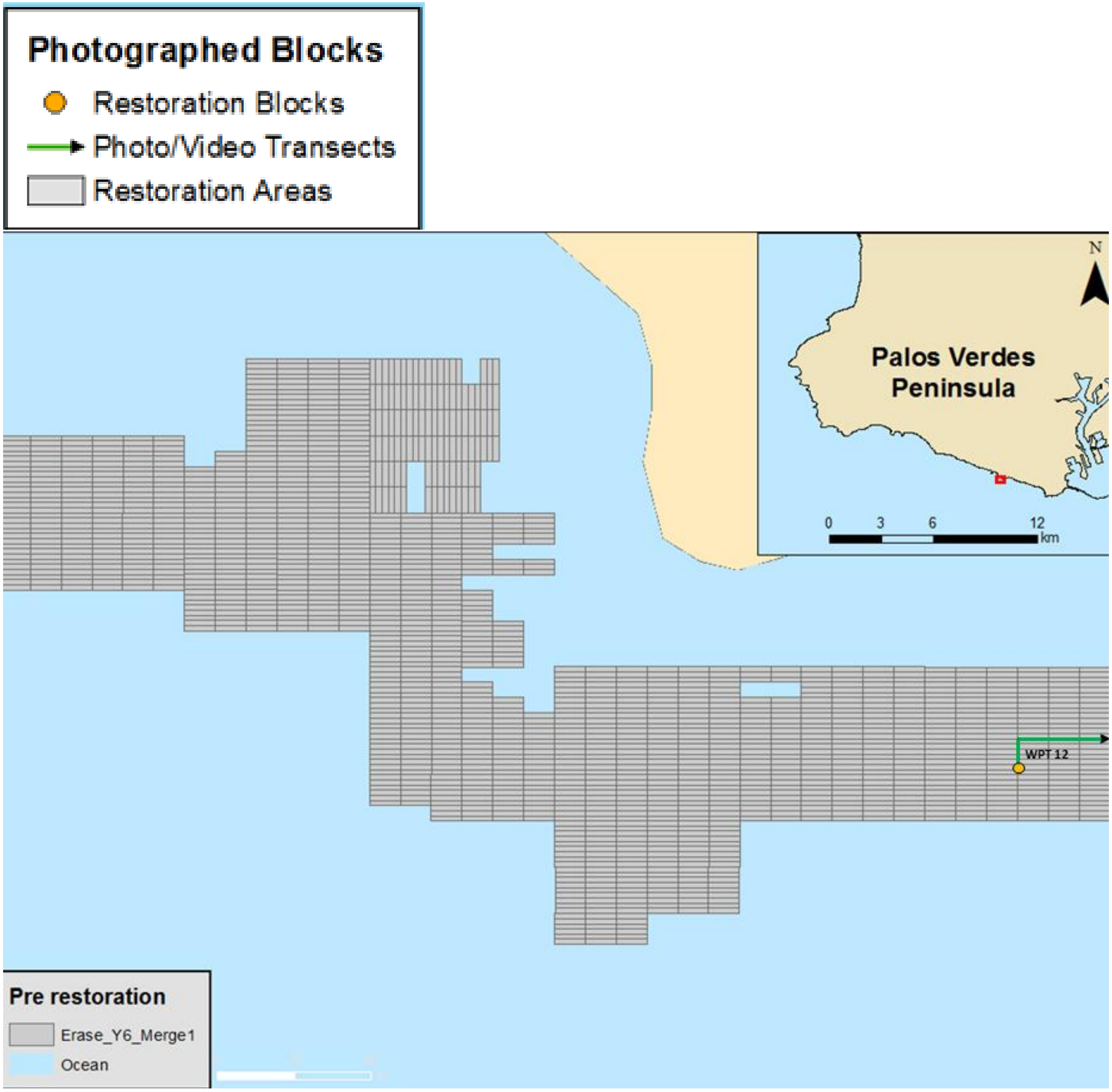

FERM J7 06/11/2021


FERM J7 08/04/22

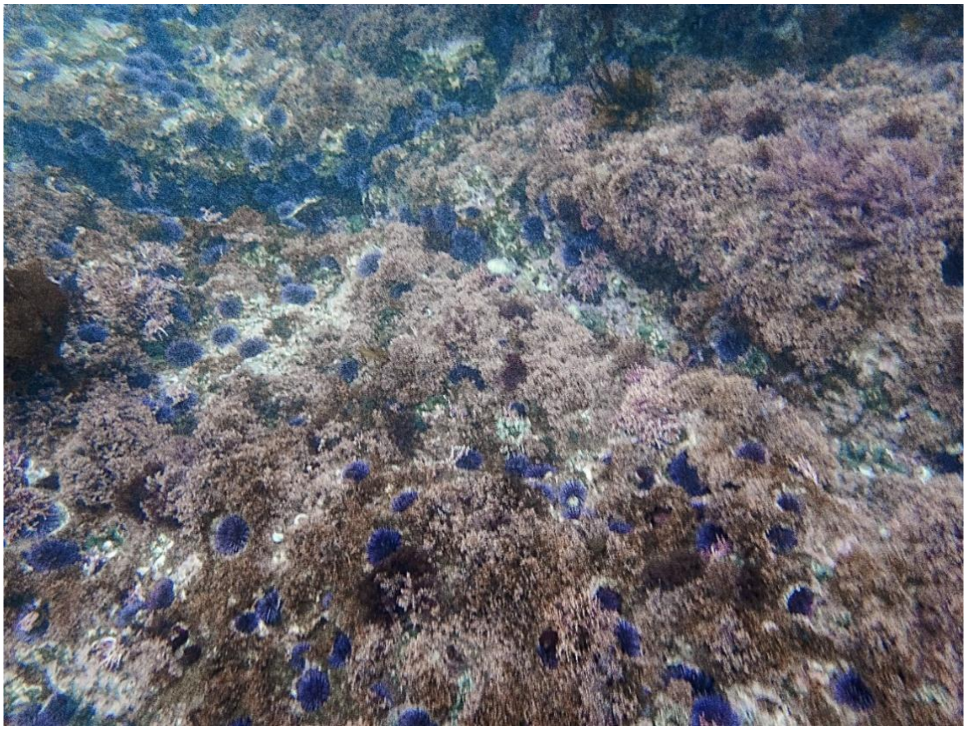
FERM J7 01/16/24

FERM J7 09/26/24

White Point



White Point Block 12 (WPT 12) video transect starts from the center of block 12 and goes 10-meters with a 0-degree heading. Then turns to a 90-degree heading and proceeds 30-meters. GPS: 33.71297, -118.3165


White Point. Shallow depth urchin density conditions. 01/17/2019

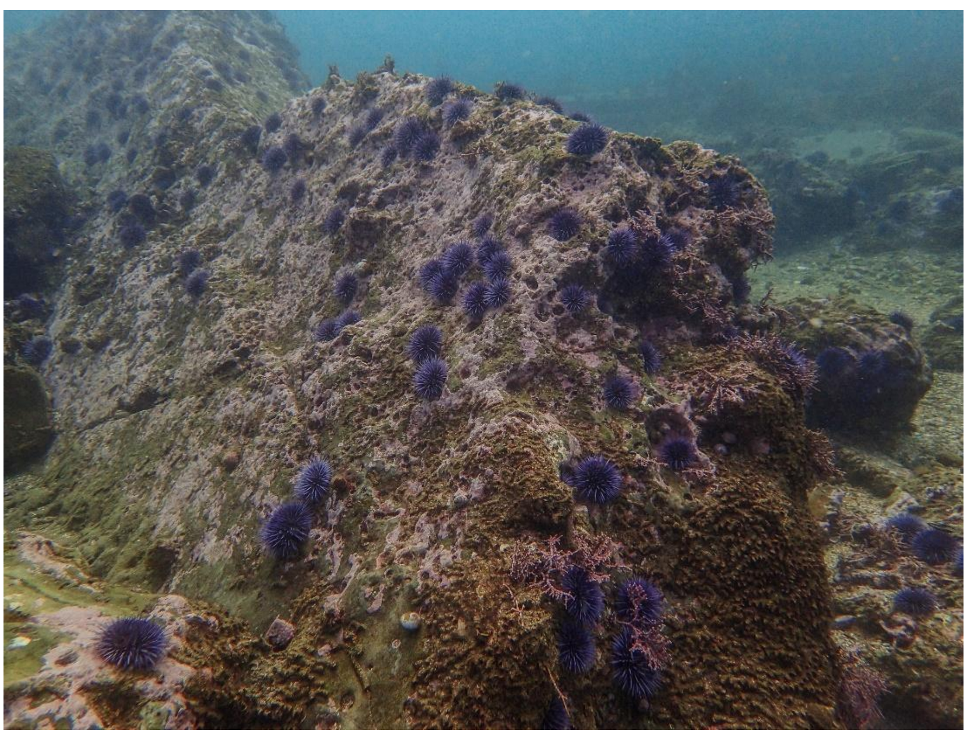
White Point, Block 12 (WPT 12) east-west running ridge with large boulder directly 7-meters from the center of block 12 with a 0-degree heading. Established permanent photo plot. GPS: 33.71297, -118.3165


WPT 12 02/07/2020

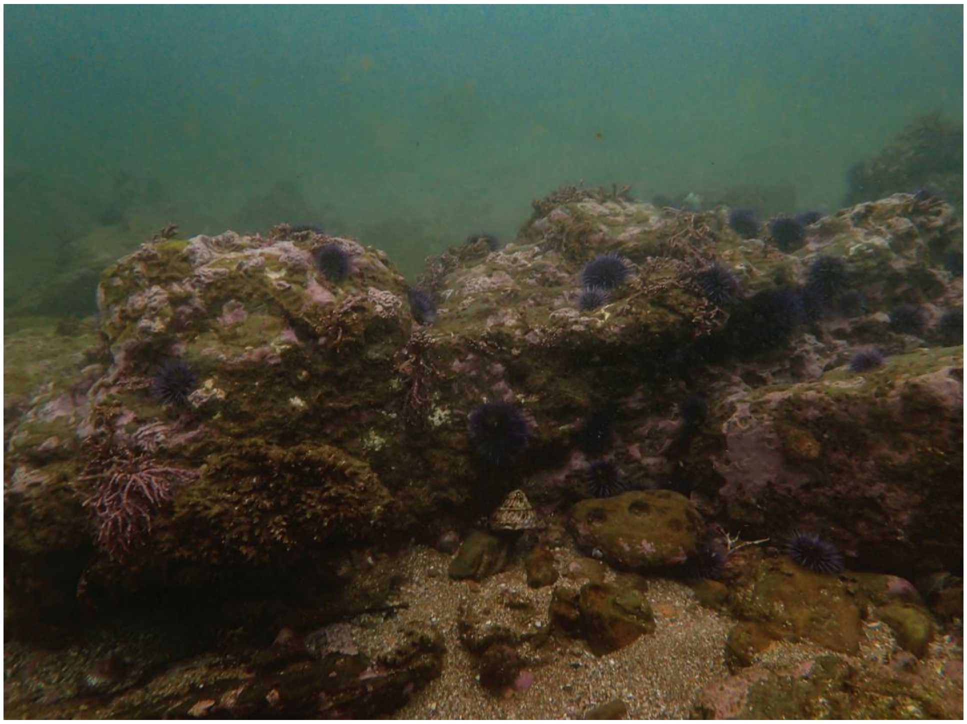
WPT 12 07/24/2020

WPT 12 06/11/2021

WPT 12 08/10/22



WPT 12 11/03/23



WPT 12 07/19/24

2024 Video Transects (video files available by request)

Video transects are recorded annually at specific GPS points per site. Transect lines are drawn on the maps above for each site. Marguerite T10 video transect was discontinued in 2020 due to budgetary restraints, as well as proximity to T16 video transect which displays similar condition.

<u>Files</u>

Honeymoon Cove:
1.0_Honeymooncove_VideoTransect_2024

Underwater Arch Cove:
2.0_UnderwaterArch_006_VideoTransect_2024
2.1_UnderwaterArch_T7-J1_VideoTransect_2024

Marguerite:
3.0_Marguerite_T16-T12_VideoTransect_2024

Hawthorne:
4.0_Hawthorne_VideoTransect_2024

Point Fermin:
5.0_PointFermin_Videotransect_2024

White Point:
6.0_Whitepoint_Videotransect_2024

Timelapse Videos of Sites (video files available by request)
Videos were taken at set blocks per site pre and post restoration. Each video consists of the same transect defined by GPS coordinates during summer months in different years.

Files
Honeymoon Cove:
1.1_Timelapse_HoneymoonCove_Videotransect_2024

Underwater Arch:
2.2_Timelapse_UnderwaterArch_Videotransect_2024

Marguerite:
3.1_Timelapse_Marguerite_Videotransect_2024

Hawthorne:
4.1_Timelapse_Hawthorne_Videotransect_2024

Point Fermin:
5.1_Timelapse_PointFermin_Videotransect_2024

White Point
6.1_Timelapse_Whitepoint_Videotransect_2024