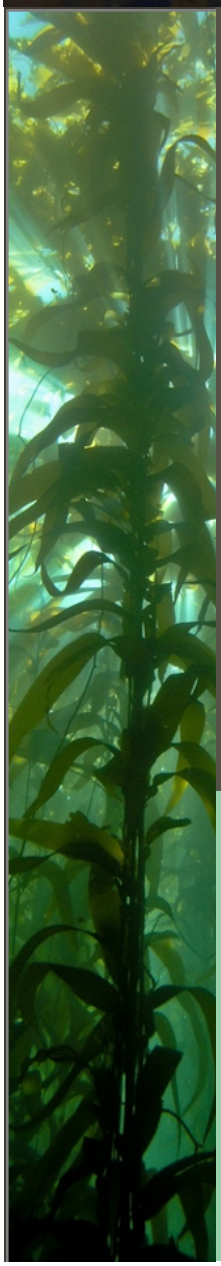

Palos Verdes Kelp Forest Restoration Project

Project Year 9: July 2021 – June 2022 (S-183390001-19133-001)

Prepared for: California Department of Fish and Wildlife

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

A) Kelp Restoration Goals

The *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 the 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. Although restoration activities at Point Fermin were suspended due to funding, beginning in January 2022, restoration activities resumed. White Point, located just north of Point Fermin, was established as a new site in summer 2018. Monitoring and additional surveys of the barren area at White Point have continued beyond the end of the Year 9 reporting deadline, resulting in expanding the total barren area to 15 acres. During this reporting period (Year 9) of July 1, 2021 through June 30, 2022 of the project, all restoration efforts were focused at Point Fermin 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, 2021 through June 30, 2022 are listed in Table 3.

Table 1. Restoration progress by site Years 1-9. Marguerite includes Marguerite North, South and Central. Specific areas restored at Underwater Arch Cove in Years 1-2 were re-cleared in Years 4 and 5 due to infiltration from an assumed *S. purpuratus* refuge population in a large and shallow tide pool. Some areas of Point Fermin that were partially restored in Years 3-5 were re-worked in Year 9.

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	Total Area (acres)
Honeymoon Cove	4.84	3.56	0	0	0	0	0	0	0	8.40
Underwater Arch Cove	3.77	4.49	0	2.34	0.28	0	0	0	0	10.88
Marguerite	0	5.07	3.68	5.27	0	0	0	0	0	14.01
Hawthorne	0	2.72	1.56	0	0.89	0	0	0	0	5.17
Point Fermin	0	0	3.93	1.13	0.22	0	0	0	0.89	6.17
Resort Point	0	0	0	0	3.78	0.22	0	0	0	4.00
White Point	0	0	0	0	0	3.11	4.38	1.33	1.33	10.15
Total Area	**8.61**	**15.84**	**9.16**	**8.74**	**5.17**	**3.33**	**4.38**	**1.33**	**2.22**	**58.77**

Table 2. Total diving effort to meet project goals Years 1-9.

July 1, 2013 - June 30, 2022		
Effort (dive hours)	**Monitoring**	**Restoration**
The Bay Foundation	2,326	88
Commercial Sea Urchin Harvesters	0	7,887
LA Waterkeeper	133	1,031
Subtotal	2,459	9,006
Total Dive Hours	**11,465**	

Table 3. Restoration areas targeted for July 1, 2021 through June 30, 2022. Restoration work will target the sites listed in the table below. 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 7.1.2021-6.30.2022 (Acres)	Status	Centroid
Point Fermin	15	July 2015	6.17	0.89	In progress	33.704, -118.291
White Point	15	July 2018	8.82	1.33	In progress	33.713, -118.315

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	11/4/13	1/6/15	Constant work, no inactive periods
Underwater Arch Cove	7/31/13	1/6/15	Main restoration accounting for 8.26 acres; Intrusion from tidepool requiring additional clearing in 2.62 acres from 4/7/17 - 7/6/17.
Marguerite	10/2/15	6/23/17	6 month break from 11/24/15 - 6/27/16 on account of wasting disease.
Hawthorne	1/20/15	5/31/16	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	7/22/15	In Progress	Initial work from 7/22/15 through 2/4/16; 7 month break until 10/7/16 where work continued til 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.
Resort Point	9/20/17	7/3/18	Constant work, no inactive periods.
White Point	7/10/18	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 have begun again during the year 9 reporting period and are ongoing.

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 (below) 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. Thus far these sites have only been monitored and will continue to be monitored as part of the experimental design of the overall project. 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 started as a control site but switched to a restoration site in 2015.			

C) Pre-Restoration Monitoring

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 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 pre-restoration site maps (Figure 1) are derived from data collected along the five 2m x 30m swaths per restoration block. The values of those data are extended and applied to the adjacent transects representing 6m x 30m swaths to estimate the total abundance of *M. franciscanus* and *S. purpuratus* pre-restoration and display the full block area on the maps. 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 9 of the project, pre-monitoring activities occurred at White Point and Point Fermin (Figure 1). Restoration efforts began at White Point in July 2018 and are currently ongoing, as unrestored areas of the site are characterized by little to no fleshy macroalgae and high *S. purpuratus* densities. Reef topography is predominantly middle to low relief substrate comprised of sand, cobbles, boulders, and bedrock. Specific areas of Point Fermin were previously restored between July 2015 – December 2016. Visual surveys in 2020 and 2021 of Point Fermin reported an influx of *S. purpuratus* to the area. Therefore, in collaboration with SeaTrees and Force Blue, restoration was started again in January 2022. The following map displays the estimated *S. purpuratus* densities before restoration activities for areas pre-monitored in Year 9 at each site [within each 10m segment]. Site maps are also included in Appendix A.

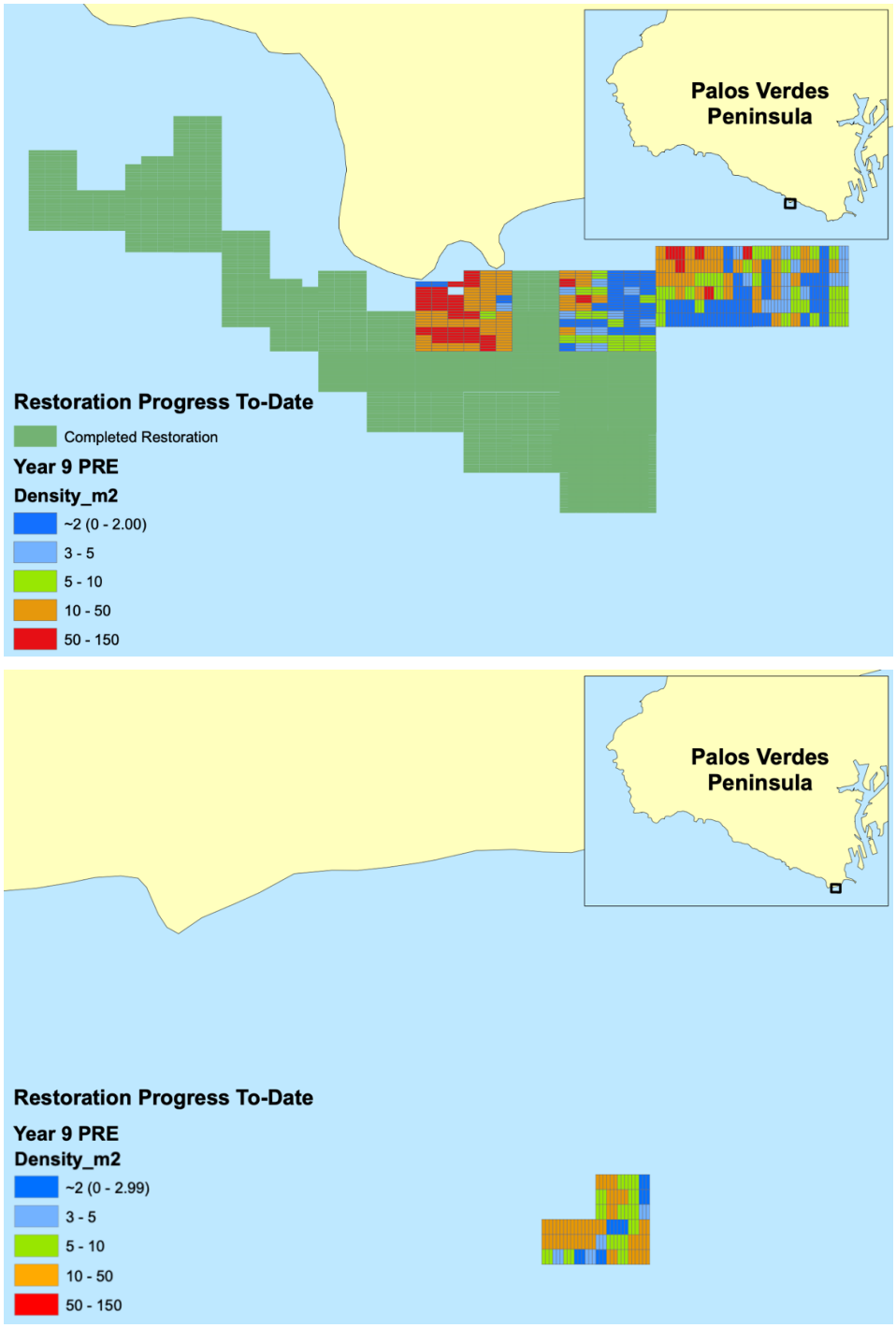

Figure 1. Density of *S. purpuratus* (individuals per square meter) pre-restoration at White Point (**top**) and Point Fermin (**bottom**), Palos Verdes Peninsula, California. Black square in the inset map indicates the White Point and Point Fermin locations in reference to the peninsula. Average *S. purpuratus* densities for White Point and Point Fermin were 10.6 and 14.4 per m^2, with some localized areas exceeding 75 per m^2 (ESRI 2021).

D) Monitoring of all Permitted sites

i. Monitoring Timeline

Table 6. Restoration and monitoring timeline July 2021 - August 2022.

Task	2021						2022					
	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	June
Urchin Suppression												
Compliance Monitoring												
Response Monitoring												
Analysis and Reporting												

Compliance Monitoring (July 2021 through June 2022)
Monitoring is conducted weekly to bi-monthly depending upon the rate of activity of restoration teams in the preceding week. These sites maintain very high *S. purpuratus* densities, limiting macroalgae settlement 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 White Point and Point Fermin (less than 20ft 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 is adamant to take advantage of all workable weather opportunities that allow for safe 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 2 displays the estimated *S. purpuratus* densities after restoration activities within each 10m segment of White Point 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.

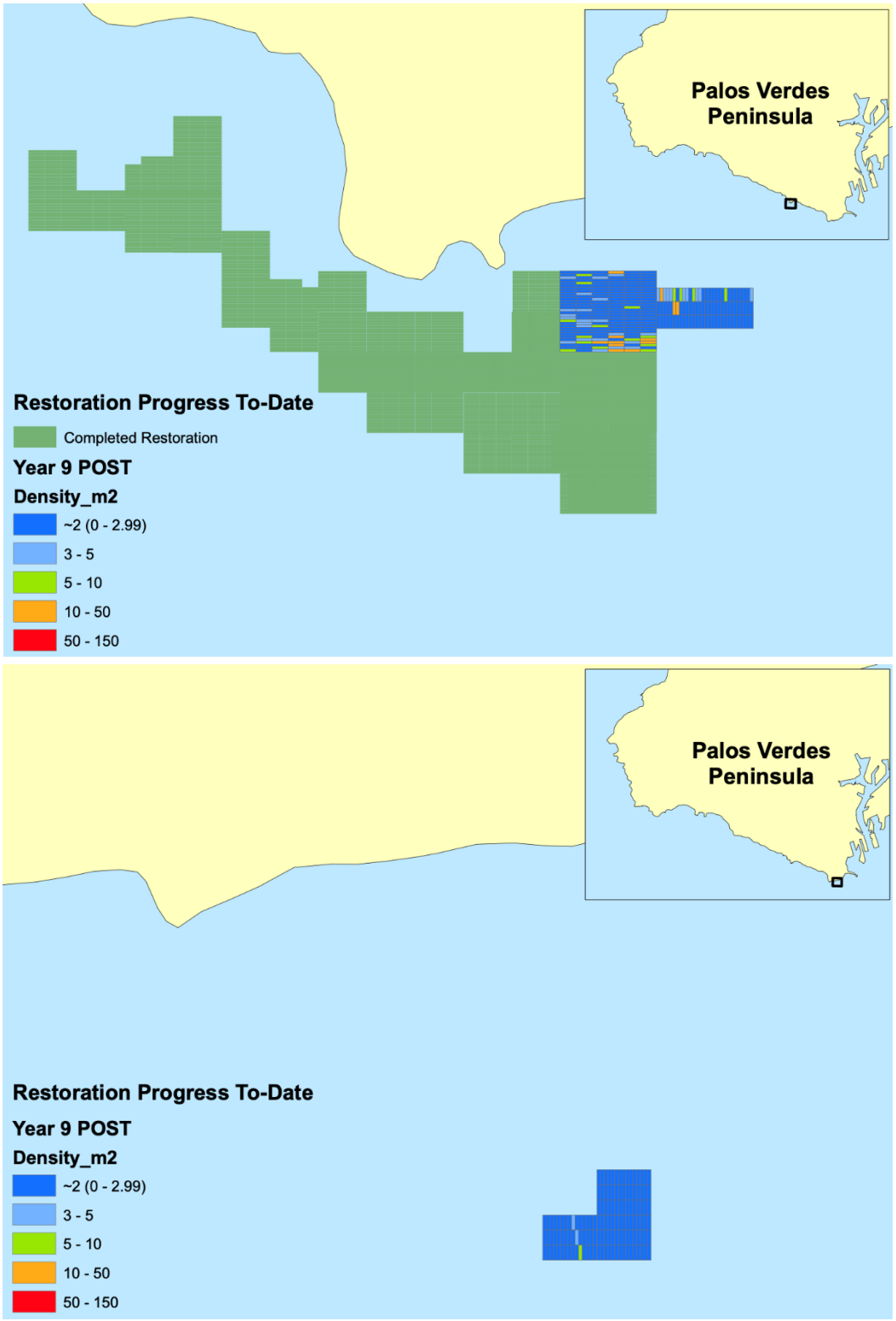

Figure 2. Density of *S. purpuratus* (individuals per square meter) post-restoration at White Point (**top)** and Point Fermin (**bottom**), Palos Verdes, California. Black square in the inset map indicates where the restoration areas are located off Palos Verdes. Average *S. purpuratus* densities for White Point and Point Fermin were 2.02 and 1.3 per m^2 after restoration is (ESRI 2021).

Response Monitoring (June 2021 through July 2022)
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.

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 4,388,103, therefore reducing the overall average density across sites from 18.9 per m^2 to 1.44 per 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 fine sediment. Also, the cryptic nature of *S. purpuratus* indicates that the average density is likely higher than observed during compliance 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, 2022)
Specific areas restored at Underwater Arch Cove in Years 1 and 2 were re-cleared in Years 4 and 5 due to the infiltration of *S. purpuratus* from a refuge population existing in a shallow tide pool. Some areas of Point Fermin that were partially restored in Years 3-5 were re-cleared in Year 9.

Site Name	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Total by Site
Underwater Arch Cove	503,189	762,649	0	35,866	9,348	0	0	0	0	1,311,050
Honeymoon Cove	821,425	514,811	0	0	0	0	0	0	0	1,336,236
Hawthorne Cove	0	136,997	60,320	0	8,778	0	0	0	0	206,095
Marguerite	0	378,523	151,114	47,847	0	0	0	0	0	577,483
Point Fermin	0	0	160,862	27,263	6,529	0	0	0	59,388	254,042
Resort Point	0	0	0	0	49,632	8,559	0	0	0	58,191
White Point	0	0	0	0	0	330,686	230,479	50,105	33,736	645,006
Total Urchins Culled	**1,324,613**	**1,792,979**	**372,296**	**110,975**	**74,287**	**339,245**	**230,479**	**50,105**	**93,124**	**4,388,103**

Justification for Removal:
The measurement of gonad development in *M. franciscanus* and *S. purpuratus* is an important measure of secondary production in the kelp forest ecosystem and will be used to inform adaptive management of the restoration project and inform research related to kelp forests and associated fisheries. During the Year 8 and 9 reporting periods, urchin collections did not occur due to volunteer restrictions put in place during COVID-19. As restrictions are lifted, TBF hopes to collect urchins for GSI studies during the Year 10 reporting period.

ii – i: Field Condition Notes
Restoration activities have been conducted at two sites (White Point and Point Fermin) throughout the Year 9 reporting period. 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) were challenging for the restoration and monitoring efforts for much of 2015 and winter 2016. It is also important to note that the timing of the response monitoring for fish and other community responses to the restoration efforts were conducted in the late spring and early summer in 2011-2014, with only two exceptions in 2011, (i.e., Honeymoon Cove and Point Vicente West were monitored on 1-28-2011 and 10-12-2011 respectively). In 2015, the surveys were conducted within the month of September, except for Honeymoon Cove which was surveyed on 8-19-2015. In 2016, two rounds of surveys were conducted in spring and summer. In 2017 and 2018, all surveys were conducted in late June and July. This shift in seasonality may impact some species, differentially

skewing the data. Perhaps more significant is the strong ENSO signature elevating sea surface temperatures throughout 2015, with persistent surface temperatures off Palos Verdes neighboring 20 degrees Celsius. These abnormally high temperatures are known to affect species composition within southern California rocky reef systems. Surveys in 2019 were performed in mid-June. Surveys from 2020-2022 were performed in late June through early August.

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

	Survey Dates												
Designation	**Site**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Restoration	Underwater Arch Cove	2/7/11	6/12/12	6/13/13	7/11/14	9/23/15	6/22/16	7/18/17	6/22/18	6/12/19	6/26/20	Aug-21	Aug-22
	Honeymoon Cove	1/28/11	3/13/12	5/31/13	7/2/14	8/19/15	6/22/16	7/18/17	6/22/18	6/12/19	6/24/20	Aug-21	Aug-22
	Hawthorne	5/3/11	6/12/12	6/11/13	6/19/14	10/7/15	9/30/16	8/25/17	7/11/18	6/14/19	6/26/20	Aug-21	Aug-22
	Marguerite Central	5/3/11	6/8/12	7/3/13	6/20/14	9/23/15	7/26/16	7/18/17	7/20/18	6/28/19	7/9/20	Aug-21	Aug-22
Reference	Ridges North	8/12/11	7/17/12	4/26/13	10/29/14	9/11/15	6/3/16	6/30/17	7/11/18	6/12/19	7/23/20	Aug-21	Aug-22
	Rocky Point North	6/24/11	6/29/12	7/2/13	7/11/14	9/25/15	6/10/16	6/29/17	7/6/18	6/19/19	7/2/20	Aug-21	Aug-22
	Point Vicente West	10/12/11	8/10/12	4/24/13	4/18/14	9/23/15	6/22/16	7/25/17	7/18/18	6/14/19	8/14/20	Aug-21	Aug-22

	Bottom Temperature (ºC)												
Designation	**Site**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Restoration	Underwater Arch Cove	15.0	19.0	15.0	15.8	21.5	15.0	18.5	18.0	15.5	16.0	NA	NA
	Honeymoon Cove	15.0	11.5	18.0	16.5	18.8	16.2	20.3	18.3	15.8	16.0	NA	NA
	Hawthorne	14.4	19.0	17.0	17.0	21.0	18.0	16.8	20.6	16.0	15.0	NA	NA
	Marguerite Central	15.0	17.0	17.0	20.0	22.0	14.0	20.0	20.0	18.0	19.7	NA	NA
Reference	Ridges North	18.0	16.6	13.7	19.8	21.0	15.0	17.9	22.0	16.5	12.6	NA	NA
	Rocky Point North	18.0	15.0	18.0	21.0	21.0	14.3	16.8	19.5	16.5	17.0	NA	NA
	Point Vicente West	11.0	19.0	13.2	13.5	21.0	15.2	19.7	19.5	16.5	16.2	NA	NA

	Coordinates		
Designation	**Site**	**Latitude**	**Longitude**
Restoration	Underwater Arch Cove	33.75291	-118.41499
	Honeymoon Cove	33.76459	-118.42406
	Hawthorne	33.75068	-118.41558
	Marguerite Central	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 slightly 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).

Designation	Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Restoration	Underwater Arch Cove	6	9	6	12	8	8	11	9	9	9	8	8
	Honeymoon Cove	0	2	4	8	5	12	7	8	8	5	5	6
	Marguerite Central	6	10	10	9	11	11	8	9	12	9	11	12
	Hawthorne	10	6	8	7	10	13	12	12	12	7	9	8
Reference	Ridges North	6	11	7	6	5	10	5	12	8	7	5	3
	Rocky Point North	8	8	8	9	6	7	9	11	8	4	6	6
	Point Vicente West	8	6	10	11	12	14	9	11	10	12	8	8

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 (2016-2022) 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). *M. pyrifera* densities increased in 2020 across both restoration and kelp reference sites, except for Underwater Arch Cove. *M. pyrifera* densities decreased in 2021 across both restoration and kelp reference sites, except for the Hawthorne restoration site, which showed increases in density compared to 2019 and 2020. In 2022, stipe density increased in all sites except for Underwater Arch Cove and Marguerite Central. Differences in stipe density post-restoration are likely explained by natural inter and intra-annual variation; e.g., kelp canopy cover, transmissivity, temperature, nutrient availability, and upwelling It should be noted that restoration events did coincide with a natural mass mortality event that contributed to decreased urchin density.

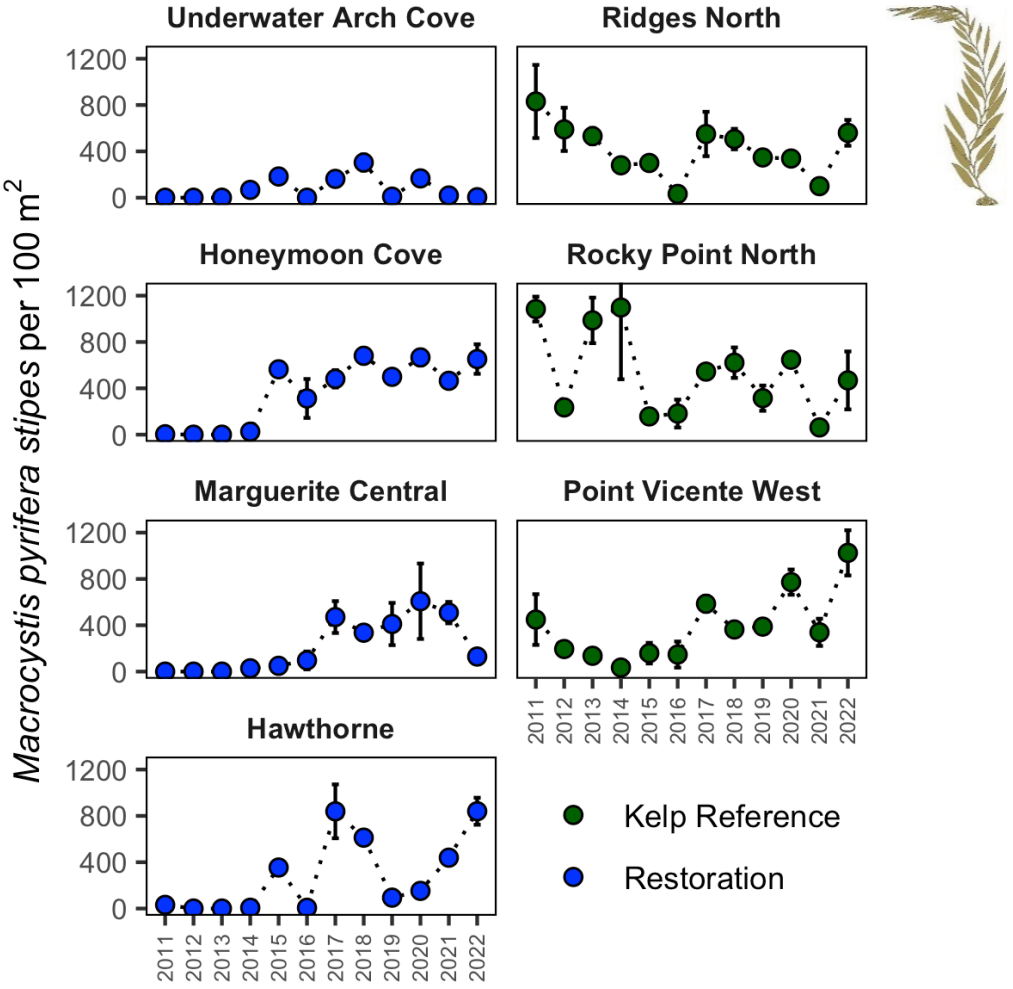

Figure 3. *Macrocystis pyrifera* stipe density (individuals per 100 m^2). Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site

Marguerite Central (previously a control site) and was completed in the Spring of 2017. Stipe density was not significantly different by site designation in 2022 (t= -1.05, p=0.343).

Mesocentrotus franciscanus* and *Strongylocentrotus purpuratus

Both *M. franciscanus* and *S. purpuratus* densities began declining in 2013-2014 (Figures 4 & 5). Their numbers remained low until the end of Year 5 when pulses of urchins (mainly *S. purpuratus*) were observed in several areas off the peninsula. Although 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 2014-2015 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. A small uptick in *M. franciscanus* and *S. purpuratus* were recorded during community analysis surveys for Year 5 for both species. In Year 6, we saw a small increase in *M. franciscanus* density and a small decrease in *S. purpuratus* density. In Year 7, we saw a small decrease in both *M. franciscanus* and *S. purpuratus* densities. In Year 8, at restoration sites, we saw increases in the number of *S. purpuratus* observed in Hawthorne and Underwater Arch Cove, but negligible change at Honeymoon Cove and Marguerite sites. In Year 9, for *M. franciscanus*, we saw increased density at all restoration sites, but no change for reference sites. For *S. purpuratus* in restoration sites, we saw an increase in density at Underwater Arch Cove, a decrease at Hawthorne, and stable densities at Honeymoon Cove and Marguerite Central. No changes were observed in *S. purpuratus* densities at reference sites. As for *M. franciscanus* in Year 9, the site types were significantly different with restoration sites showing slight increases, while reference sites displayed negligible change. For *S. purpuratus* in Year 9, the site types were not considered significantly different, although a sharp increase at Underwater Arch Cove was observed.

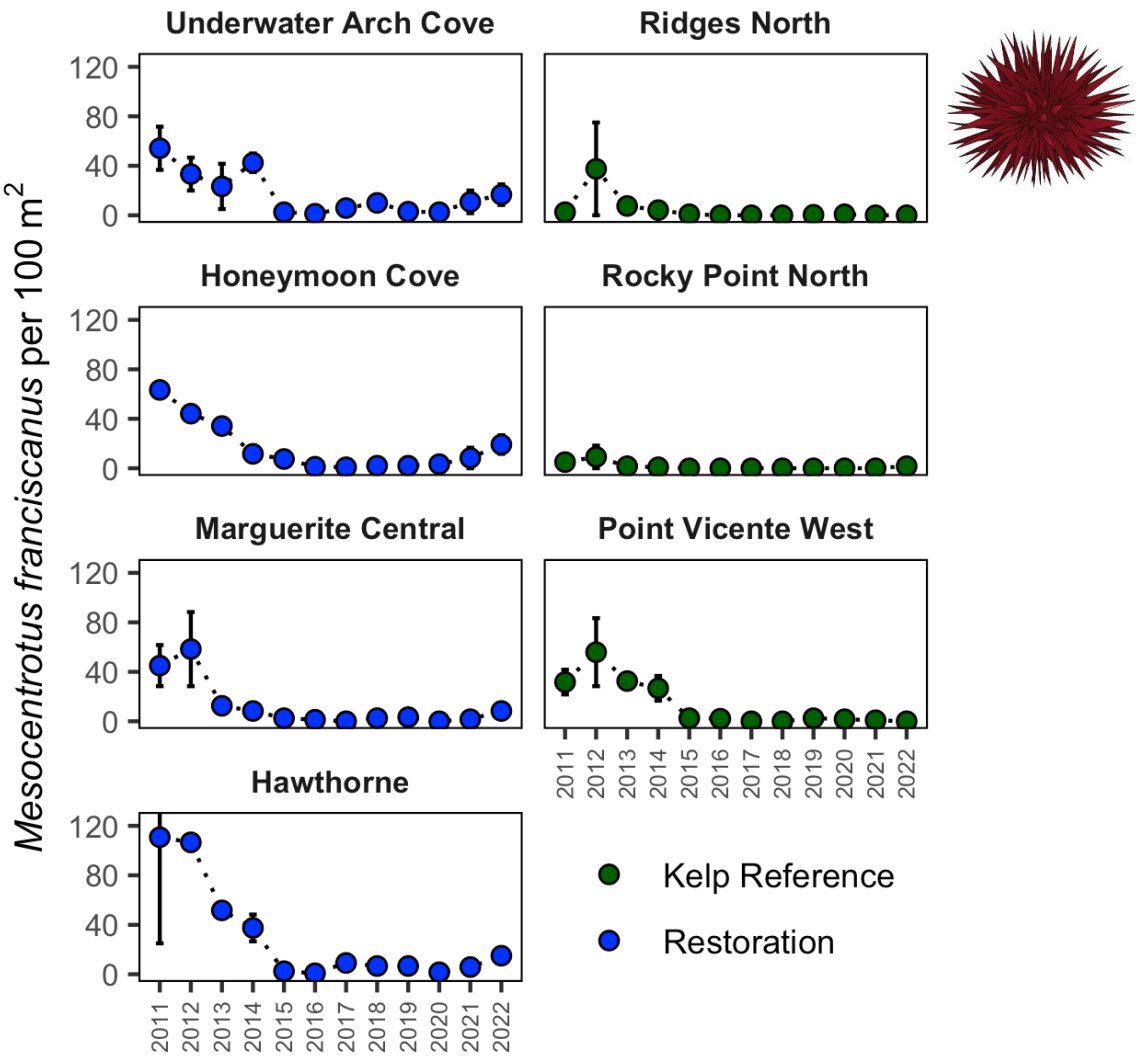

Figure 4. *M. franciscanus* density (individuals per 100 m^2). Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *M. franciscanus* density was significantly different by site designation in 2022 (t= 5.98, p= 0.007).

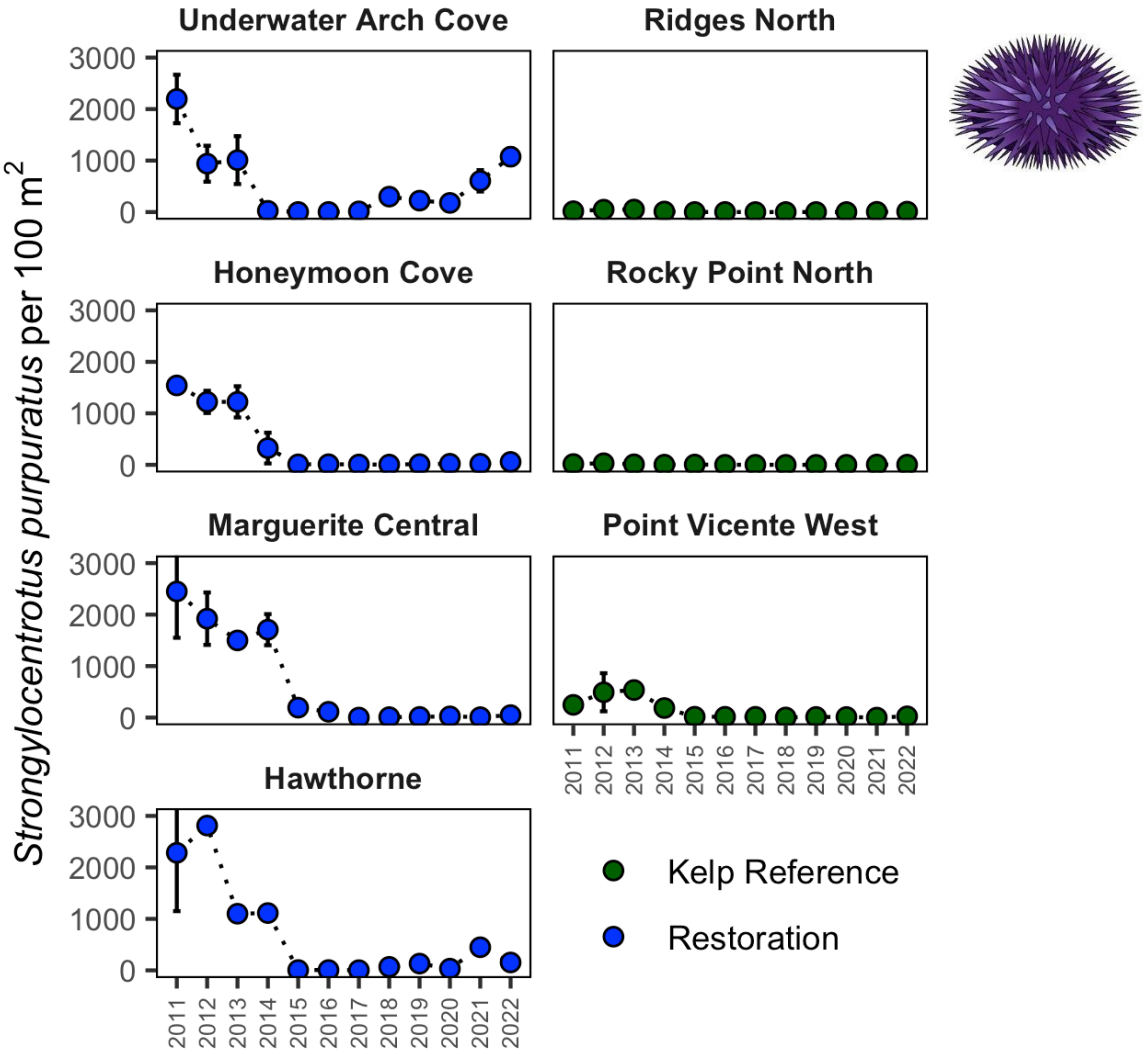

Figure 5. *S. purpuratus* density (individuals/100 m^2). Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *S. purpuratus* density was not significantly different by site designation in 2022 (t= 1.29, p = 0.287).

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 6). 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 Year 9 (2022), abundance levels increased in both restoration and reference sites with numbers in the reference sites surpassing all previous years dating back to 2011. 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.

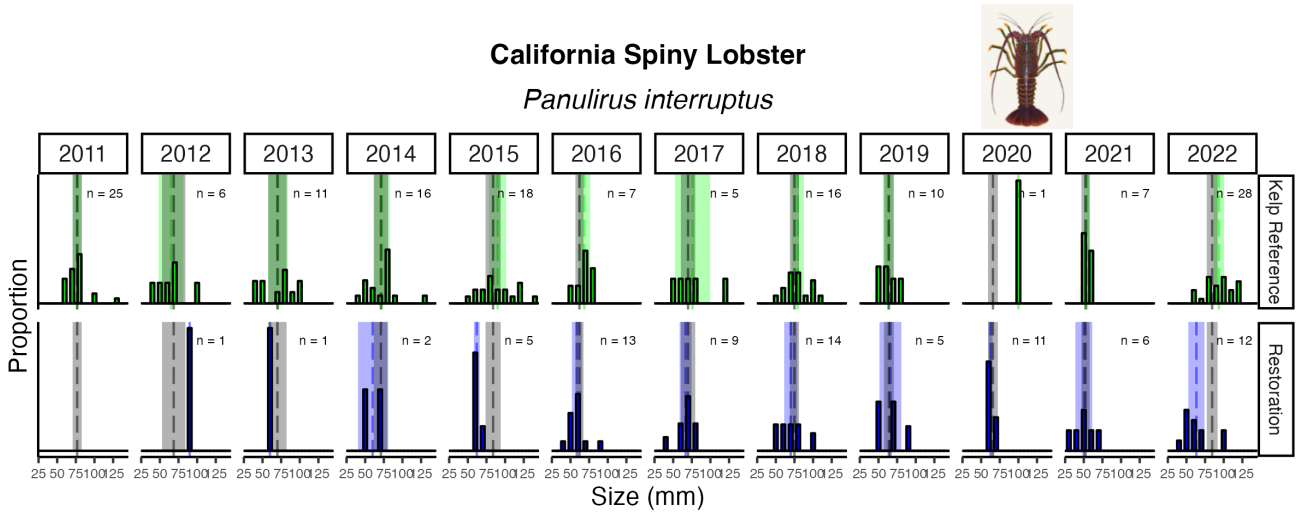

Figure 6. Mean *P. interruptus* density (Individuals per 100 m^2) and size at kelp forest reference sites shown in green (Ridges North, Rocky Point North, and Point Vicente West) and restoration sites shown in blue (Underwater Arch, Honeymoon Cove, Marguerite Central and Hawthorne).

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 7 & 9). In the surveys conducted in 2018, kelp bass density and biomass indicated an increasing trend since being restored and were on par with kelp forest reference sites. This increased number of kelp bass could be due to a multiyear increase and persistence of *M. pyrifera* within these restoration sites. During 2020 surveys, the overall kelp bass density for reference sites increased, while there was a slight decline in overall density for restoration sites. This was punctuated by a steeper decline from Marguerite Central from 2019 to 2020, most likely associated with impacts from the increased sedimentation on the reef resulting from the coastal bluff slough that occurred in spring 2019. During 2021 surveys, *P. clathratus* increased in density at Underwater Arch, Marguerite, Hawthorne, and Ridges North Sites, while Honeymoon, Rocky Point North, and Point Vicente West decreased. During 2022 surveys, *P. clathratus* decreased in density at all restoration sites, as well as the Ridges North reference site. However, there was slight increase in density at reference sites Rocky Point North and Point Vicente West. Biomass trends were different with increased biomass observed at restoration site Marguerite Central and reference site Point Vicente West. Overall, density and biomass in restoration sites depict the same trends as kelp reference sites, with no significant difference by site type.

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. Restoration sites may have a larger density compared to reference sites, yet smaller biomass, on account of fishing pressure for larger sized individuals, thus leaving a high abundance of smaller sized fish in restoration sites. In 2022, 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 8 & 10). Surveys from 2022 continue to exhibit this annual variation, with various sites displaying slight increases in density and biomass from 2021, while other sites show slight decreases. However, density and biomass in restoration sites depict the same trends as kelp reference sites, with no significant difference by site type.

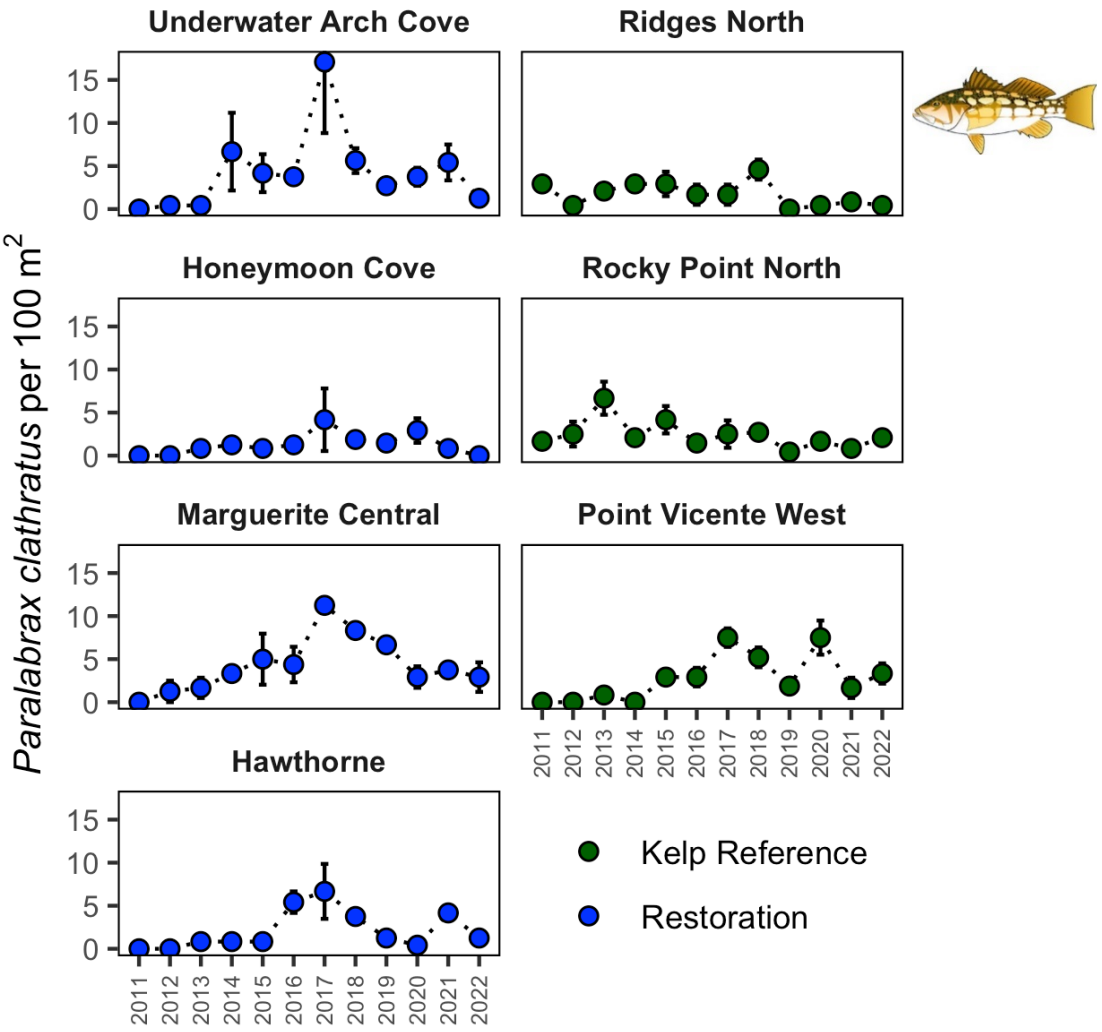

Figure 7. Density of *P. clathratus* by site type: restoration and reference. Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *P. clathratus* density was not significantly different by site designation in 2022 (t = -0.57, p = 0.6).

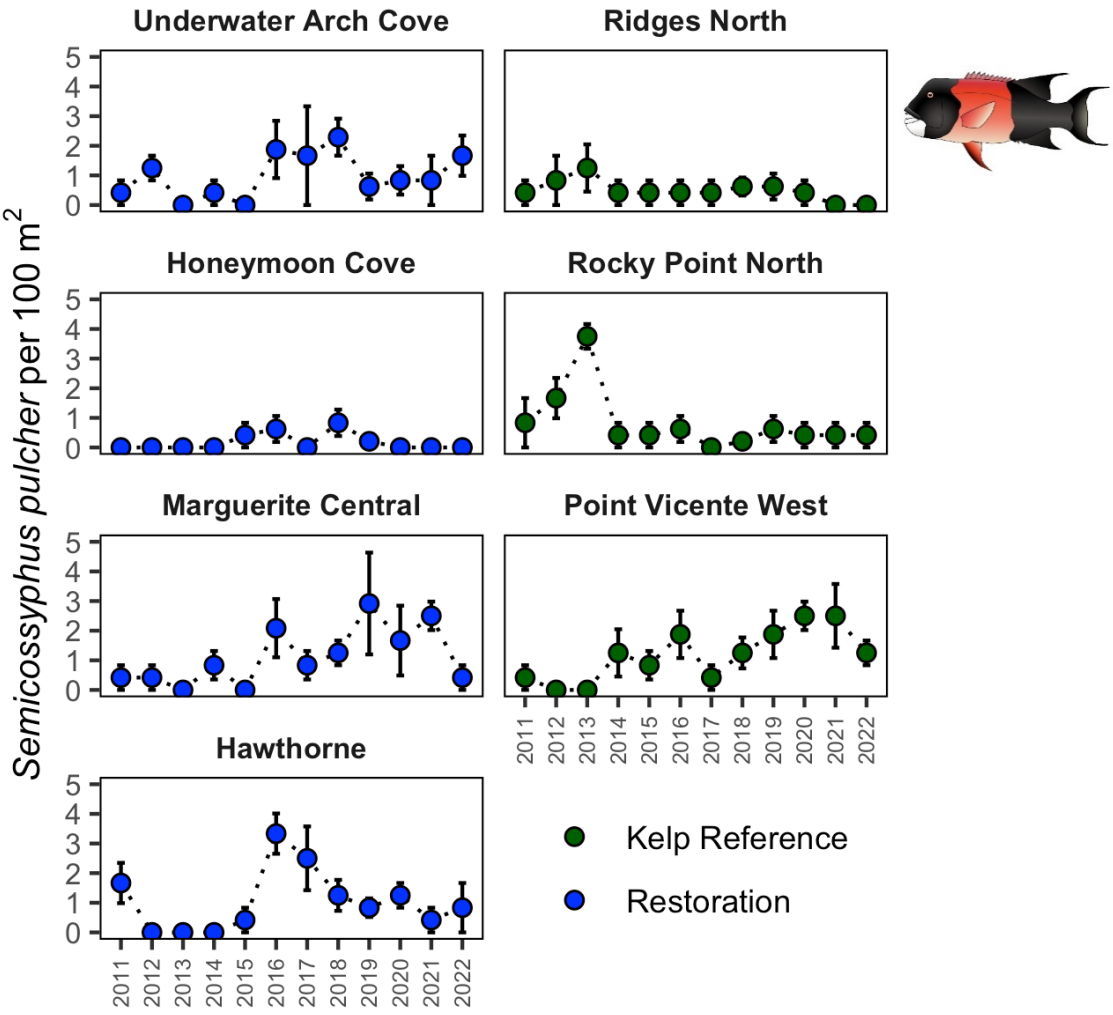

Figure 8. Density of *S. pulcher* by site type: restoration and reference. Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *S. pulcher* density was not significantly different by site designation in 2022 (t = 0.34, p = 0.749).

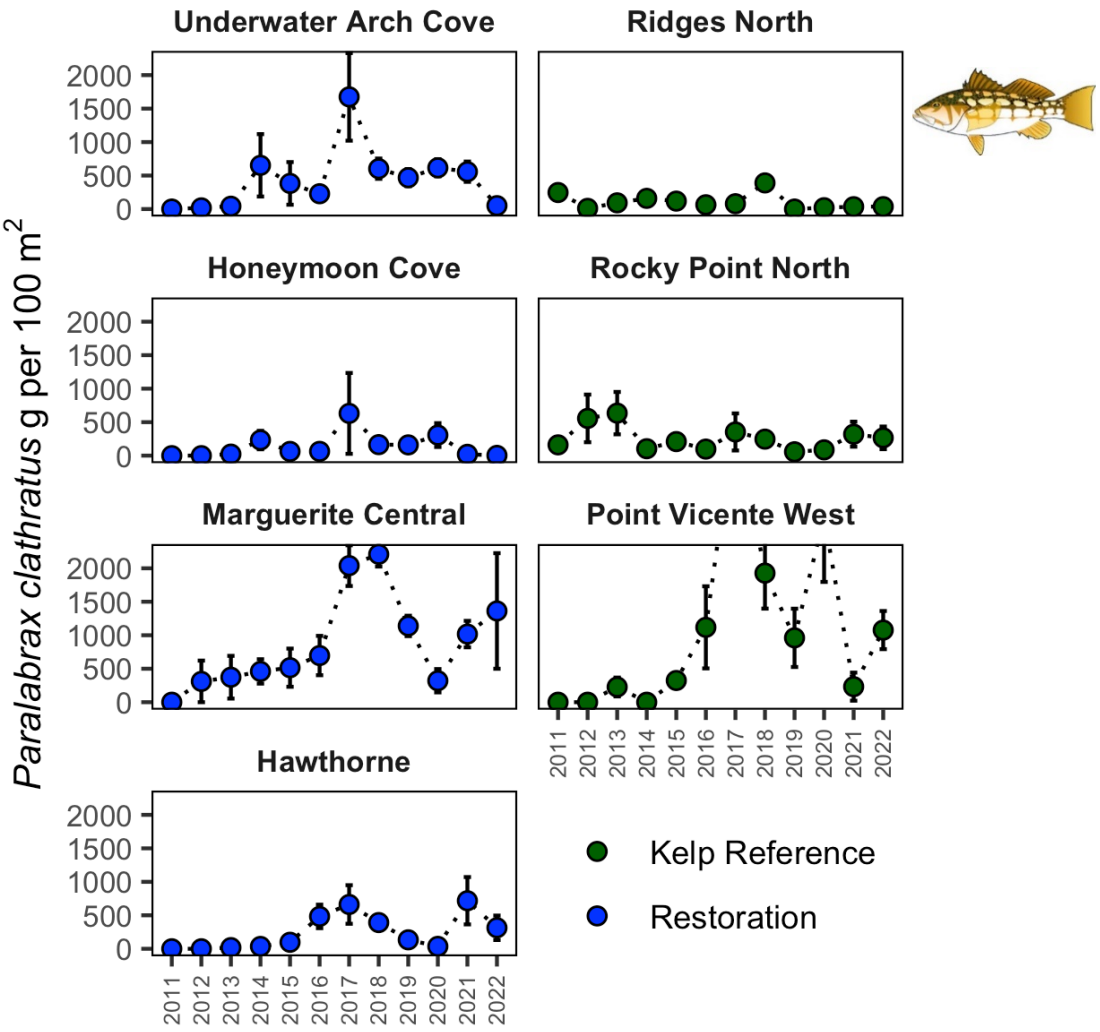

Figure 9. Biomass of *P. clathratus*, per 100 m^2, by site type: restoration and reference. Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *P. clathratus* biomass was not significantly different by site designation in 2022 (t = -0.06, p = 0.955).

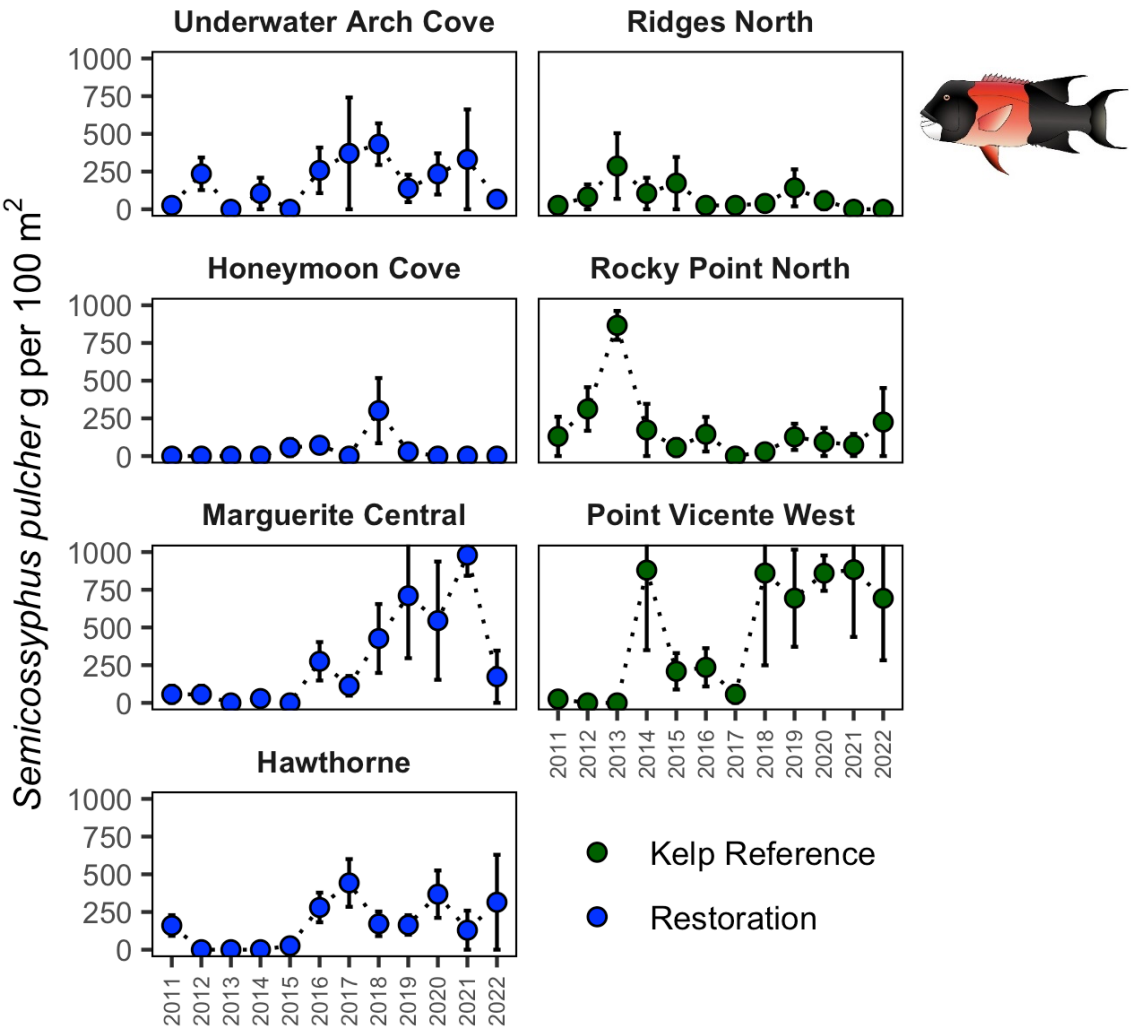

Figure 10. Biomass of *S. pulcher*, per 100 m^2, by site type: restoration and reference. Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration began in 2015 at the site Marguerite Central (previously a control site) and was completed in the Spring of 2017. *S. pulcher* biomass was not significantly different by site designation in 2022 (t = -0.78, p = 0.504).

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. 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 11). 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. In 2022, restoration sites mimic diversity index measurements for kelp reference sites for both algal/invertebrate diversity and fish diversity (Figure 11 & 12).

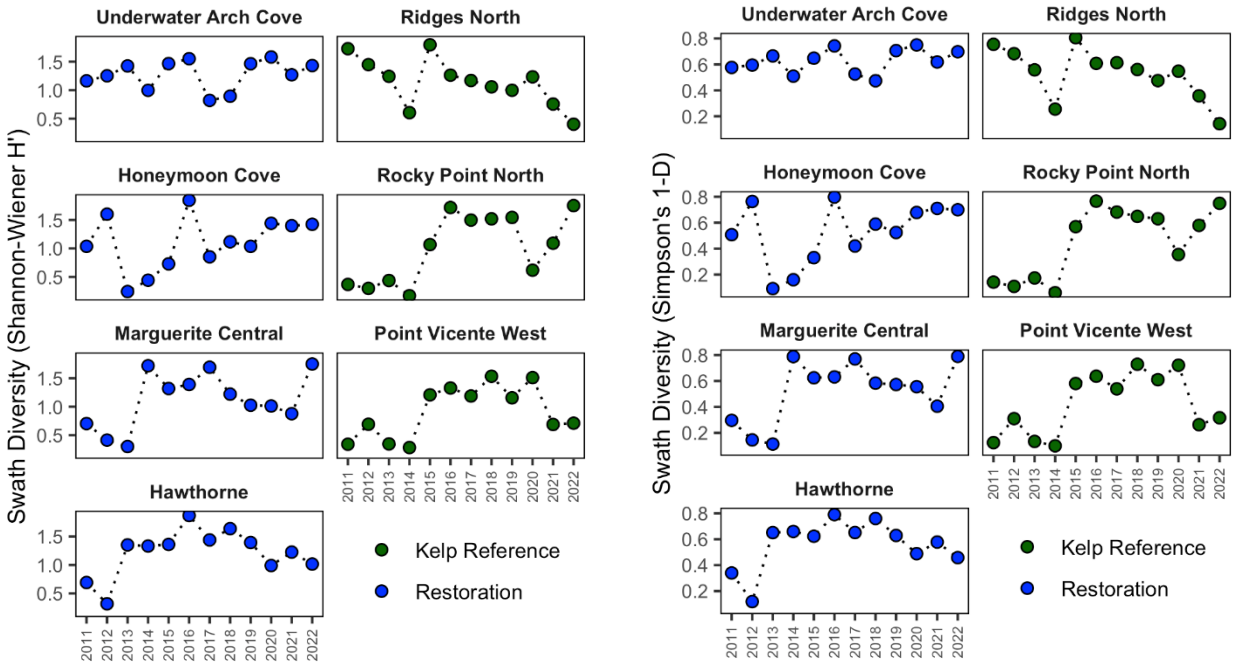

Figure 11. Algal and invertebrate diversity at restoration sites (Underwater Arch, Honeymoon Cove, Marguerite Central and Hawthorne) and reference sites (Ridges North, Rocky Point North, and Point Vicente West). Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 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, Shannon-Wiener (t= 1.03, p= 0.389) (Left) and Simpson's Diversity (t= 1.33, p= 0.286) (Right), were not significantly different by site designation in 2022.

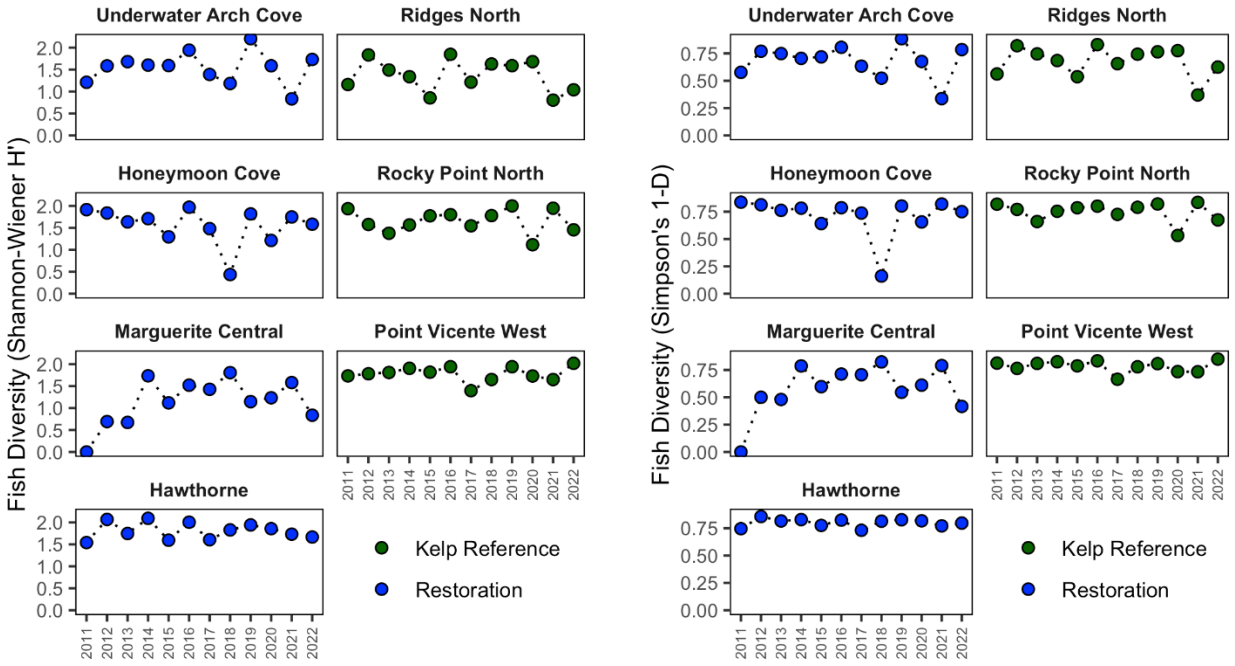

Figure 12. Fish diversity at restoration sites (Underwater Arch, Honeymoon Cove, Marguerite Central and Hawthorne) and reference sites (Ridges North, Rocky Point North, and Point Vicente West). Sites Underwater Arch, Honeymoon Cove, and the majority of Hawthorne were restored as of 2015. Restoration 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= -0.14, p= 0.893) (Left) and Simpson's Diversity (t= -0.26, p= 0.807) (Right), were not significantly different by site designation in 2022.

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 Year 8 and 9 annual 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 currently have an urchin gonad publication in review that will be shared with CDFW upon acceptance.

F) <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 18) and fish biomass (Figure 19) 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.

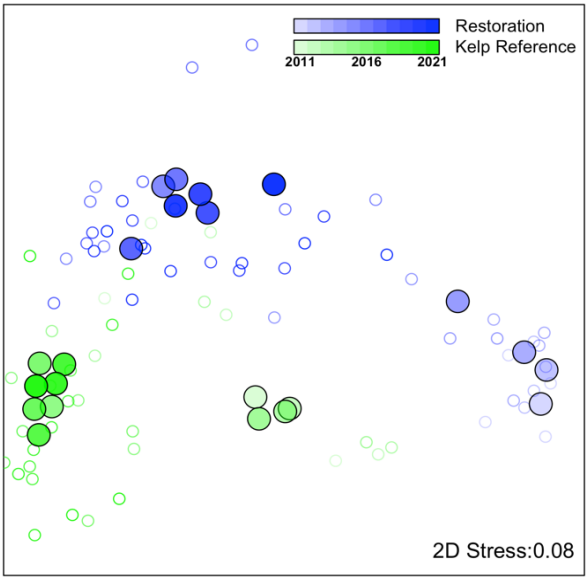

Figure 18. Two-dimensional Non-metric multidimensional ordination plot of kelp and macroinvertebrate communities using Bray-Curtis similarity based on the square-root transformed mean taxa density for each site/sampling period combination (Note: this kelp and macroinvertebrate plot was not updated with the 2022 data).

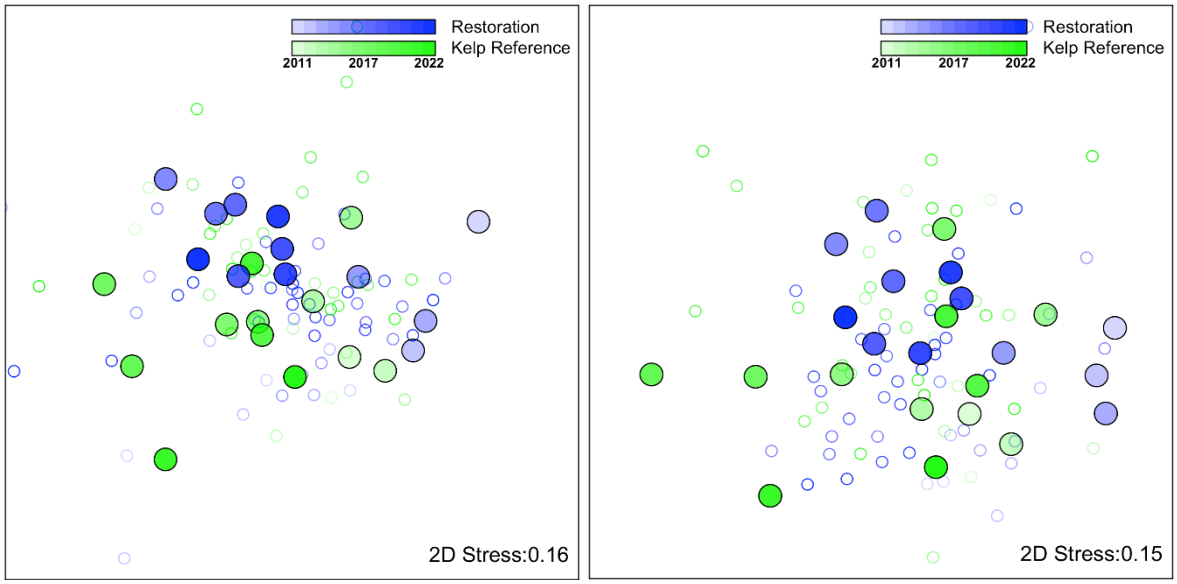

Figure 19. (Left) Two-dimensional Non-metric multidimensional ordination plot of fish biomass using Bray-Curtis similarity based on the square-root transformed mean taxa density for each site/sampling period combination. (Right) Two-dimensional nMDS plot of fish density for each site/sampling period 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* 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.

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

A few statements can be made that generally describe conditions during this project that directly impacted the amount, type, and accuracy of work conducted. 2015-2016 proved to be one of the most powerful El Niño signatures recorded on the west coast of the United States. This El Niño event followed, and was perhaps strengthened, by the persistence of "the blob", a large area of atypically warm ocean surface water that impacted the California Current. For Palos Verdes and elsewhere in southern California, these environmental factors resulted in abnormally high sea surface temperatures, which were only punctuated periodically by localized upwelling events. The thermal related stress associated with the confluence of these stressors slowed or prevented the development of *M. pyrifera* and other macroalgae and may have contributed to the virulence and mass wasting of several genera of *Pisaster* spp. and in the fall of 2015, a seemingly similar, yet less widespread or virulent wasting of *M. franciscanus* and *S. purpuratus.* In 2016, the project failed to collect a sufficient number of *M. franciscanus*, and individuals were not collected from barren sites for dissections. During 2019, the project was only able to collect one *M. franciscanus* from a barren site. There are currently no signs of widespread mass wasting disease off Palos Verdes. During pre and post monitoring surveys, divers utilize flashlights to more accurately and efficiently quantify *M. franciscanus* and *S. purpuratus* in active restoration sites.

During 2017-2018 (Year 5 of the project), *M. franciscanus* and *S. purpuratus* densities rose noticeably, and TBF chose several areas of concern to begin restoration efforts. These sites (mainly Resort Point and a new area of Hawthorne, as well as minor work in Underwater Arch Cove and Point Fermin) consisted of high *S. purpuratus* densities, but also supported high biomass of fish, invertebrates, and *M. pyrifera*. The work done in these sites were to cull *S. purpuratus* numbers to prevent these reefs from reverting to pre-2015 barrens. Near the beginning of summer 2018 more reef was identified as having high *S. purpuratus* densities, and White Point was chosen as the most problematic. This site had developed into an *S. purpuratus* barren, devoid of macroalgae besides coralline algae, and a 2018 average density of 24.24 *S. purpuratus* per m^2, with some isolated patches reaching densities of 150+ per m^2. TBF began monitoring and restoring this site in the summer of 2018. Restoration at White Point is in progress but incomplete as of the close of the Year 8 timeframe. Inclement weather conditions, in conjunction with COVID-19 restrictions, precluded significant restoration activities to occur in Year 8. TBF was able to double their restoration effort from the previous year in Year 9. However, the seemingly reduced effort from previous years was due to limited funding availability for the project.

Underwater Arch Cove

Underwater Arch Cove was considered restored in January 2015, being that no expanses of the reef were observed to support densities of *S. purpuratus* in excess of two per square meter. However, in Year 4 of the project, one locale within Underwater Arch Cove showed higher than two *S. purpuratus* per square meter during the spring and summer of 2016. The Bay Foundation re-monitored Underwater Arch to determine the expansion of *S. purpuratus* in the area and to decide if suppression should be started again. The expansion of *S. purpuratus* was found to be relatively contained near the large tidepool at the north edge of the site. The renewed restoration of this section of Underwater Arch took place from 4/7/17 – 6/20/17, which reduced *S. purpuratus* densities from 4.83/m^2 to 1.07/m^2 across a total area of 2.34 acres.

In Year 5 of the project, the Underwater Arch restoration site was similar to kelp reference sites in terms of *M. pyrifera*, fish biomass, and *S. purpuratus* densities. However, during annual monitoring at the end of Year 5, increased densities were observed further east of the area revisited in Year 4. TBF biologists culled *S. purpuratus* from 0.28 acres on 7/6/17. This area was surveyed in the fall of 2018 and may require *S. purpuratus* suppression to reestablish the kelp forest. At this time, no additional restoration efforts have been conducted at the site, but divers will continue to monitor the area and assess *S. purpuratus* densities. In Year 8, we observed small pockets of reef exhibiting high S. purpuratus densities. Analyses showed fish community diversity (both Shannon-Wiener and Simpson's indexes) decreased. In addition, algae/invertebrate community diversity (both Shannon-Wiener and Simpson's indexes) decreased from Year 7. However, in both cases, the site maintained values well above pre-restoration. In Year 9, vast *S. purpuratus* barren areas were observed at the site and documented. Community analysis monitoring displayed drastic increases in *S. purpuratus* and decreases in *P. clathratus* density/biomass at the site. However, community diversity did not seem to be impacted.

In August 2022, georeferenced photos and video were taken to visually represent the changes over time at Underwater Arch. See Appendix C.

Honeymoon Cove

Honeymoon cove restoration was completed in January 2015. Surveys have since been conducted by TBF personnel periodically to quickly assess the condition of the reefs found in this cove. This will continue in the coming year to ensure that the restoration target of two *S. purpuratus* per square meter are maintained and that *M. pyrifera* and other biota are persisting in the area. Due to the high success of restoration at Honeymoon Cove, The Bay Foundation and NOAA biologists outplanted 827 *Haliotis fulgens* (Green Abalone) onto a section of restored reef in June 2015. Subsequent monitoring was conducted in March of 2017 identifying several emergent *H. fulgens* on the site. The last survey completed in August 2022 found approximately 40 *H. fulgens* within the 10 by 10-meter outplant site. Prior to outplanting, only 10 *H. fulgens* were found within the site. Genetic analysis based upon tissue samples taken in situ is ongoing to determine whether these emergent *H. fulgens* are in whole or in part the same organisms that were outplanted.

The increase in *M. pyrifera* density has been gradual since restoration completion, while fish density has been variable. Fish and algae/invertebrate community diversities (both Shannon-Wiener and Simpson's indexes) show a general trend of increasing since restoration, with Year 9 displaying higher values than previous years.

Georeferenced photos and video were collected in August 2022 to document conditions within the site over time. See Appendix C.

Resort Point
Resort Point is a deep site (40-60 feet) located offshore of Honeymoon Cove. Resort Point has had persistent kelp since the start of this project, yet consisted of high *M. franciscanus* and *S. purpuratus* densities. The reef complex that exists between Honeymoon Cove and Resort Point has no barrier to *M. franciscanus* and *S. purpuratus* movement (e.g., sand channels and high energy shallow prominences). Restoration blocks along the western edge of Honeymoon Cove were separated by a thin line of existing kelp approximately 45 m wide. Both the continuity of this high concentration of urchins to Honeymoon Cove and lack of an incursion barrier encouraged urchin suppression at Resort Point. Urchin suppression focused on protecting this existing kelp forest in a total of 4 acres. Divers will continue to visit this site periodically to ensure densities have not increased.

The greater average depth of Resort Point and the presence of kelp make it a statistical outlier in the overall monitoring scheme developed to inform the project. Thus, to determine the effect of the work conducted at Resort Point and Honeymoon Cove, we have relied on the data collected within Honeymoon Cove, consistent with other depth profiles, for comparability across restoration and reference sites. Though separately defined operationally, we consider these two sites to function statistically as a single unit.

Photo points and video transects were not established in this site due to its proximity to Honeymoon Cove.

Hawthorne
The Hawthorne restoration site exists south of Underwater Arch Cove. It is a section of exposed coast comprised of large bedrock shelves, as well as boulders forming low lying expanses of unconsolidated reef. In spring 2017, an area slightly less than an acre (0.89 acres) outside of the previously restored area was found supporting high densities of *S. purpuratus* and was cleared during the summer of 2017. Hawthorne has proven to be a very dynamic site with high wave energy and considerable sediment movement. Consequently, the neighboring reef that initially surrounded the large rock and pinnacle in the HAW 2 block (where the permanent photo point is located), has been covered as a result of sediment transport.

In Year 9, fish community diversity (both Shannon-Wiener and Simpson's indexes) displayed similar values to previous years, while algae/invertebrate community diversity (both Shannon-Wiener and Simpson's indexes) decreased slightly. Of note was the drastic increase in *M. pyrifera* stipe density at Hawthorne.

Georeferenced photos and video were collected in August 2022. See Appendix C.

Marguerite
At the start of this project, Marguerite was designated to serve as a control (barren) site throughout the permitted work. However, in 2015, discussions with CDFW resulted in the expansion of restoration actions to Marguerite. Marguerite is an expansive area of reef located between Honeymoon Cove to the north and Underwater Arch Cove to the south. Restoration actions were initiated in December of 2015 at the southern and northern terminuses of this site. At times, three restoration teams were working in this area as they progressed towards one another reducing the gap between them. This site is openly exposed to northerly and westerly swell energy and receives some wrap around from south westerly energy. This site is comprised of high relief reef with semi vertical walls, 20-30 feet in height extending

from the sea floor to the surface. Between these reefs, expansive boulder fields and some sandy expanses exist. The shoreline is defined by bench-like bedrock or cobble beaches. The physical structure of this site supports higher rates of fish production and increased diversity of benthic organisms due to its heterogeneity.

Although Figures 4 and 5 show a complete lack of *M. franciscanus* and *S. purpuratus* throughout the 3 years of restoration activities (2015-2017), the fine-scale density surveys completed by TBF in the Marguerite site showed that densities of purple urchins remained above 2 per m^2. Year 2 pre-restoration density of *S. purpuratus* was 19.52 per m^2, Year 3 pre-restoration density of *S. purpuratus* was 11.06 per m^2, and Year 4 pre-restoration density of *S. purpuratus* was 3.33 per m^2, all representative densities associated with urchin barrens. In Year 9, fish community diversity (both Shannon-Wiener and Simpson's indexes) displayed a decrease, while algae/invertebrate community diversity (both Shannon-Wiener and Simpson's indexes) increased. Fish diversity has remained high at this site throughout monitoring due to its physical structure. Algae/invertebrate diversity remains significantly above pre-restoration values.

The photo and videos for Marguerite were collected in August 2022. Visibility has been hampered by sediment on the reef in recent years.

Point Fermin

Point Fermin is near the southeastern terminus of the Palos Verdes Peninsula. Restoration actions were started in July of 2015 and continued through February 2016 but were then suspended until October 2016. Approximately four (3.93) acres were restored in those few months, clearing a barren that is roughly central to the shallow expanses of the reef complex. Restoration activities resumed in October 2016 through December 2016, clearing 1.35 acres of reef. An additional 0.22 acres were restored in July 2017. This area is low relief, largely tabular, and dominated by soft sedimentary rock, making it very different from the other restoration sites. In addition, Point Fermin is sheltered from northerly and westerly swells, but is directly exposed to southerly and some south westerly wave energy. The restoration efforts at Fermin have resulted in the development of *M. pyrifera*, other macroalgae and several phyla of sessile life on the reef. While initial restoration activities yielded positive results, culminating with a 98% canopy cover in 2017 according to MBC data, during the Year 6 reporting period, TBF staff discovered high densities of *S. purpuratus,* resulting in a shift back towards a barren state. This phase shift can best be explained by two factors: (1) during restoration efforts a large *S. purpuratus* recruitment pulse occurred where many individuals were observed in the 0.5-1cm range making comprehensive and targeted suppression difficult, and (2) the site contains several long channels inshore with deep crevices occupied with larger *S. purpuratus*. Therefore, TBF staff speculate that intrusion from this area into the site may have contributed to the shift back towards a barren state.

Similar to White Point, CRANE surveys were never conducted for Point Fermin due to different exposure, substrate characteristics, and the unsettled condition of the site from start and stop restoration actions. Since restoration work was required to address the barren state of the reef at Point Fermin, CRANE surveys will need to be conducted moving forward. Data collected and analyzed for the restoration efforts at Point Fermin will be used solely to describe the condition and trends within this site over time. CRANE surveys will be conducted before the Year 10 reporting period ends.

Photos and videos for Point Fermin were collected in August 2022. See Appendix C. The photos and videos from Point Fermin, in previous years, quite convincingly display the changes resulting from the *S.*

purpuratus suppression in that site, and further display the consequences of refuge *S. purpuratus* populations. Additional area at Point Fermin will be targeted during Year 10 of the project.

White Point

White Point is a section of exposed coast located north of Point Fermin and has a depth profile that ranges from 5-35 feet. The White Point restoration site was established in the summer of 2018 due to the high density of *M. franciscanus* and *S. purpuratus.* At the close of the Year 6 reporting period, 3.11 acres out of an estimated 9.93 acres have been cleared of excess *S. purpuratus*. In Year 7 of the project, an additional 4.38 acres were restored, and further surveys expanded the estimated barren area from 9.93 to 15 acres. The substrate of the area is primarily comprised of bedrock and scattered boulder cover, with various pinnacles becoming exposed during low tide. In addition, there are significant sand channels interspersed within the site. Community response monitoring for White Point was delayed a year due to funding and was monitored for the first time in August 2020.

CRANE surveys were never conducted within White Point due the proximity of standing kelp along the perimeter of the barren and the exposure of the site. The distance identified at the outset of the project for the entirety of two CRANE transects, at fixed depths, comprising 60 meters in length, was to be at least 20 meters from the edge of existing kelp. The configuration of the barren at White Point, and the topography, did not accommodate the necessary distance and would have skewed the results. In 2020, CRANE surveys were conducted for the first time as the distance to existing kelp was determined to be sufficiently distant to not compromise the data, due to edge effects. In addition, White Point and Point Fermin share a different exposure than the near contiguous efforts located further to the north and west. This difference may cause localized responses due to differences in wave energy, upwelling, wind, turbidity, and (based upon observations) transmissivity and possible recruitment events. For these additional factors, data will be collected moving forward but will not be analyzed to determine the overall trend of restoration sites at Palos Verdes. The data will solely be used to describe the condition of the restoration site at White Point over time. As evident in Table 10 (next page), increases in fish and swath diversity and giant kelp density are apparent from 2020-2022, showing the beneficial aspects of restoration activities at this site.

In addition, it should be noted that restoration activities were paused at White Point during summer 2022. Extremely high densities of *S. purpuratus* still remain in shallow areas directly adjacent to the tidepools. Due to White Point being exposed to wind and swell, this area has posed problems for restoration divers to safely complete culling operations. Divers will continue to work these shallow areas, weather permitting.

Photos for White Point were collected in August 2022, depicting the establishment of understory algae (*Dictyopoteris* sp., *Zonaria* sp*., Eisenia arborea*, and other brown and red algae), as well as canopy *M. pyrifera*, indicating the successful transition away from a barren state. The White Point permanent video transect was established in summer 2019. Restoration work will continue into Year 10.

Table 10. Community analysis monitoring data for White Point.

White Point Crane Data - September 2020-2022			
Analysis	**2020**	**2021**	**2022**
Coordinates:			
Latitude	33.71287	33.71287	33.71287
Longitude	-118.3159	-118.3159	-118.3159
Temperature (°C)	17.5	16.1	17.9
Fish Richness	10	10	7
Fish Diversity H	2.029	0.48	1.68
Fish Diversity 1-D	0.83	0.17	0.79
Fish Density:			
Paralabrax clathratus (/100m²)	2.1 ± 0.4	3.3 ± 2.3	0
Semicossyphus pulcher (/100m²)	1.3 ± 0.4	1.3 ± 0.4	1.3 ± 0.8
Fish Biomass:			
Paralabrax clathratus (g/100m²)	373.3 ± 108.5	514.3 ± 350	0
Semicossyphus pulcher (g/100m²)	402.2 ± 220.6	572.4 ± 572.4	917.4 ± 743.1
Swath Diversity H	0.875	1.997	2.56
Swath Diversity 1-D	0.35	0.832	0.91
Swath Density:			
Macrocystis pyrifera stipes (/100m²)	11.7 ± 8	687.5 ± 60.8	375.8 ± 144.2
Panulirus interruptus (/100m²)	-	1.67 ± 1.67	9.2 ± 9.2
Mesocentrotus franciscanus (/100m²)	4.2 ± 4.2	15 ± 3.3	20 ± 5
Strongylocentrotus purpuratus (/100m²)	510 ± 278	160.9 ± 6.3	258.3 ± 45

Note: Figure 20 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.

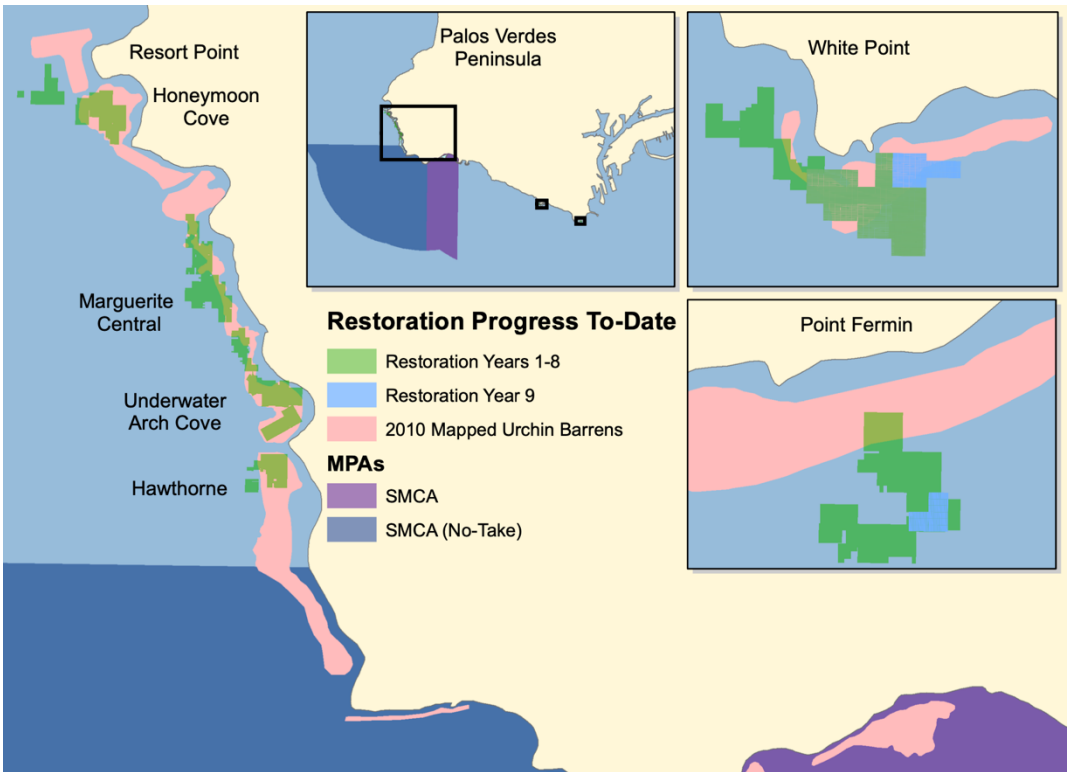

Figure 20. Urchin barrens as mapped in 2010 and areas restored, representing a possible expansion and/or shift of urchin barrens. The locations of urchin barren areas are in pink, restoration areas completed in Years 1 through 8 are green, and restoration areas completed in Year 9 are blue (ESRI 2021).

H) Geo-referenced images before and after restoration activities

Between July 1, 2013 and August 31, 2022, photos and video 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 11). 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 2022 have been recorded and time-lapse videos were edited together using one 30m segment to show changes over time within each site.

Table 11. 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

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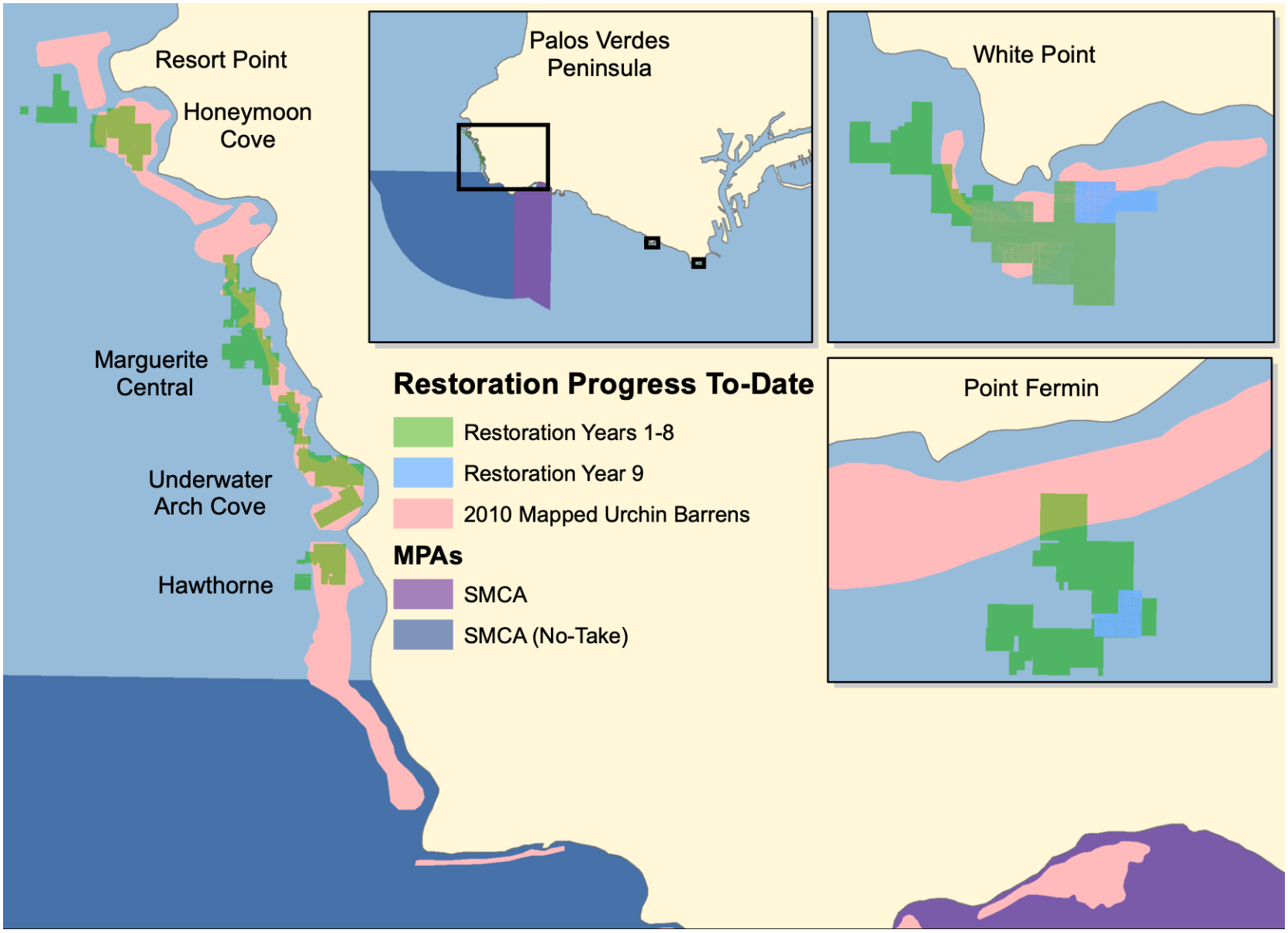
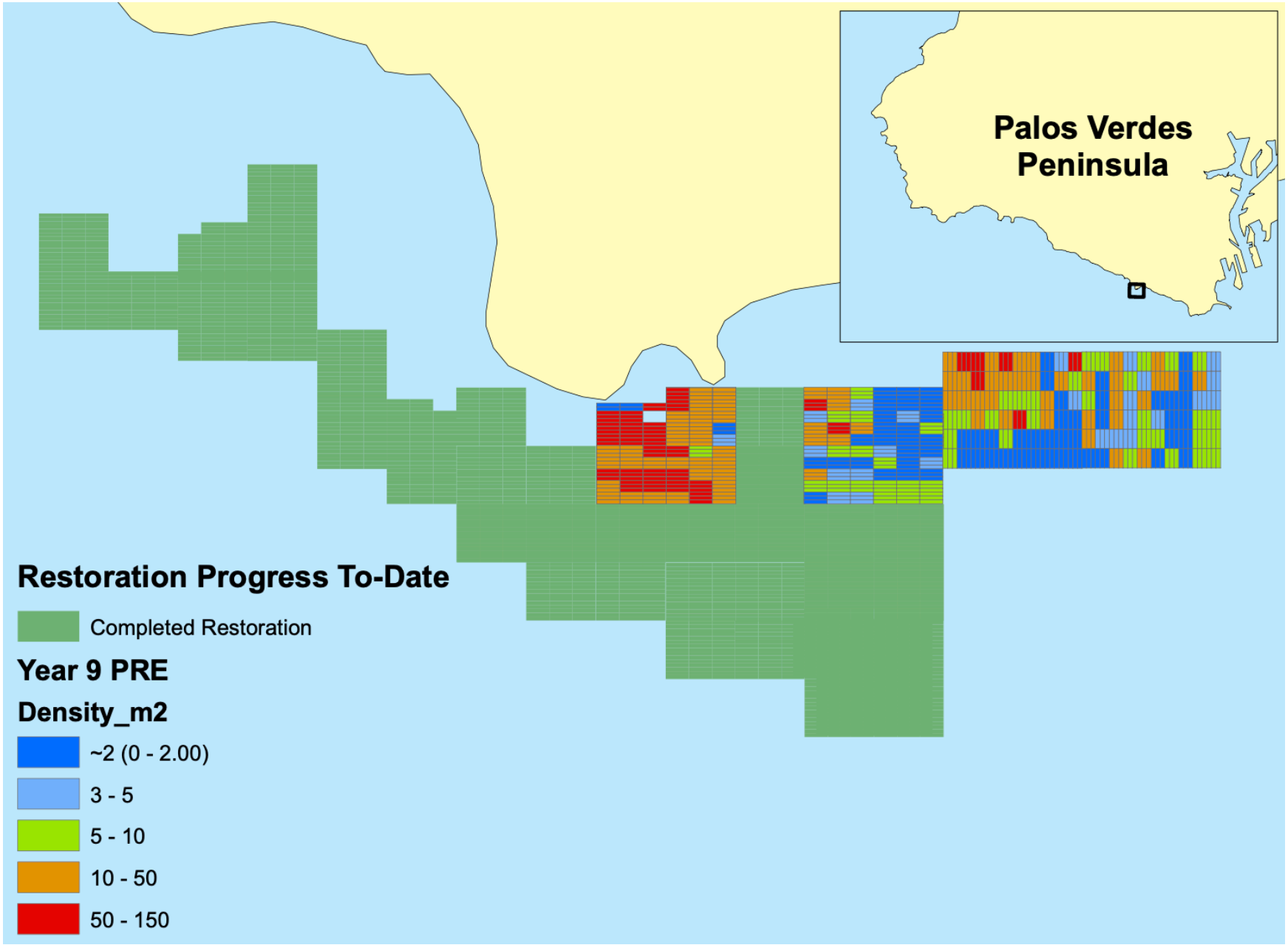
Williams, J.P., Claisse, J.T., Pondella II, D.J., Williams, C.M., Robart, M.J., Scholz, Z., Jaco, E.M., Ford, T., Burdick, H. and Witting, D., 2021. Sea urchin mass mortality rapidly restores kelp forest communities. *Marine Ecology Progress Series*, *664*, pp.117-131.

Appendix A. Palos Verdes Kelp Restoration Project Map Images

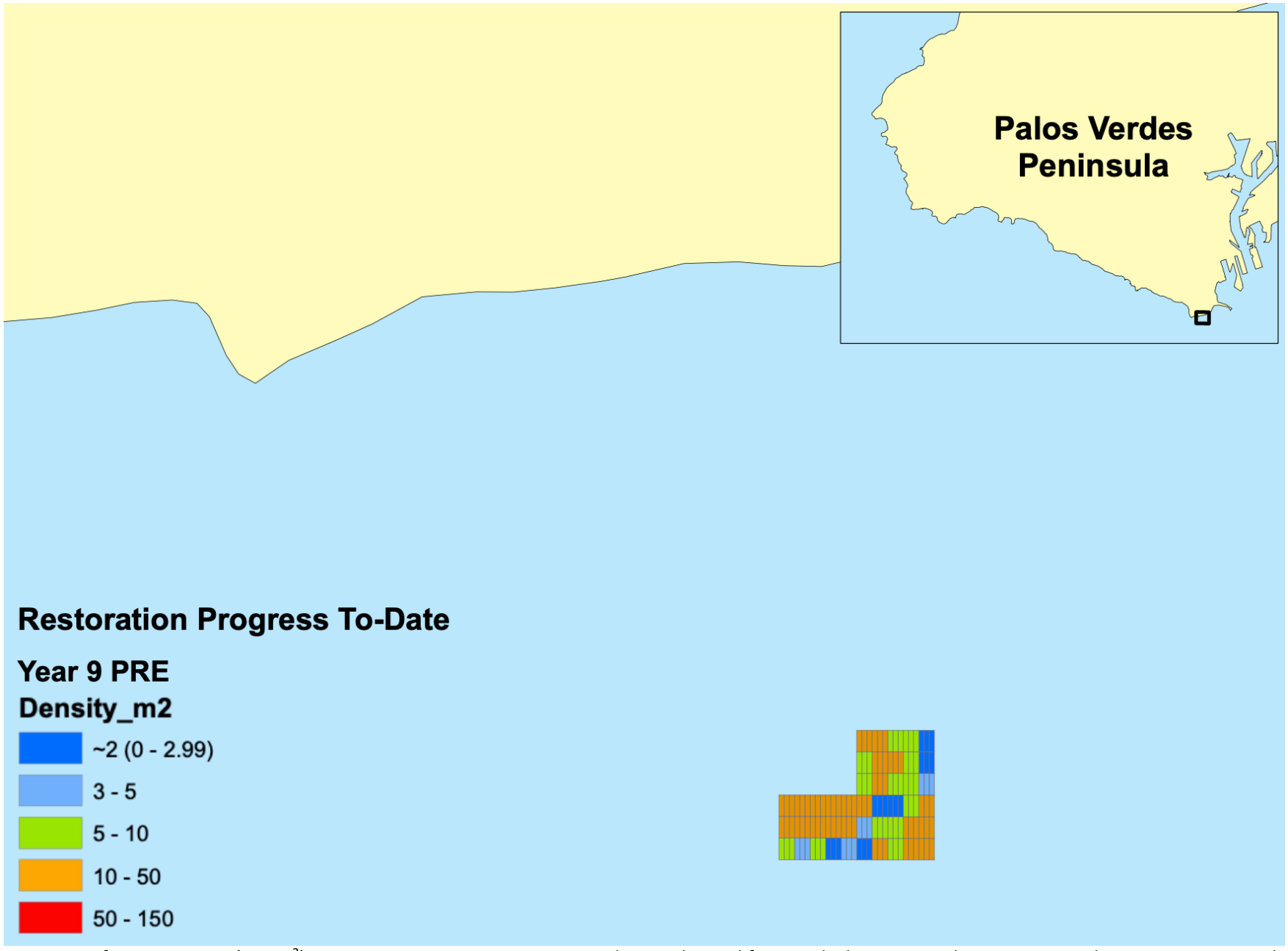


Map A1. Overview of the project area along Palos Verdes Peninsula showing the urchin barren extent (pink) mapped in 2010. The locations of the restoration areas completed in years 1 through 8 are in green. Areas restored in Year 9 are in blue (ESRI 2022)

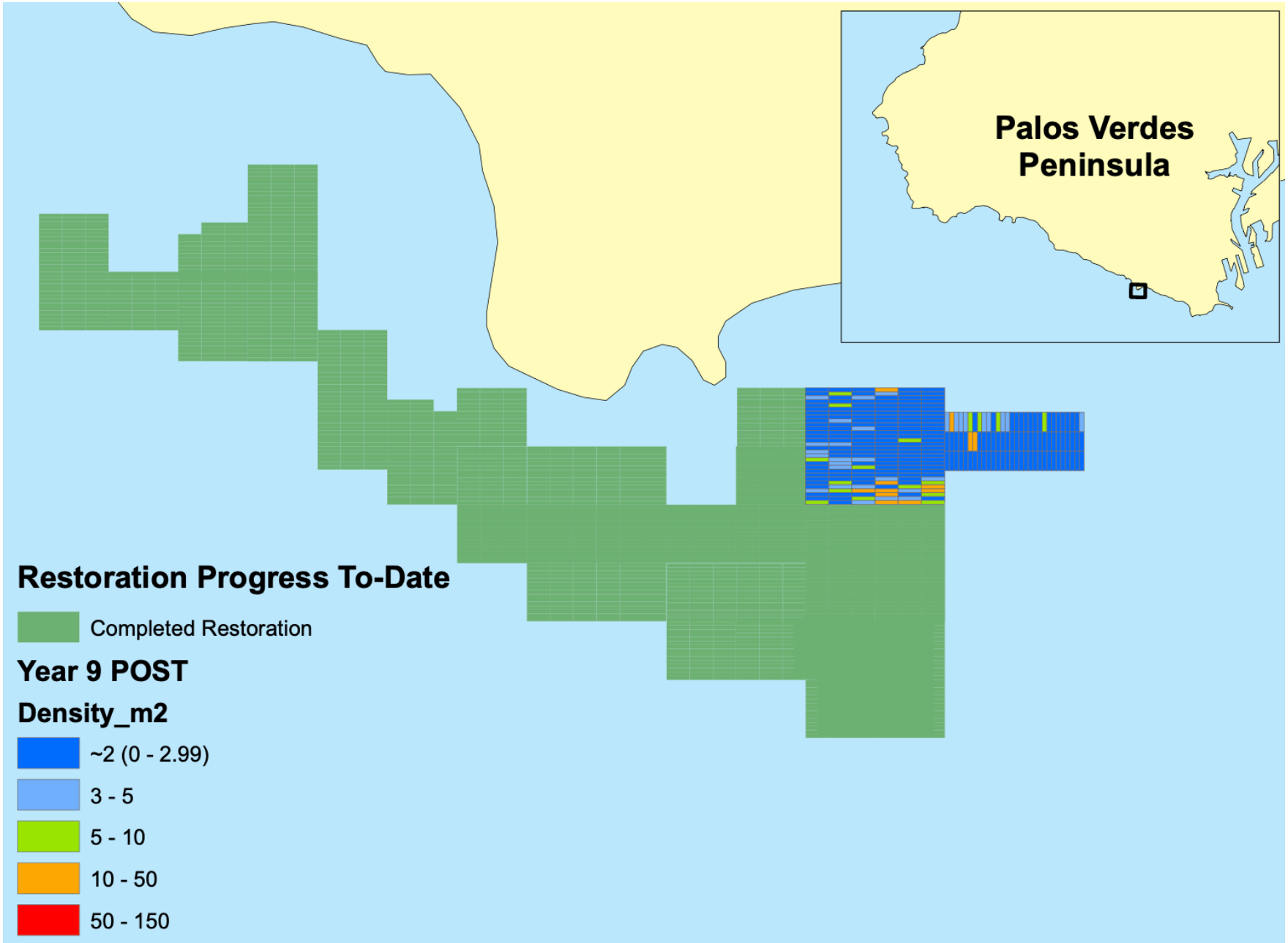
Pre and Post Restoration Urchin Density Maps – July 1, 2021 through June 30, 2022



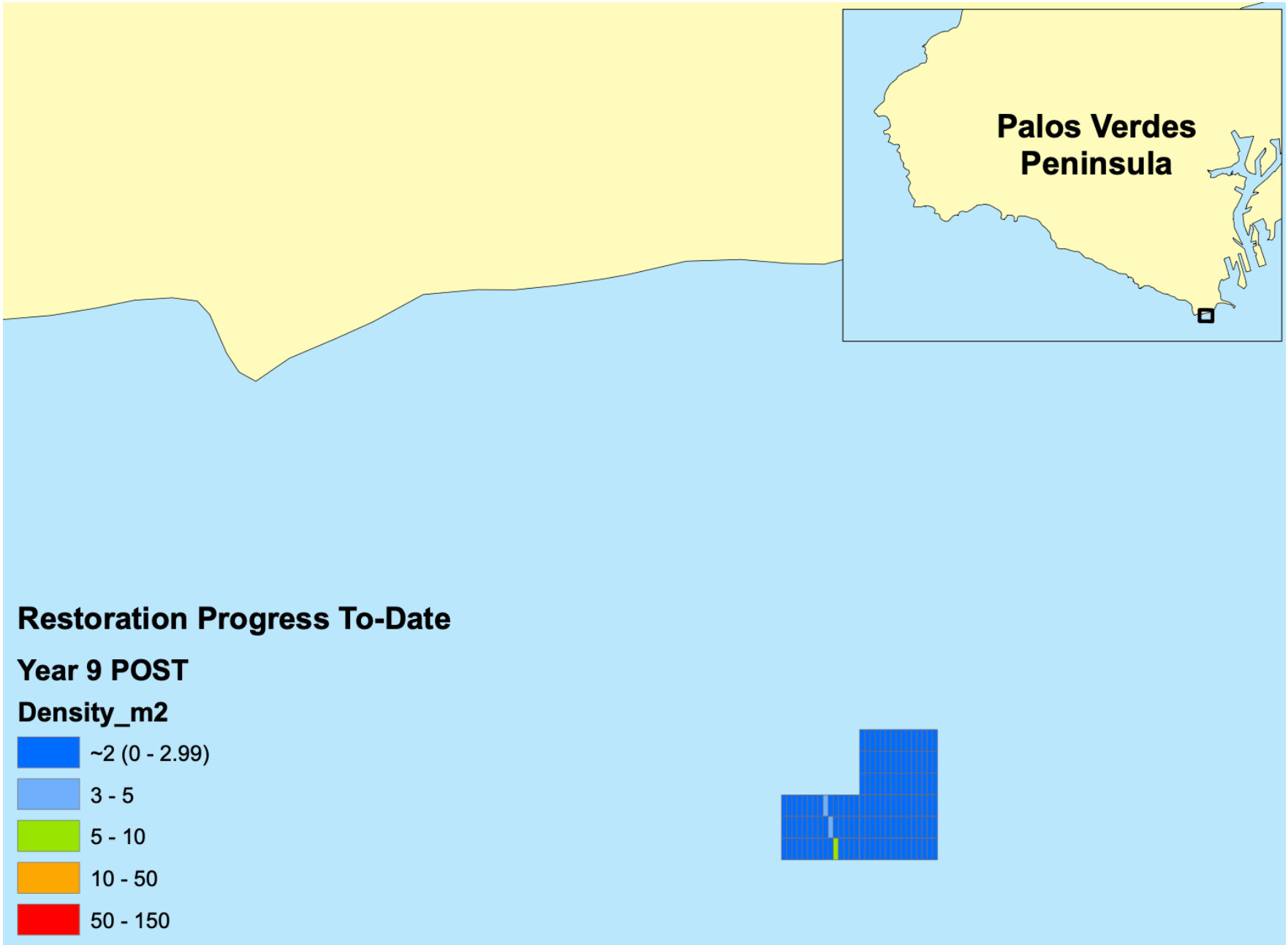
Map A2. Density of *S. purpuratus* (per m^2) pre-restoration in White Point, Palos Verdes, California. Black square in the inset map indicates White Point location in reference to Palos Verdes. Average *S. purpuratus* density for this site is 10.6 per m^2, with some localized areas up to 75 per m^2 (ESRI 2022).



Map A3. 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 14.4 per m^2, with some localized areas up to 50 per m^2 (ESRI 2022).



Map A4. Density of *S. purpuratus* (per m^2) post-restoration in White Point, Palos Verdes, California. Black square in the inset map indicates White Point location in reference to Palos Verdes. Average *S. purpuratus* density for this site is 2.02 per m^2 (ESRI 2022)



Map A5. Density of *S. purpuratus* (per m^2) post-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 1.3 per m^2 (ESRI 2022)

Appendix B: CRANE Data Tables 2011 – 2022.

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 Metadata.

	Survey Dates											
Designation	**Site**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Restoration	Underwater Arch Cove	2/7/11	6/12/12	6/13/13	7/11/14	9/23/15	6/22/16	7/18/17	6/22/18	6/12/19	6/26/20	Aug-21	Aug-22
	Honeymoon Cove	1/28/11	3/13/12	5/31/13	7/2/14	8/19/15	6/22/16	7/18/17	6/22/18	6/12/19	6/24/20	Aug-21	Aug-22
	Hawthorne	5/3/11	6/12/12	6/11/13	6/19/14	10/7/15	9/30/16	8/25/17	7/11/18	6/14/19	6/26/20	Aug-21	Aug-22
	Marguerite Central	5/3/11	6/8/12	7/3/13	6/20/14	9/23/15	7/26/16	7/18/17	7/20/18	6/28/19	7/9/20	Aug-21	Aug-22
Reference	Ridges North	8/12/11	7/17/12	4/26/13	10/29/14	9/11/15	6/3/16	6/30/17	7/11/18	6/12/19	7/23/20	Aug-21	Aug-22
	Rocky Point North	6/24/11	6/29/12	7/2/13	7/11/14	9/25/15	6/10/16	6/29/17	7/6/18	6/19/19	7/2/20	Aug-21	Aug-22
	Point Vicente West	10/12/11	8/10/12	4/24/13	4/18/14	9/23/15	6/22/16	7/25/17	7/18/18	6/14/19	8/14/20	Aug-21	Aug-22

	Bottom Temperature (ºC)											
Designation	**Site**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Restoration	Underwater Arch Cove	15.0	19.0	15.0	15.8	21.5	15.0	18.5	18.0	15.5	16.0	NA	NA
	Honeymoon Cove	15.0	11.5	18.0	16.5	18.8	16.2	20.3	18.3	15.8	16.0	NA	NA
	Hawthorne	14.4	19.0	17.0	17.0	21.0	18.0	16.8	20.6	16.0	15.0	NA	NA
	Marguerite Central	15.0	17.0	17.0	20.0	22.0	14.0	20.0	20.0	18.0	19.7	NA	NA
Reference	Ridges North	18.0	16.6	13.7	19.8	21.0	15.0	17.9	22.0	16.5	12.6	NA	NA
	Rocky Point North	18.0	15.0	18.0	21.0	21.0	14.3	16.8	19.5	16.5	17.0	NA	NA
	Point Vicente West	11.0	19.0	13.2	13.5	21.0	15.2	19.7	19.5	16.5	16.2	NA	NA

	Coordinates		
Designation	**Site**	**Latitude**	**Longitude**
Restoration	Underwater Arch Cove	33.75291	-118.41499
	Honeymoon Cove	33.76459	-118.42406
	Hawthorne	33.75068	-118.41558
	Marguerite Central	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).

Designation	Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Restoration	Underwater Arch Cove	6	9	6	12	8	8	11	9	9	9	8	8
	Honeymoon Cove	0	2	4	8	5	12	7	8	8	5	5	6
	Marguerite Central	6	10	10	9	11	11	8	9	12	9	11	12
	Hawthorne	10	6	8	7	10	13	12	12	12	7	9	8
Reference	Ridges North	6	11	7	6	5	10	5	12	8	7	5	3
	Rocky Point North	8	8	8	9	6	7	9	11	8	4	6	6
	Point Vicente West	8	6	10	11	12	14	9	11	10	12	8	8

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

.

Species	Designation	Site	#/100 m^2 ± SE 2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
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	—
		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	—
		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
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	—	—	—	—	—
		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	—
		Marguerite Central	.83 ± .8	—	—	—	—	—	.83 ± .8	1.67 ± 1.7	—	1.67 ± 1.7	6.67 ± 3.3	2.5 ± 2.5
	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
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	—	—
	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
		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
		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	—	—	—	—	—	—
		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
	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
		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
		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	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	3.33 ± 3.3	3.33 ± 3.3	—	14.2 ± 7.5
	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
		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
		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
		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	—
	Reference	Ridges North	—	4.2 ± 0.8	0.8 ± 0.8	—	—	1.7 ± 0	—	—	0.4 ± 0.4	—	—	—
		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	—	—
Leptogorgia chilensis	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—
		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
		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
		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
		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
	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
		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
		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
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
		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
		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
		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
	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
		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
		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
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
		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
		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
		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
	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
		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
		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
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	—	—	—	—	—
		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	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	2.5 ± 2.5	—	0.8 ± 0.8	—	—	—	—	—	—	—	—
		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
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	.83 ± .8	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	0.8 ± 0.8	—	—	—	—	—	—	—	—
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	—	—	—
		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
		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
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
		Honeymoon Cove	35 ± 10	8.3 ± 0	20 ± 5	—	—	—	—	—	—	—	—	—
		Hawthorne	1.7 ± 1.7	0.8 ± 0.8	0.8 ± 0.8	—	—	—	—	—	—	—	—	—
		Marguerite Central	1.67 ± 1.7	13.33 ± 6.7	.83 ± .8	—	—	—	—	—	—	—	—	—
	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	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	0.83 ± 0.8	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	0.83 ± 0.8	—
		Point Vicente West	—	—	0.8 ± 0.8	—	—	—	0.8 ± 0.8	—	—	—	—	—
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	—	—	—
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
		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
		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
		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
		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
		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
		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
	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
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	—	—	—	—
		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
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
		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
		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 ± 0.6	0.2 ± 0.2	.4±.4	0.8 ± 0.5	nv
		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	—
		Marguerite Central	.8±.8	—	6.3±5.2	—	—	—	—	—	20.4±18.3	—	41.7 ± 41.7	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	1.7±1.7	—	—
		Rocky Point North	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	—
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
		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
	Reference	Ridges North	0.4 ± 0.4	—	—	—	—	0.4 ± 0.4	—	0.4 ± 0.3	0.8 ± 0.5	—	—	0.42 ± 0.42
		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
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	—	—	—	—
		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	—	—	—
		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
	Reference	Ridges North	—	—	—	—	—	—	—	0.4 ± 0.3	0.2 ± 0.2	—	—	—
		Rocky Point North	—	0.8 ± 0.8	—	1.7 ± 1	1.3 ± 0.8	2.1 ± 1.2	—	—	0.2 ± 0.2	—	—	—
		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	—	—

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	—
		Hawthorne	0.8 ± 0.8	—	—	—	3.3 ± 1.5	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
		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
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
		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
		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 ± 1.8
	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	—
		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
		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

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	—	—	—	—	—	—	—
		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	—	—	—
		Marguerite Central	—	.4±.4	—	—	4.2±2.5	.2± 2	—	—	.8±.5	.4±.4	0.4 ± 0.4	0.42 ± 0.42
	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	—
		Honeymoon Cove	—	—	—	0.8 ± 0.8	2.9 ± 1.3	0.2 ± 0.2	12.1 ± 5.6	—	—	—	—	0.42 ± 0.42
		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
		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
	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	—	—	—	—	—	—	—	—
		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
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	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	0.4 ± 0.4	0.4 ± 0.4	—	1.3 ± 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
		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	—
		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
		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
	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
		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
		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
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
		Honeymoon Cove	—	—	—	0.8 ± 0.5	—	—	—	1.5 ± 0.6	0.2 ± 0.2	.4±.4	0.8 ± 0.8	0.42 ± 0.42
		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
		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
		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
	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	—	—
		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
		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
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).

Species	Designation	Site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
								g/100 m^2 ± SE						
Anisotremus davidsonii	Restoration	Underwater Arch Cove	—	—	—	—	50.5 ± 50.5	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	19.9 ± 13	119.4 ± 119.4	—	—	—	—	—
		Hawthorne	—	—	—	—	101 ± 101	174.7 ± 126.5	—	10 ± 10	7.9 ± 7.9	—	—	—
		Marguerite Central	—	—	—	—	11117.8±8614.	—	28.8±28.8	—	—	235.5±235.5		2833.67 ± 2592.44
	Reference	Ridges North	—	—	—	—	—	5.3 ± 5.3	—	532.2 ± 331.3	10 ± 10	—	1272 ± 1115	—
		Rocky Point North	—	—	—	—	—	—	1154.1 ± 1127.7	973.9 ± 521	4.8 ± 4.8	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—
Atherinopsidae	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	995.2 ± 930.8	—	—	—	—	—
		Marguerite Central	—	—	—	—	130.2±130.2	78.5±78.5	94.5±94.5	—	550.9±378.1	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	4.1 ± 4.1	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	12.7 ± 12.7	—	—	—	.5± 5		—
Brachyistius frenatus	Restoration	Underwater Arch Cove	—	—	—	31.9 ± 31.9	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	3.6 ± 2.2	5.3 ± 5.3	—	—	19.4 ± 16.8	21.96 ± 15.29
		Hawthorne	—	—	—	—	—	—	—	15.1 ± 9.7	—	—	18.6 ± 12	0.36 ± 0.36
		Marguerite Central	—	—	—	—	—	—	—	57.4±47.3	—	8.2±4.2	64.5 ± 51.3	162.87 ± 37.12
	Reference	Ridges North	8.1 ± 8.1	6 ± 6	—	—	—	—	—	—	—	778.4±734.2	—	25.5 ± 25.5
		Rocky Point North	40.9 ± 18.5	13.7 ± 13.7	12.4 ± 12.4	10.6 ± 10.6	—	—	1.2 ± 1.2	19.6 ± 4.2	1 ± 1	6.±6.0	14 ± 8.3	5.97 ± 4.30
		Point Vicente West	10.6 ± 10.6	26.8 ± 17.1	11 ± 7.6	—	135.3 ± 62.5	29.3 ± 29.3	217.6 ± 123.9	177.8 ± 107.7	—	8.1±8.1	351.3 ± 235	59.48 ± 50.25
Chromis punctipinnis	Restoration	Underwater Arch Cove	60.3 ± 60.3	39.1 ± 39.1	13 ± 13	79.7 ± 39.7	8.6 ± 8.6	245.6 ± 134.6	120.6 ± 120.6	25.2 ± 13	16.6 ± 11.2	—	10.2 ± 10.2	—
		Honeymoon Cove	—	—	—	—	—	49.4 ± 49.4	—	—	—	—	—	—
		Hawthorne	20.1 ± 20.1	—	8 ± 5.7	—	27.3 ± 27.3	282.9 ± 247.7	5.1 ± 5.1	—	13.3 ± 9	—	54.4 ± 54.4	—
		Marguerite Central	20.5±20.5	3.0±3.0	194.9±153.7	—	—	—	—	—	634.4±531.5	—	1305 ± 1305	33.63 ± 23.17
	Reference	Ridges North	—	—	—	—	—	57.3 ± 33.2	—	—	—	85.4±69.6		—
		Rocky Point North	10.2 ± 10.2	—	—	—	—	—	—	10.2 ± 10.2	—			—
		Point Vicente West	—	—	75.4 ± 75.4	290.4 ± 195.3	9.4 ± 7.4	370.9 ± 319.4	—	3 ± 3	44.7 ± 23.2	1049.5±498.5	54.8 ± 42.2	—
Damalichthys vacca	Restoration	Underwater Arch Cove	—	—	—	56.6 ± 56.6	—	—	—	28.3 ± 28.3	—	—	24.3 ± 24.3	—
		Honeymoon Cove	—	—	—	56.6 ± 56.6	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	56.6 ± 56.6	—	—	—	—	—
		Marguerite Central	113.2±65.4	198.9±182.4	—	819.8±819.8	—	—	—	—	—	—	558.7 ± 558.7	—
	Reference	Ridges North	—	—	—	56.6 ± 56.6	—	—	—	—	—	12.6±12.6	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	116.4 ± 106.8	—	109 ± 109	—	—	—	—	—	—	—	—
Embiotoca jacksoni	Restoration	Underwater Arch Cove	453.2 ± 371.9	14.7 ± 14.7	24.2 ± 24.2	83.8 ± 83.8	42.5 ± 21.6	4.3 ± 4.3	24.2 ± 24.2	213.2 ± 48.4	24.3 ± 17.4	105.1±45.3	44.9 ± 28.8	14.77 ± 14.77
		Honeymoon Cove	—	64.7 ± 64.7	—	2.7 ± 2.7	—	18.2 ± 13	6.3 ± 5.1	66.2 ± 41.6	27.2 ± 27.2	45.2±45.2	70.5 ± 65.2	0.96 ± 0.96
		Hawthorne	173.3 ± 46.6	91.4 ± 34.1	266.2 ± 116.2	214.9 ± 136.7	1294.9 ± 1294.9	89.8 ± 89.8	126.8 ± 60.3	0.8 ± 0.8	292.4 ± 219.1	206.±177.8	45.2 ± 45.2	11.2 ± 11.2
		Marguerite Central	24.2±24.2	192.6±113.1	251.4±114.7	151.2±102.	138.1±130.3	59.5±32.2	97.1±52.8	2.7±2.7	234.±93.8	210.3±128.2	100.2 ± 54.9	621.4 ± 209.88
	Reference	Ridges North	26.9 ± 23.4	1.7 ± 1.7	—	—	—	64.7 ± 64.7	—	13 ± 8.6	111.8 ± 80	—	—	24.21 ± 24.21
		Rocky Point North	313.2 ± 179	366.8 ± 153.2	138.3 ± 138.3	83.8 ± 61.1	43.2 ± 25.3	55.1 ± 51.8	—	61.1 ± 43.8	38.5 ± 23.4	—	—	65.64 ± 65.64
		Point Vicente West	78.4 ± 43.5	64.7 ± 64.7	677.7 ± 183.7	474.5 ± 160.9	78.9 ± 61.5	107.5 ± 58.3	—	71.3 ± 70.4	159.5 ± 60.6	541.9±397.5	32.4 ± 22.8	499.99 ± 172.04
Gibbonsia elegans	Restoration	Underwater Arch Cove	—	—	—	—	—	—	6.8 ± 6.8	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	4693.2±2199.8	—	—	—	—	—	—
	Reference	Ridges North	—	8.8 ± 8.8	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—	—
Girella nigricans	Restoration	Underwater Arch Cove	284.7 ± 251.1	16.9 ± 16.9	—	26.1 ± 26.1	—	61.9 ± 61.9	52.2 ± 30.1	42.6 ± 16.5	—	—	—	4.07 ± 4.07
		Honeymoon Cove	—	—	—	—	186.6 ± 186.6	27.7 ± 21.2	—	—	—	—	—	—
		Hawthorne	338.1 ± 117.7	100.7 ± 59.3	186.6 ± 118.7	—	863.9 ± 863.9	216 ± 216	901.4 ± 646.3	—	273.7 ± 248.7	—	—	—
		Marguerite Central	—	238.8±238.8	—	62.7±62.7	1161.6±966.6	—	62.7±62.7	125.5±125.5	658.±329.7	374.8±374.8	5038.6 ± 3215	3944.42 ± 2748.33
	Reference	Ridges North	—	3.8 ± 3.8	—	—	—	—	—	21.5 ± 14.5	31.4 ± 31.4	—	—	—
		Rocky Point North	—	125.5 ± 125.5	—	434.3 ± 255.7	463.7 ± 269	340.4 ± 185.2	—	—	26.8 ± 26.8	—	—	—
		Point Vicente West	—	—	463.7 ± 269	771.8 ± 524.9	62.7 ± 62.7	181.3 ± 104.9	777.5 ± 530.2	119.4 ± 78.2	771.2 ± 352.4	718.2±425.8	—	—

Gobiidae	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	0.12 ± 0.12	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	0.6 ± 0.6	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—
Haemulon californiensis	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	72 ± 67.5	—	—	—	—
		Rocky Point North	—	—	—	—	—	164.2 ± 164.2	4904.8 ± 1887.8	—	—	14.2 ± 8.3	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—
Halichoeres semicinctus	Restoration	Underwater Arch Cove	70 ± 40.4	—	35 ± 35	46.4 ± 46.4	65.2 ± 21	1129.7 ± 774.4	180.4 ± 60.5	154.2 ± 76.5	114.4±65.8		17.33 ± 17.33
		Honeymoon Cove	—	—	—	120 ± 79.7	5.1 ± 3.6	1103.6 ± 320.8	129.2 ± 51.9	179.4 ± 60.7	29.9±29.9	50.2 ± 29	—
		Hawthorne	70 ± 70	—	—	—	110.8 ± 63.1	929.5 ± 638.5	175.9 ± 45.1	275.5 ± 73.7	382.8±220	81.1 ± 47.7	177.25 ± 73.54
		Marguerite Central	—	—	—	—	221.3±50.4	—	547.5±168.5	164 ±83.2	114.6±53.2	96.8 ± 56	20.99 ± 20.99
	Reference	Ridges North	—	17.6 ± 10.7	79.1 ± 44.7	4.2 ± 2.7	85.5 ± 17.9	11.3 ± 11.3	8.9 ± 4.6	45.5 ± 23.3	105.7±87.9		—
		Rocky Point North	154.2 ± 136	—	99.9 ± 55.4	35 ± 35	188.3 ± 43.9	473.9 ± 179.3	82.5 ± 40.1	73 ± 47.1	—	5.3 ± 5.3	22.92 ± 20.42
		Point Vicente West	35 ± 35	—	35 ± 35	—	37.2 ± 13.3	105 ± 35	93.2 ± 38.4	99.8 ± 42.7	229.6±71.4		35.08 ± 35.08
Hermosilla azurea	Restoration	Underwater Arch Cove	—	—	—	—	—	73.1 ± 73.1	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	483.1±464.3	—	448.7±286.4	—	—	—	1495.15 ± 928.57
	Reference	Ridges North	—	—	—	—	—	—	—	—	14.2±14.2	131.2 ± 131.2	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	149.6 ± 149.6	1114.4 ± 671.4	—	292.4 ± 195.2	149.6±149.6	—	—
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	—	—	—	—	—	—	1216.9 ± 1216.9	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	711.6 ± 711.6	—	—	—
Heterostichus rostratus	Restoration	Underwater Arch Cove	—	—	—	—	—	43.4 ± 43.4	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	10.48 ± 10.48
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	8.5±8.5	—	—	—	—	—	—
	Reference	Ridges North	21.3 ± 21.3	1.1 ± 1.1	—	—	—	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	—	—	—	—
Hypsurus caryi	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	148 ± 148	—	—	—
		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	716.2 ± 388.5	671 ± 412	1926.9 ± 1262.2	1151 ± 384.3	347.8 ± 161.9	567.5±237.9	174.2 ± 125.7	93.67 ± 43.52
		Honeymoon Cove	—	—	—	—	—	300.7 ± 300.7	208.3 ± 102.8	16.5 ± 16.5	41 ±41.	—	—
		Hawthorne	223 ± 120.2	345.9 ± 82.5	1425.2 ± 214.7	1190 ± 388	3895.9 ± 675.1	5495.5 ± 2321.4	932.6 ± 293.3	1211.4 ± 210.7	1836.5±751.1	1008.5 ± 174.7	1114.42 ± 296
		Marguerite Central	—	1656.9±751.9	1128.5±292.9	2024.8±840.9	1991.7±1319.5	1188.7±953.3	4014.4±1087.	2930.5±1097.8	2994.6±1107.2	6006.1 ± 2322	2310.54 ± 658.91
	Reference	Ridges North	—	20.5 ± 20.5	271.4 ± 271.4	406.5 ± 398.8	0.1 ± 0.1	300.7 ± 300.7	91.5 ± 54.1	222.4 ± 56.8	—	41 ± 41	—
		Rocky Point North	400.7 ± 163.6	427 ± 272	891.9 ± 492.1	—	38.2 ± 16.5	—	553.4 ± 310.7	347 ± 137	251.3±145.9	141.3 ± 141.3	91.19 ± 53.17
		Point Vicente West	1503.1 ± 527.1	801.8 ± 366	1502.9 ± 444.3	3107.1 ± 1229	2449.2 ± 745.1	1657.2 ± 689.9	1403.4 ± 473.7	667.9 ± 270.6	4091.5±1238.8	277.8 ± 129.7	1677.29 ± 546.24

Labrisomus xanti	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	6.6 ± 6.6	—	—	—	—
		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	—	—	—	—	236.2 ± 186.7	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	58.3 ± 58.3	—	—	—	846 ± 403.7	—	20.6 ± 13.9	29.2 ± 29.2	—	—	—
		Marguerite Central	—	24.9±24.9	—	—	404.5±246.8	—	—	32.6±18.8	16.3±16.3	30.1 ± 30.1	42.78 ± 42.78
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	113 ± 113	—	—	—	98.2 ± 18.6	171.3 ± 171.3	—	—	16.3±16.3	—	—
Oxyjulis californica	Restoration	Underwater Arch Cove	—	14.1 ± 14.1	10.9 ± 10.9	237.3 ± 195.2	—	—	—	65 ± 62.8	313.1±313.1	128.3 ± 124.6	6.34 ± 6.34
		Honeymoon Cove	—	—	28.1 ± 28.1	28.2 ± 28.2	57 ± 19.6	536.3 ± 328.9	—	9.5 ± 8	—	—	11.37 ± 11.37
		Hawthorne	142.7 ± 95.1	35.2 ± 21.1	40.5 ± 31.9	63.4 ± 46.5	140.1 ± 57.2	11.6 ± 11.6	5.7 ± 5.7	24.1 ± 15.8	495.4±462.5	86.2 ± 61.1	35.72 ± 29.47
		Marguerite Central	—	28.2±28.2	63.1±36.8	147.9±75.8	287.9±269.5	—	15.4±15.4	347.±137.1	—	23.1 ± 23.1	801.06 ± 309.8
	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	21.1 ± 13.5	—	11.4 ± 5.3	—	1.3 ± 1.3	—	—	—	—	—
		Point Vicente West	862.5 ± 503.5	81.3 ± 42.9	191.6 ± 70.1	700.3 ± 299.7	9.2 ± 2.8	98.4 ± 71.9	—	40 ± 28.5	109.1±65.2	76.2 ± 62	46.27 ± 30.49
Oxylebius pictus	Restoration	Underwater Arch Cove	—	14.9 ± 14.9	—	—	—	—	—	—	—	—	—
		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	—	162.4±95.6	23.2±23.2	—	—	—	14.9±14.9	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	23.2 ± 23.2	23.2 ± 23.2	—	49 ± 17.7	—	—	—	—	—	—	—
Paralabrax clathratus	Restoration	Underwater Arch Cove	—	17.7 ± 17.7	42.3 ± 42.3	652.8 ± 465.5	382.9 ± 318.5	1675.2 ± 654.4	602.7 ± 151.7	468.4 ± 126.6	616.2±127.7	557.6 ± 151.6	50.85 ± 17.08
		Honeymoon Cove	—	—	22.8 ± 16.7	232.6 ± 137.8	62.8 ± 59.1	630.7 ± 603.9	164 ± 51.1	160.5 ± 68.4	307±178	19.5 ± 19.5	3.74 ± 3.74
		Hawthorne	—	—	17.9 ± 10.4	35.3 ± 20.4	97.5 ± 79.5	661.7 ± 288.2	391.7 ± 78.1	133.8 ± 76.4	36.2±36.2	717.5 ± 353.7	314.49 ± 182.73
		Marguerite Central	—	310.6 ± 310.6	373.1 ± 319.2	459.7 ± 182.0	515.5 ± 285.3	2039.2 ± 303.9	2326.9 ± 177.2	1135.5 ± 152.0	320.5±174.3	1017.3 ± 197.7	1365.25 ± 864.64
	Reference	Ridges North	246.8 ± 93.6	10.4 ± 8.6	92.6 ± 49.5	159.7 ± 56.7	118.5 ± 72.8	79.4 ± 61.8	390.1 ± 107.9	—	20.3±20.3	35.3 ± 20.4	36.28 ± 36.28
		Rocky Point North	160.8 ± 114.9	555.8 ± 355.6	634.4 ± 316.7	103.3 ± 47.5	209.5 ± 57.8	353.4 ± 276.8	246.1 ± 86.1	57.6 ± 46.5	86.4±35.3	319.8 ± 186.3	266.21 ± 169.47
		Point Vicente West	—	—	227.5 ± 140.5	—	324.2 ± 93.4	4282 ± 1664.5	1927.4 ± 529.4	961 ± 435.4	2770.7±974.5	232.3 ± 209.4	1079.07 ± 285.58
Paralabrax maculatofasciatus	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—
Paralabrax nebulifer	Restoration	Underwater Arch Cove	—	—	—	224.7 ± 169.4	—	380.8 ± 237.7	22.8 ± 22.8	89.9 ± 89.9	45.7±45.7	364.6 ± 266.8	84.46 ± 38.1
		Honeymoon Cove	—	—	—	38.1 ± 22	—	—	380.2 ± 194.7	7.7 ± 7.7	125.8±125.8	267.6 ± 267.6	69.77 ± 69.77
		Hawthorne	—	45.7 ± 45.7	—	27.8 ± 16.2	—	262.8 ± 94.7	41.9 ± 27.6	196.6 ± 139.3	45.7±45.7	—	12.34 ± 12.34
		Marguerite Central	89.5±89.5	—	45.7±45.7	83.8±48.8	—	400.5±242.8	—	342.7±342.7	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	306 ± 205.4	—	—	79.2 ± 79.2	—
Rhacochilus toxotes	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	6.1±6.1	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—

Rhinogobiops nicholsii	Restoration	Underwater Arch Cove	—	—	—	—	—	—	—	—	—	—	—
		Honeymoon Cove	—	—	9.1 ± 5.2	7.5 ± 5	—	—	0.2 ± 0.1	—	—	—	—
		Hawthorne	—	—	—	—	—	—	0.9 ± 0.9	—	—	—	—
		Marguerite Central	—	—	6.1±6.1	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	1.6 ± 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	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	23.1 ± 23.1	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	0.5 ± 0.5	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	1.1 ± 1.1	—	—	—	—	—
		Point Vicente West	—	—	—	99.8 ± 99.8	—	—	—	—	—	—	—
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 carnatus	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	—	—	2.8 ± 2.8	—	—	—	—	—	—	—	—
		Hawthorne	—	—	3.3 ± 3.3	2 ± 2	—	—	—	—	—	—	—
		Marguerite Central	—	—	2.0±2.0	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	1.0 ± 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	—	—	0.3 ± 0.3	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	0.6 ± 0.6	21.6 ± 21.6	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	—	—	—	—	—

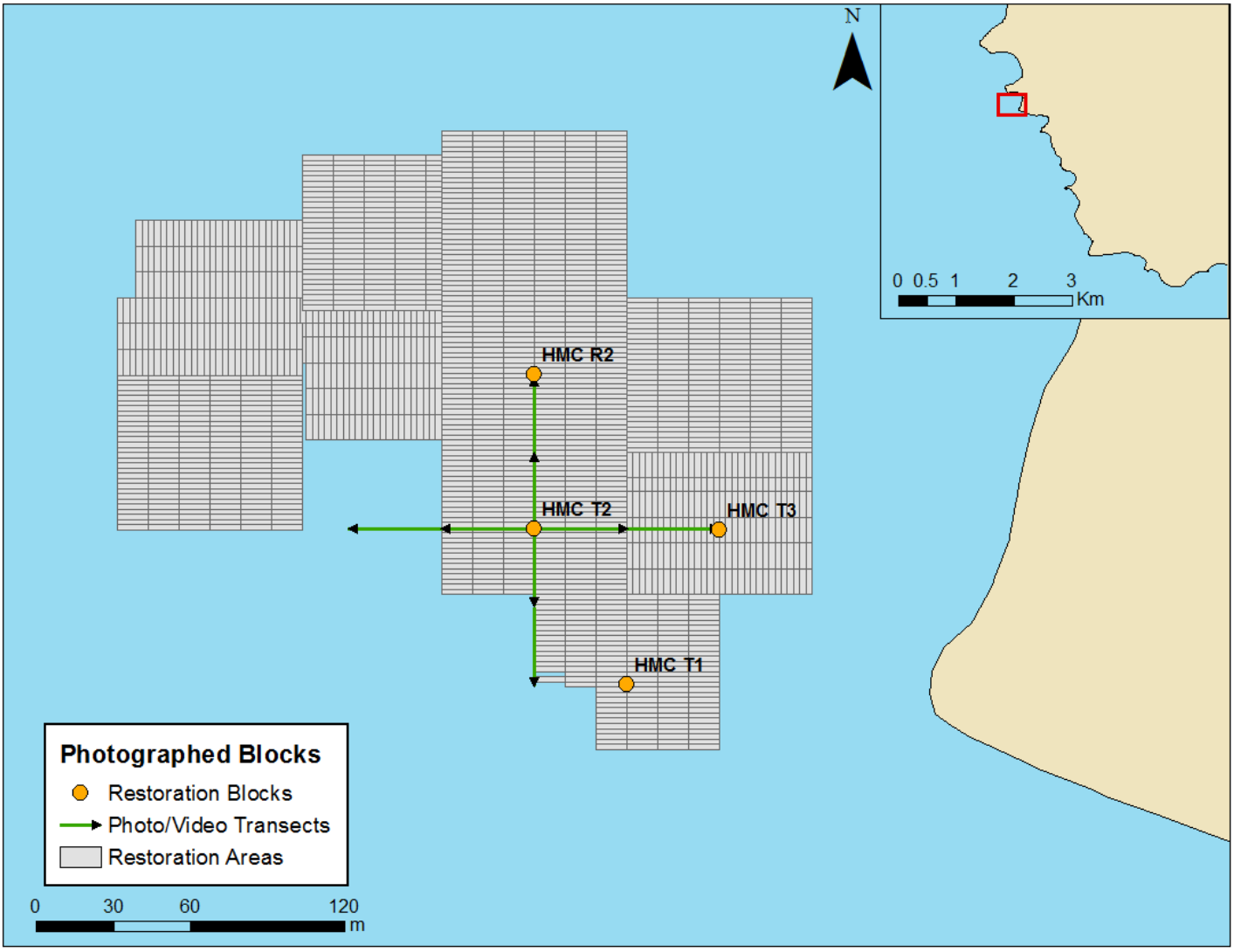
Semicossyphus pulcher	Restoration	Underwater Arch Cove	25.7 ± 25.7	235.1 ± 108.1	—	104.7 ± 104.7	—	370.6 ± 370.6	431.5 ± 138.1	138.3 ± 90.8	234.1±136.7	331 ± 331	66.9 ± 32.2
		Honeymoon Cove	—	—	—	—	56.6 ± 56.6	—	301.3 ± 216.1	28.3 ± 28.3	—	—	—
		Hawthorne	160.3 ± 68.5	—	—	—	25.7 ± 25.7	442.6 ± 158	171.6 ± 81.3	163.8 ± 64.7	368 ±157.1	129.5 ± 129.5	315.36 ± 315.36
		Marguerite Central	56.6 ± 56.6	56.6 ± 56.6	—	28.5 ± 17.2	—	113.2 ± 65.4	416.0 ± 222.4	692.9 ± 404.0	545.3±392.1	980 ± 137.5	173.61 ± 173.61
	Reference	Ridges North	25.7 ± 25.7	82.3 ± 82.3	286.5 ± 217.6	104.7 ± 104.7	173.3 ± 173.3	25.7 ± 25.7	38.6 ± 18.8	142 ± 122.6	56.6±56.6	—	—
		Rocky Point North	130.4 ± 130.4	312.2 ± 144.4	866.5 ± 95.8	173.3 ± 173.3	56.6 ± 56.6	—	28.3 ± 28.3	127.4 ± 87.3	93.5±93.5	73.6 ± 73.6	226.05 ± 226.05
		Point Vicente West	25.7 ± 25.7	—	—	880.1 ± 530.6	209.4 ± 120.9	56.6 ± 56.6	860.9 ± 612	694.1 ± 322	860.1±117.3	883.4 ± 446	694.61 ± 411.48
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	—	—	—	—	—	—	—	35.7 ± 35.7	—	—	—
		Honeymoon Cove	—	—	—	—	—	—	—	—	—	—	—
		Hawthorne	—	—	—	—	—	—	—	—	—	—	—
		Marguerite Central	—	—	—	—	—	—	—	—	—	—	—
	Reference	Ridges North	—	—	—	—	—	—	—	—	—	—	—
		Rocky Point North	—	—	—	—	—	—	—	—	—	—	—
		Point Vicente West	—	—	—	—	—	—	28.6 ± 28.6	—	—	—	—

Table B6. White Point CRANE survey data for Years 7-9.

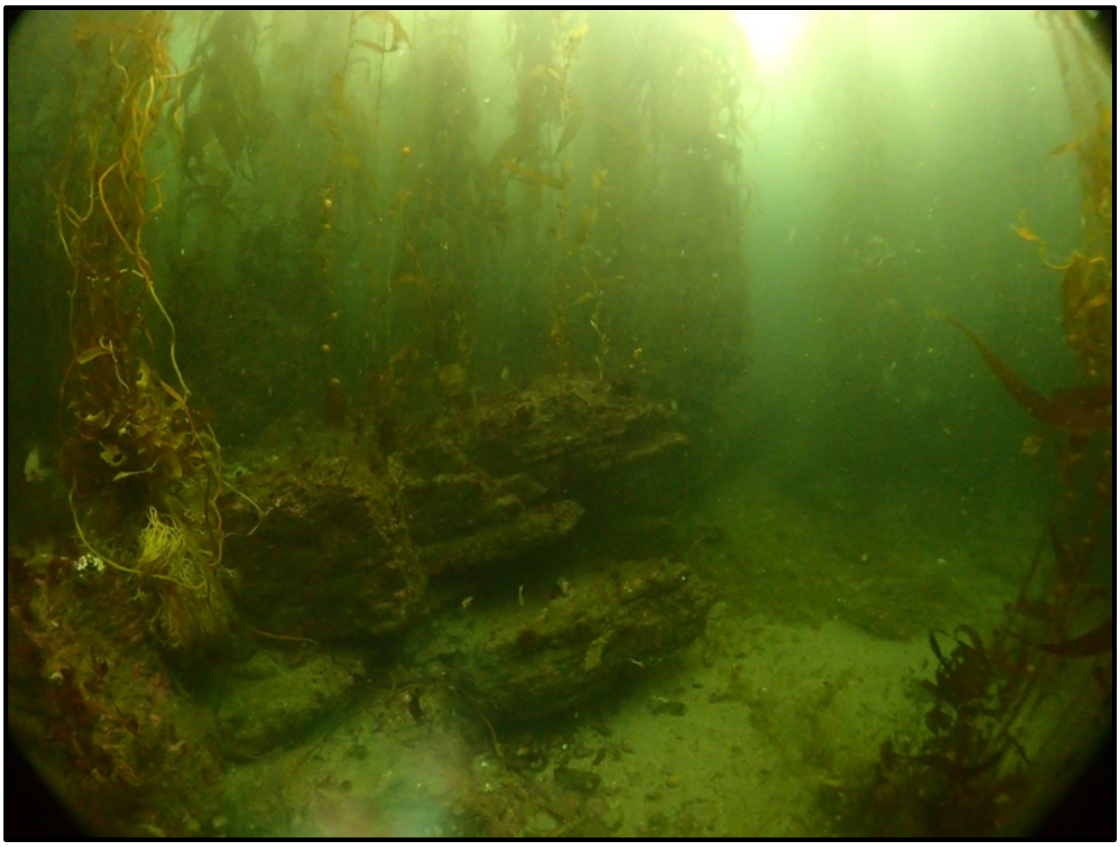
White Point Crane Data - September 2020-2022			
Analysis	**2020**	**2021**	**2022**
Coordinates:			
Latitude	33.71287	33.71287	33.71287
Longitude	-118.3159	-118.3159	-118.3159
Temperature (°C)	17.5	16.1	17.9
Fish Richness	10	10	7
Fish Diversity H	2.029	0.48	1.68
Fish Diversity 1-D	0.83	0.17	0.79
Fish Density:			
Paralabrax clathratus (/100m²)	2.1 ± 0.4	3.3 ± 2.3	0
Semicossyphus pulcher (/100m²)	1.3 ± 0.4	1.3 ± 0.4	1.3 ± 0.8
Fish Biomass:			
Paralabrax clathratus (g/100m²)	373.3 ± 108.5	514.3 ± 350	0
Semicossyphus pulcher (g/100m²)	402.2 ± 220.6	572.4 ± 572.4	917.4 ± 743.1
Swath Diversity H	0.875	1.997	2.56
Swath Diversity 1-D	0.35	0.832	0.91
Swath Density:			
Macrocystis pyrifera stipes (/100m²)	11.7 ± 8	687.5 ± 60.8	375.8 ± 144.2
Panulirus interruptus (/100m²)	-	1.67 ± 1.67	9.2 ± 9.2
Mesocentrotus franciscanus (/100m²)	4.2 ± 4.2	15 ± 3.3	20 ± 5
Strongylocentrotus purpuratus (/100m²)	510 ± 278	160.9 ± 6.3	258.3 ± 45

Appendix C: Permanent Photo Point and Video Transects

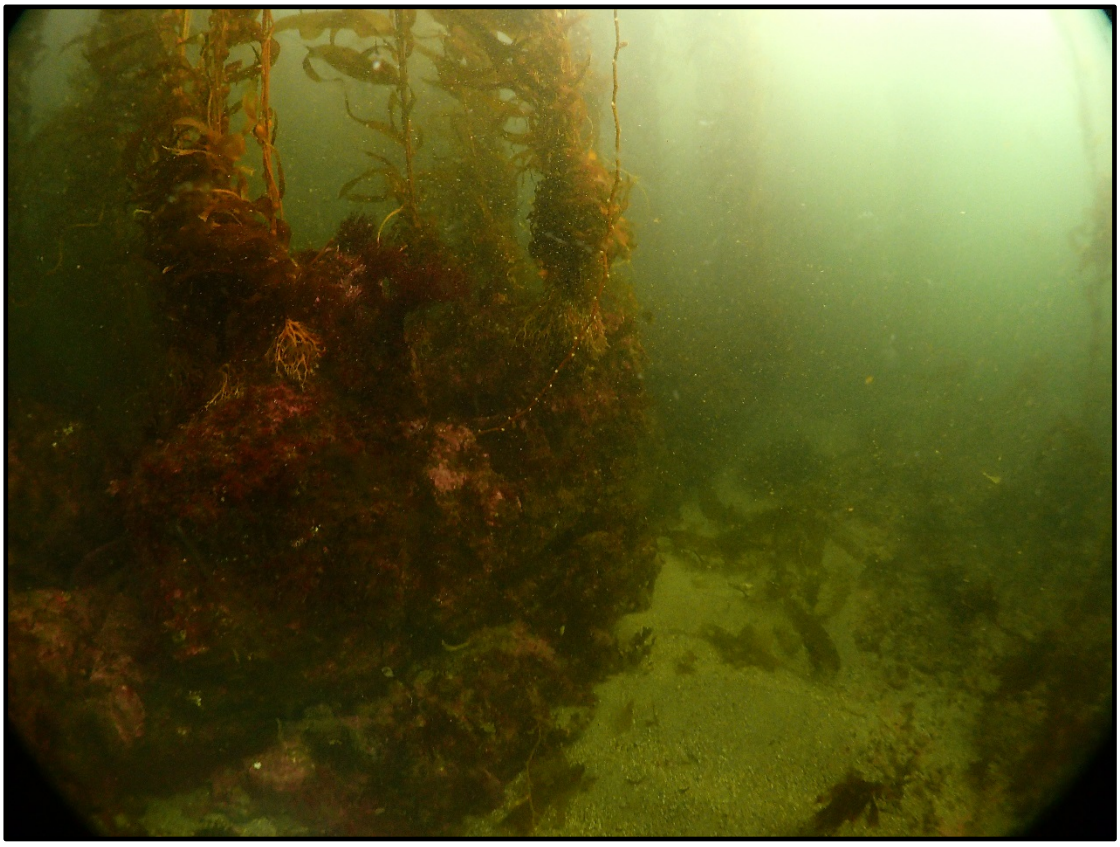
Honeymoon Cove



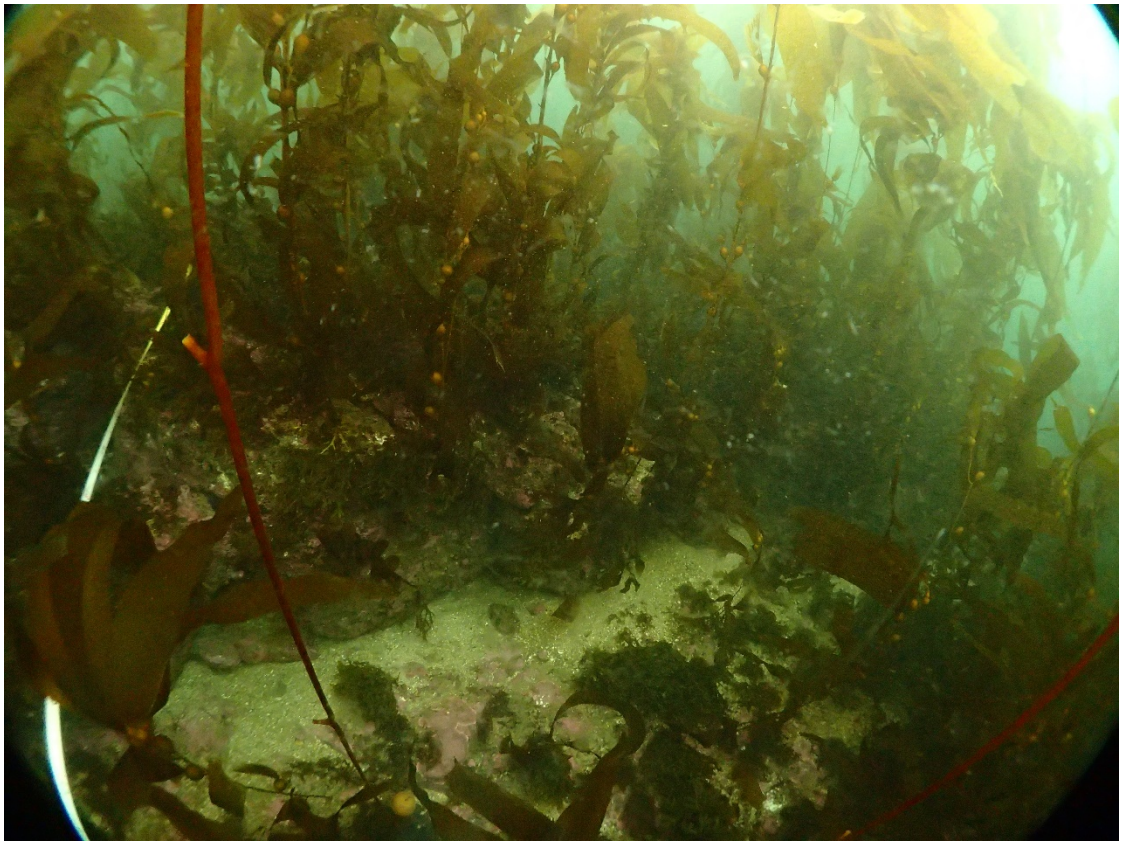
Honeymoon Cove Block T2 (HMC T2) east-west running ridge is a large distinguishable feature easily found by divers. This block was restored in March 2014. GPS: 33.764260, -118.423734



HMC T2 07/29/16

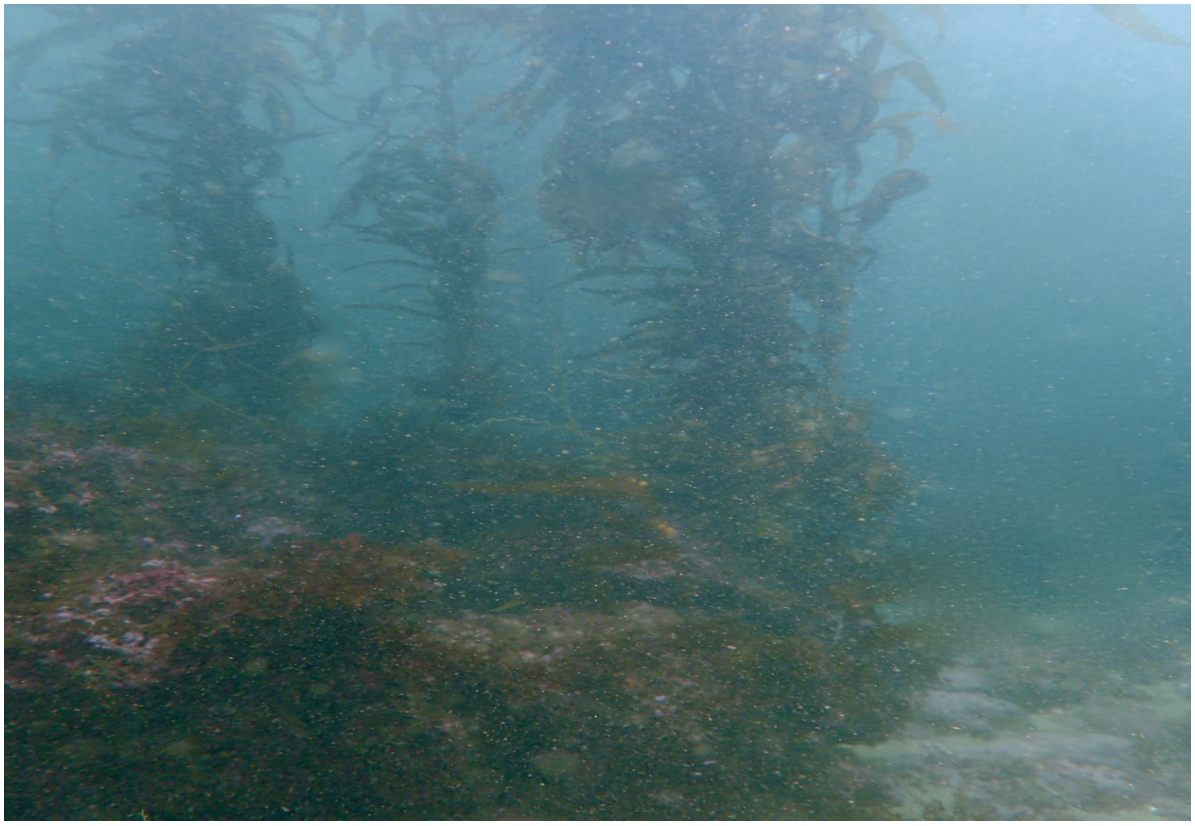


HMC T2 08/07/17

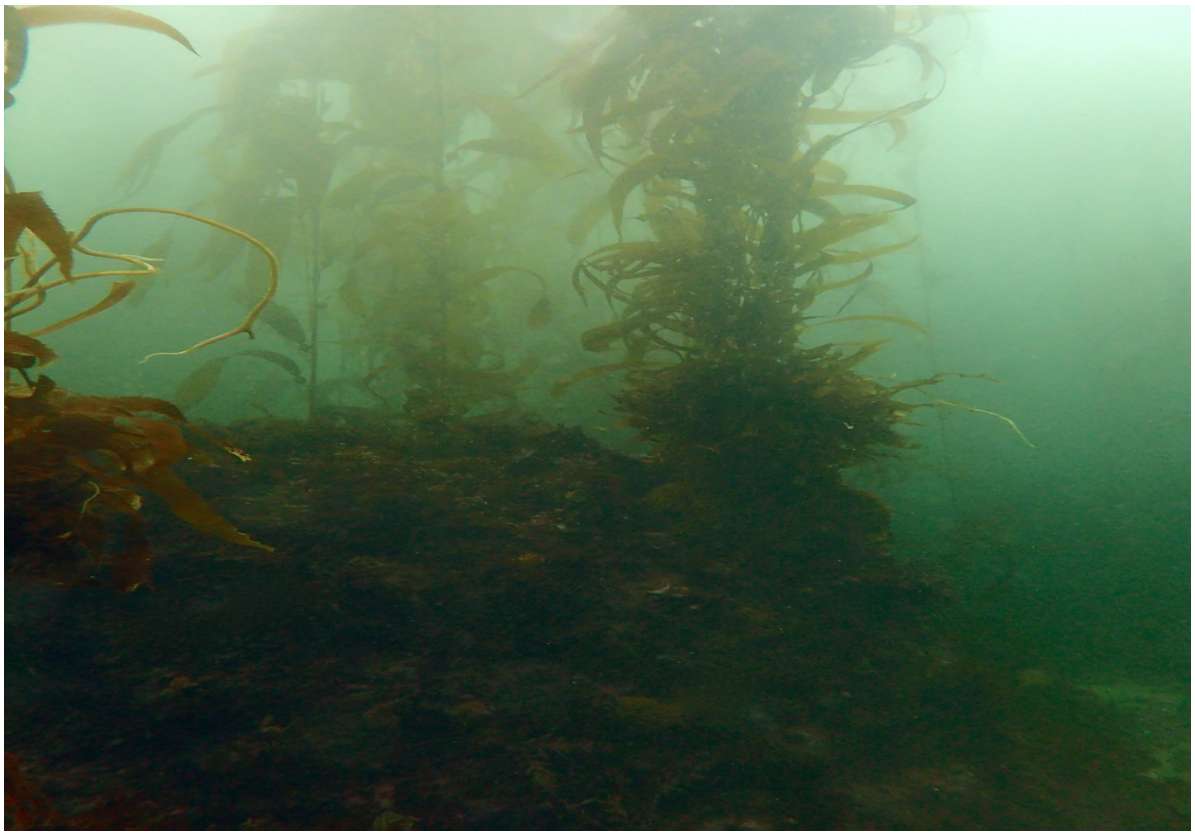


HMC T2 07/18/18

HMC T2 07/18/19



HMC T2 07/17/2020



HMC T2 08/31/21

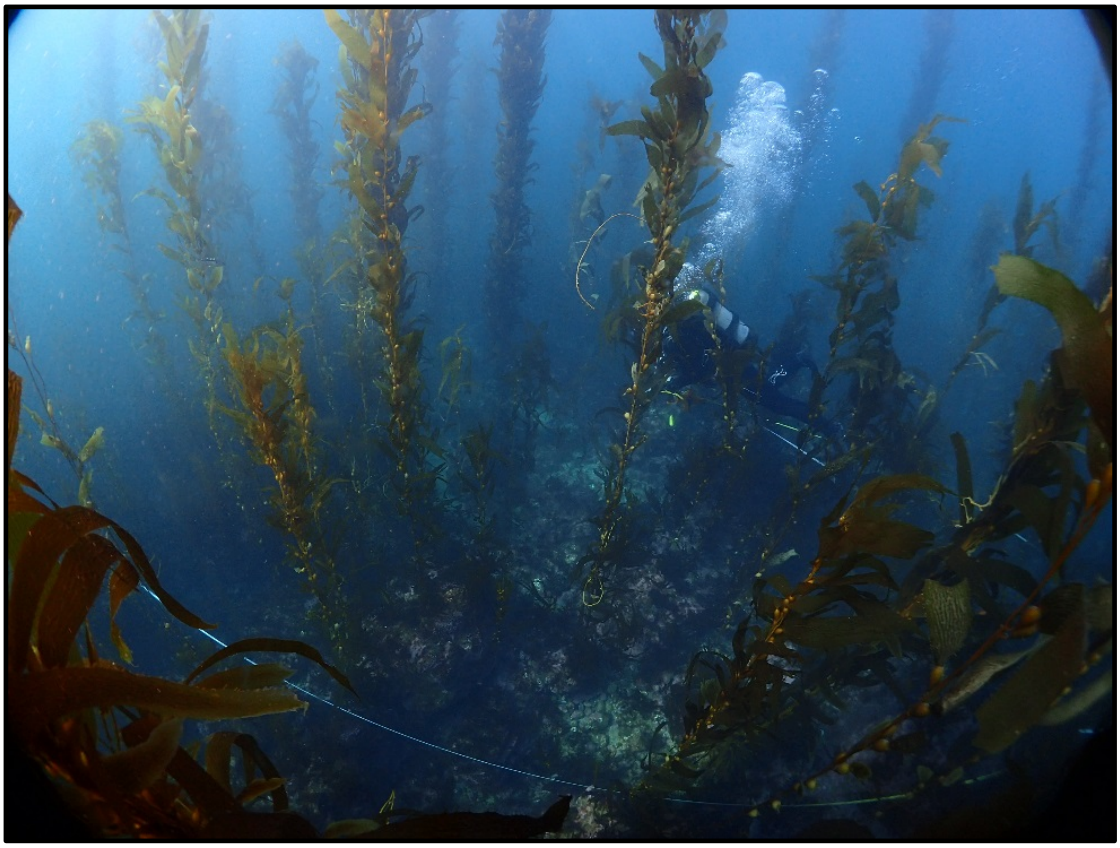
HMC T2 08/16/22

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

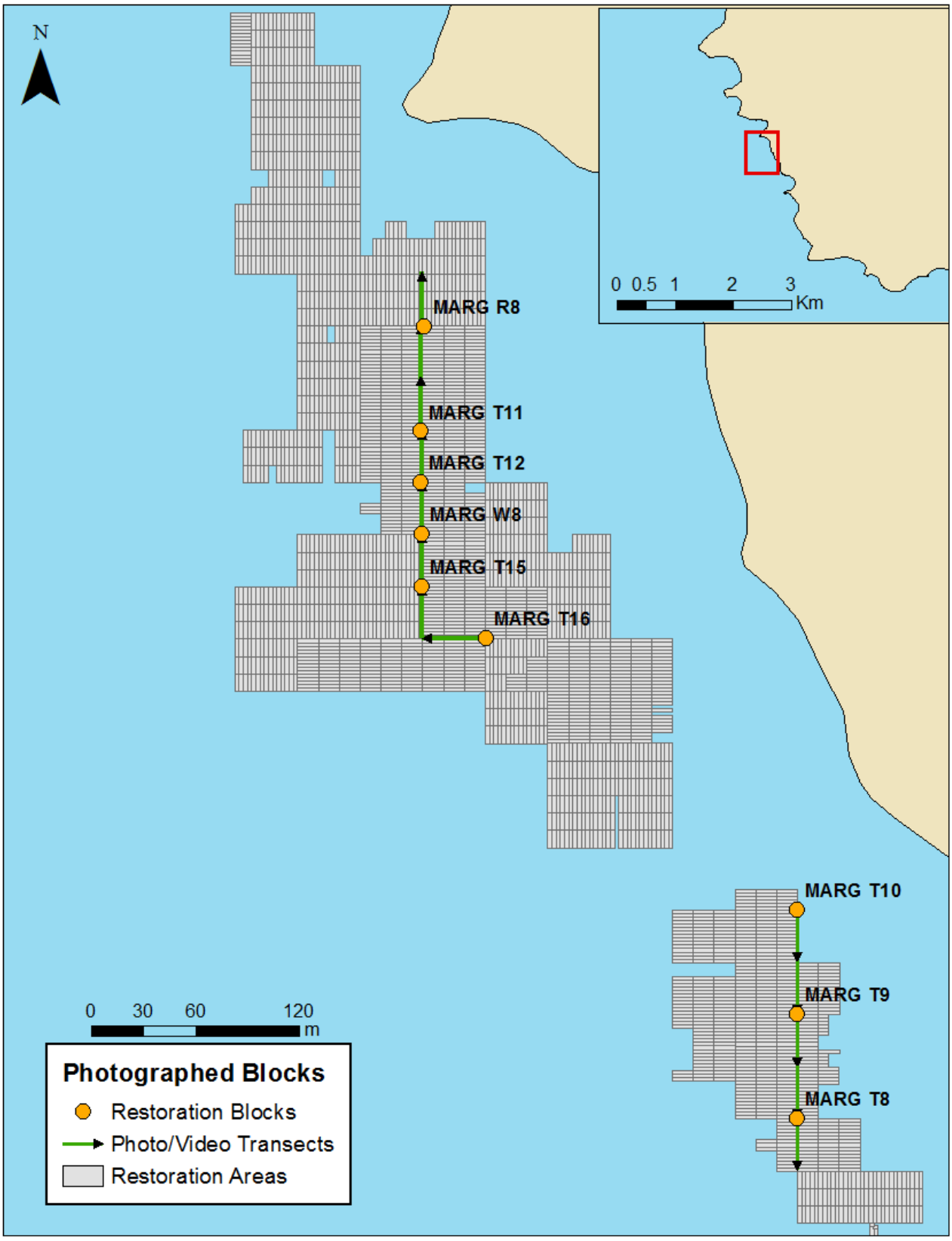
HMC R5 07/18/19

HMC R5 07/17/20

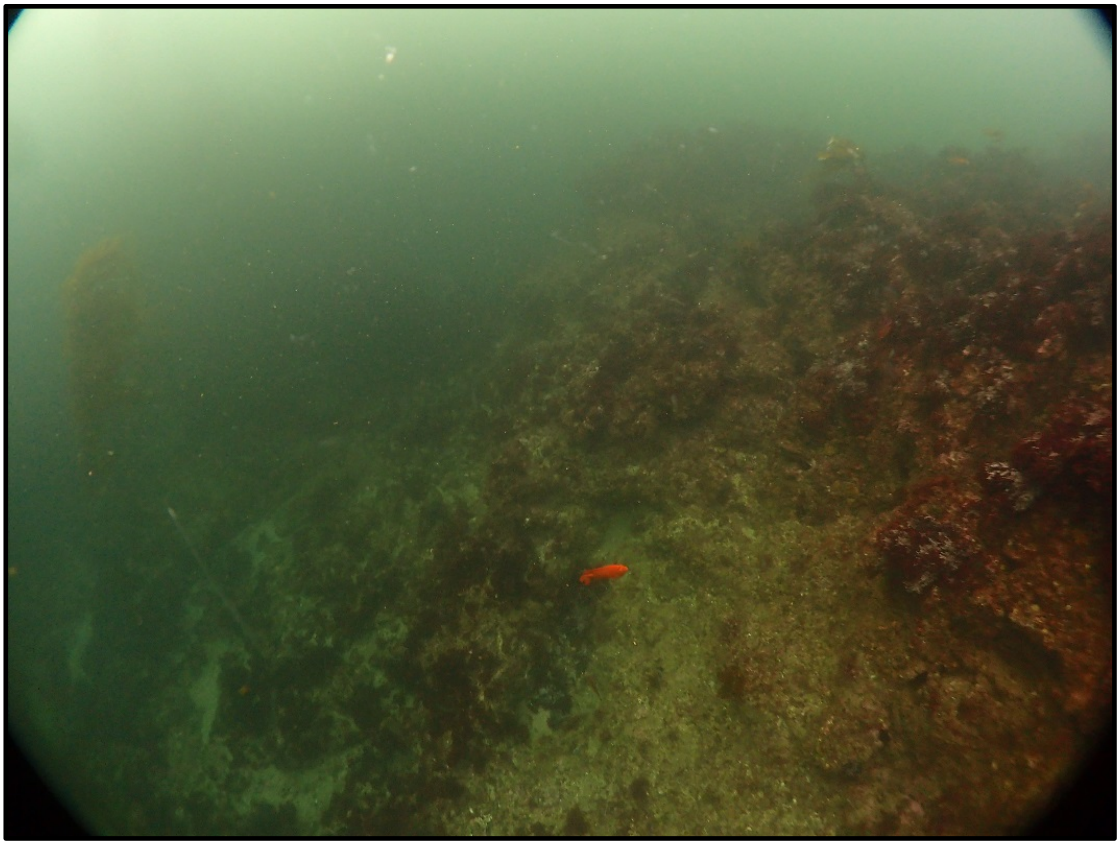
HMC R5 08/31/21

HMC R5 08/18/22

Marguerite

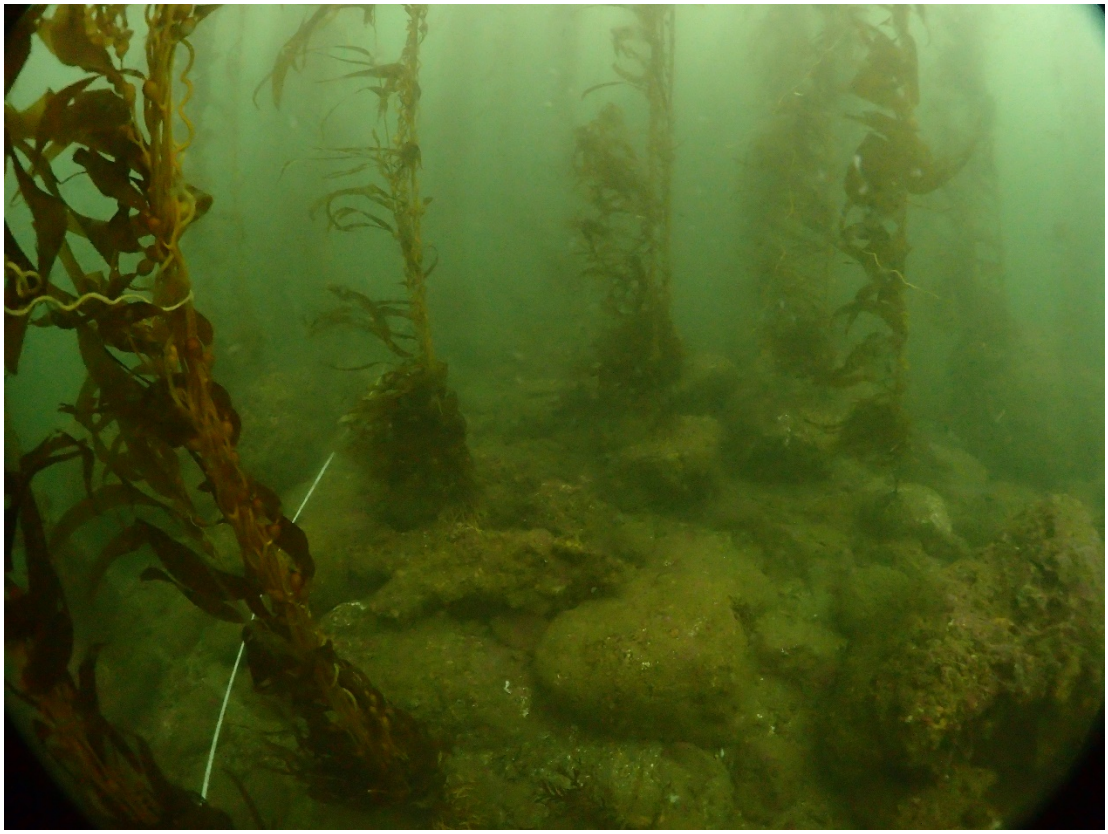


Marguerite Block T16 (MARG T16) was monitored monthly by TBF divers for 2 years starting in 2016 for a wave attenuation study. This block was restored in September 2016. Subsequent photo/videos occur annually. GPS: 33.757561, -118.41782



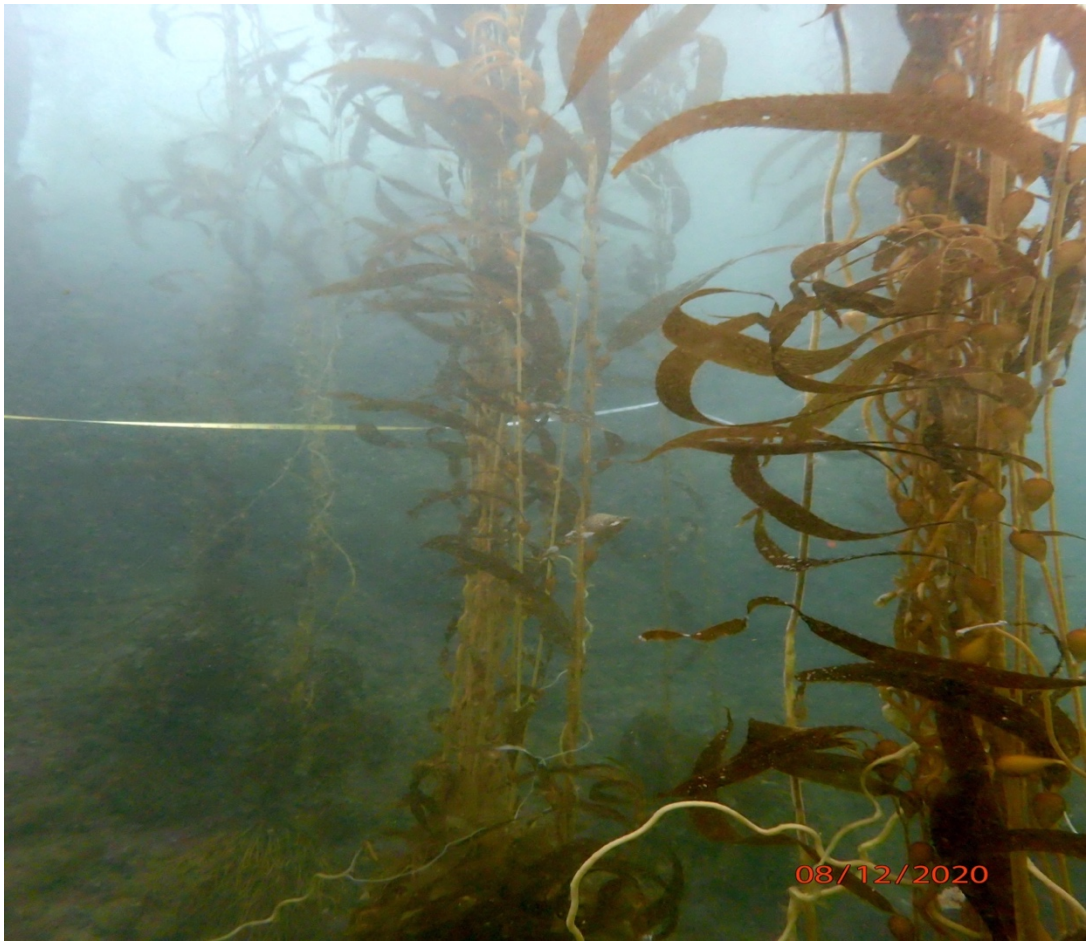
MARG T16 08/10/16

MARG T16 08/3/17

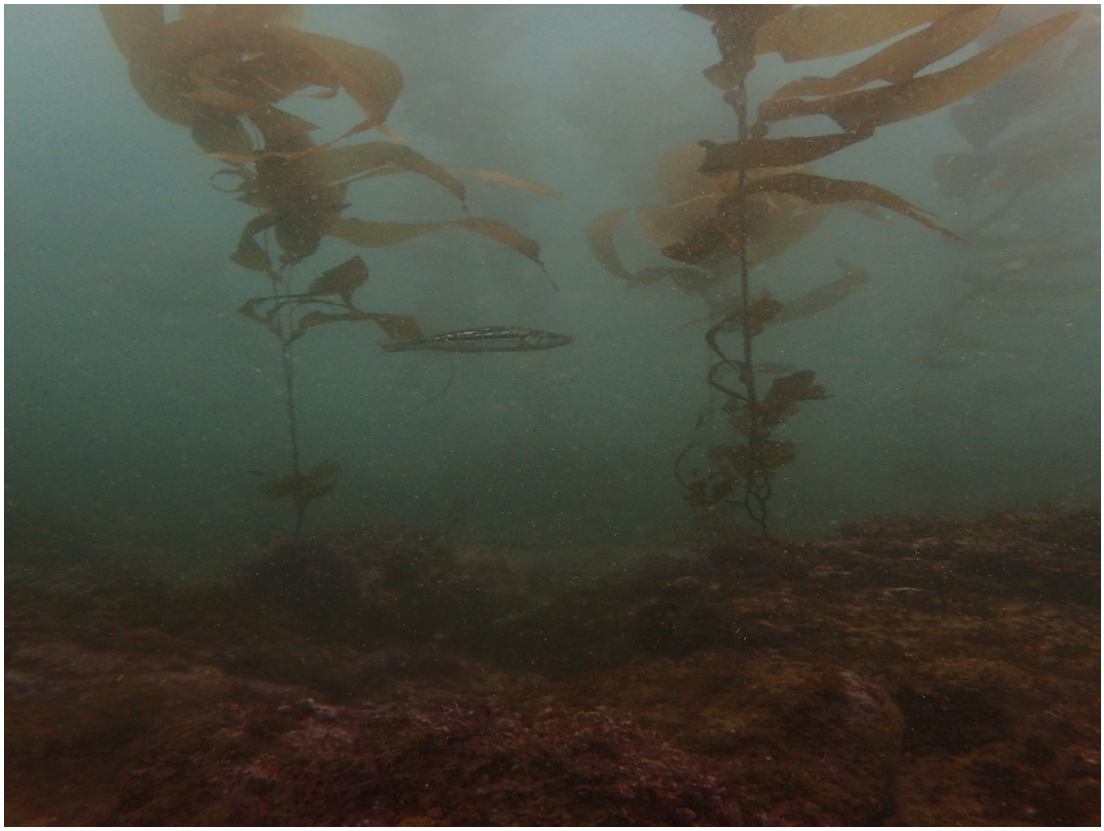


MARG T16 07/20/18

MARG T16 06/21/19



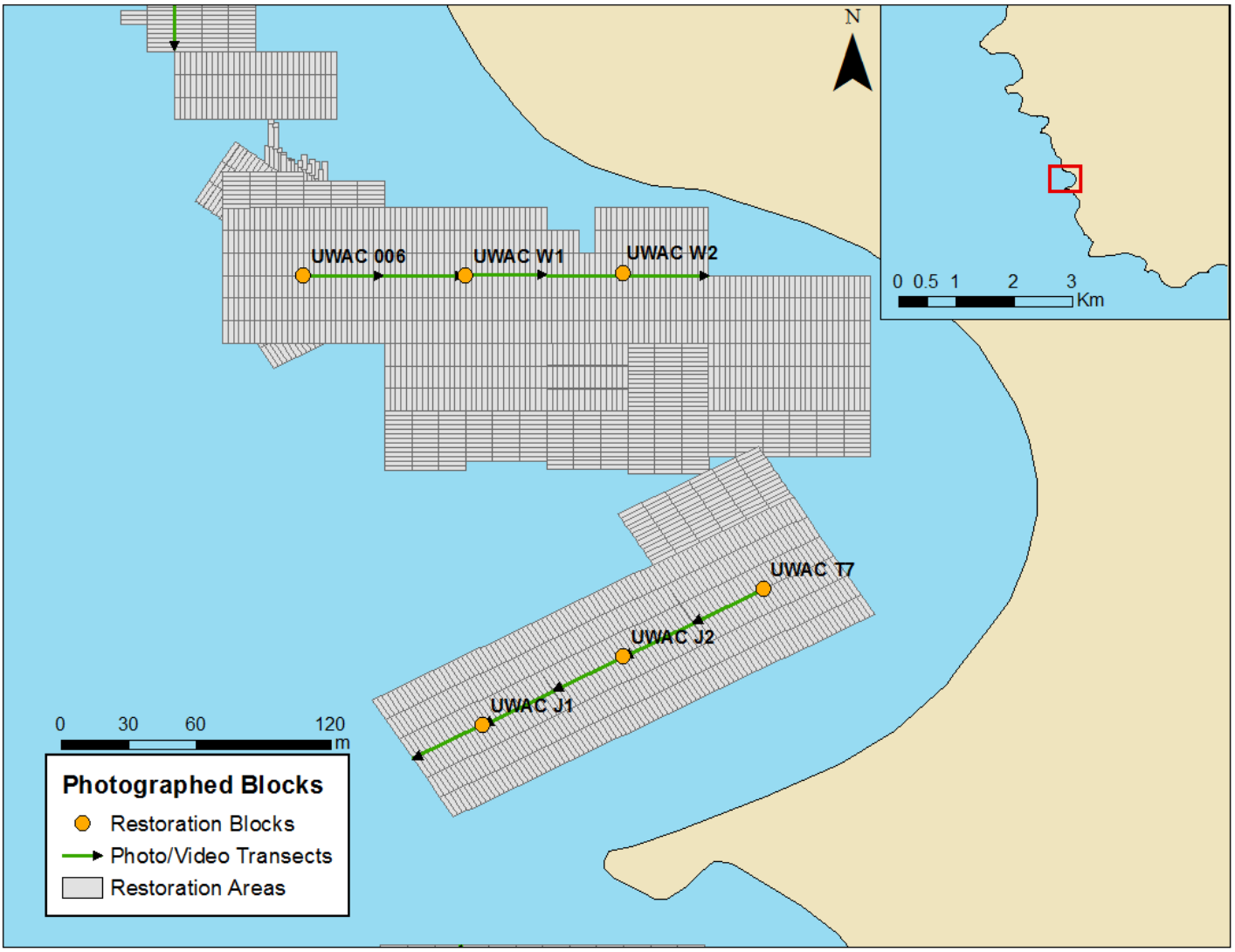
MARG T16 08/12/20



MARG T16 07/09/21

MARG T16 08/18/22

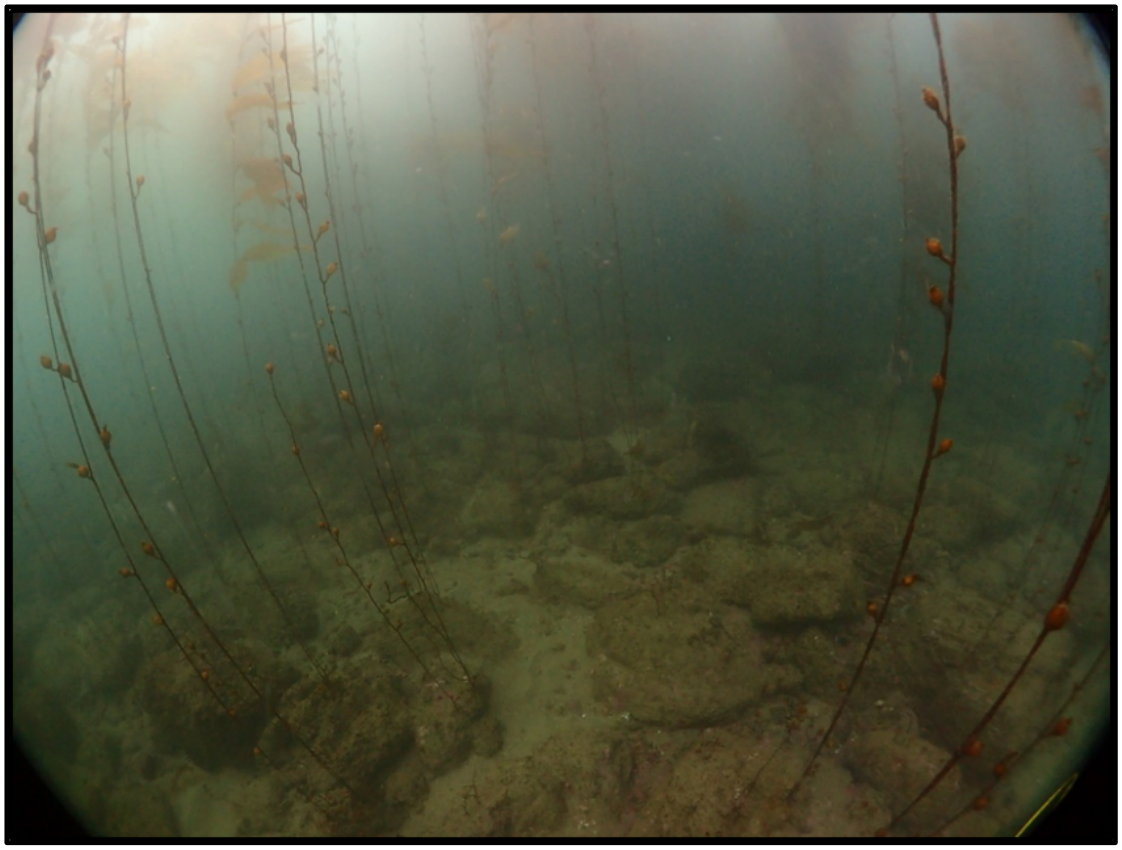
Underwater Arch Cove



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

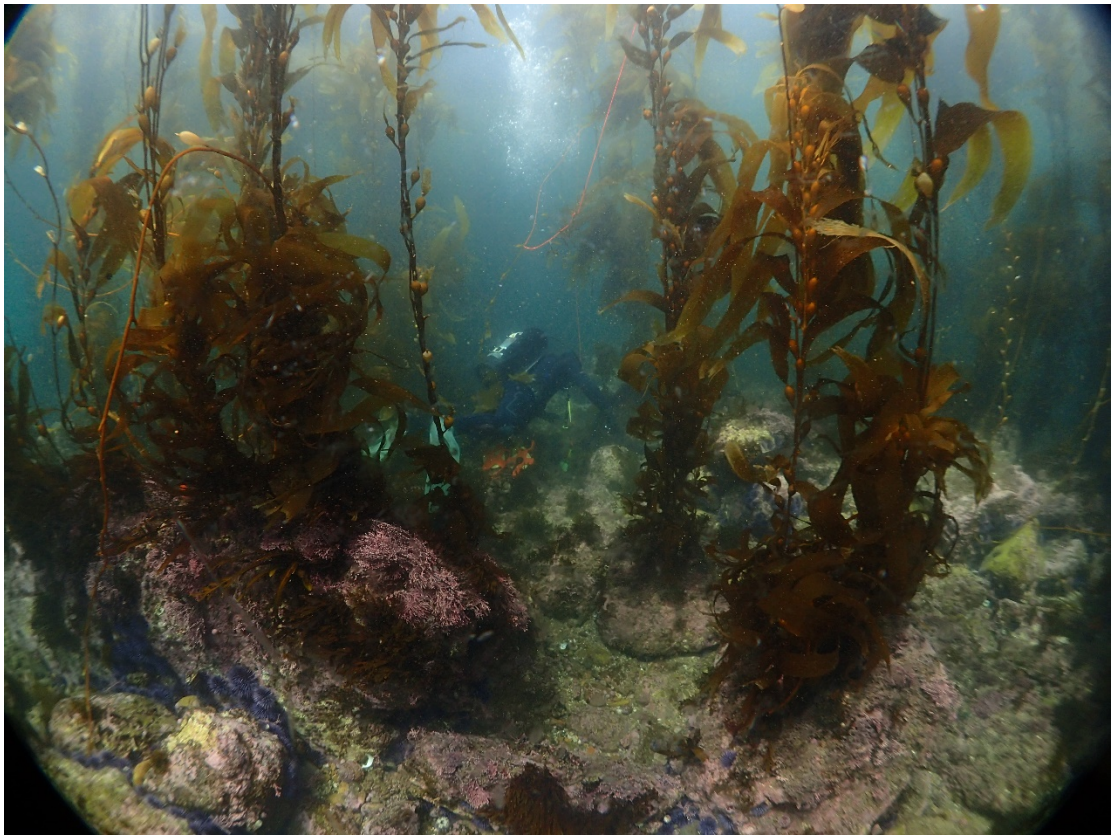
UWAC J1 restoration was complete in November 2013. GPS: 33.75205979, -118.4156861

UWAC J1 08/14/14



UWAC J1 07/07/16

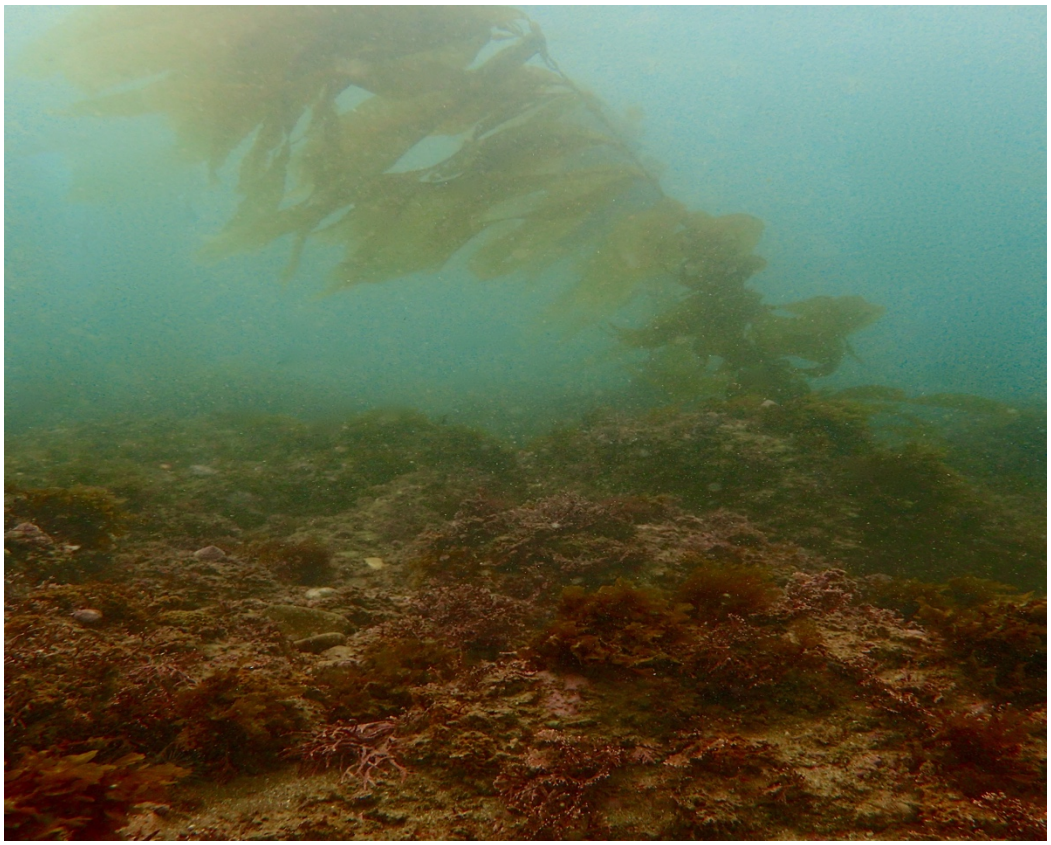
UWAC J1 07/27/17

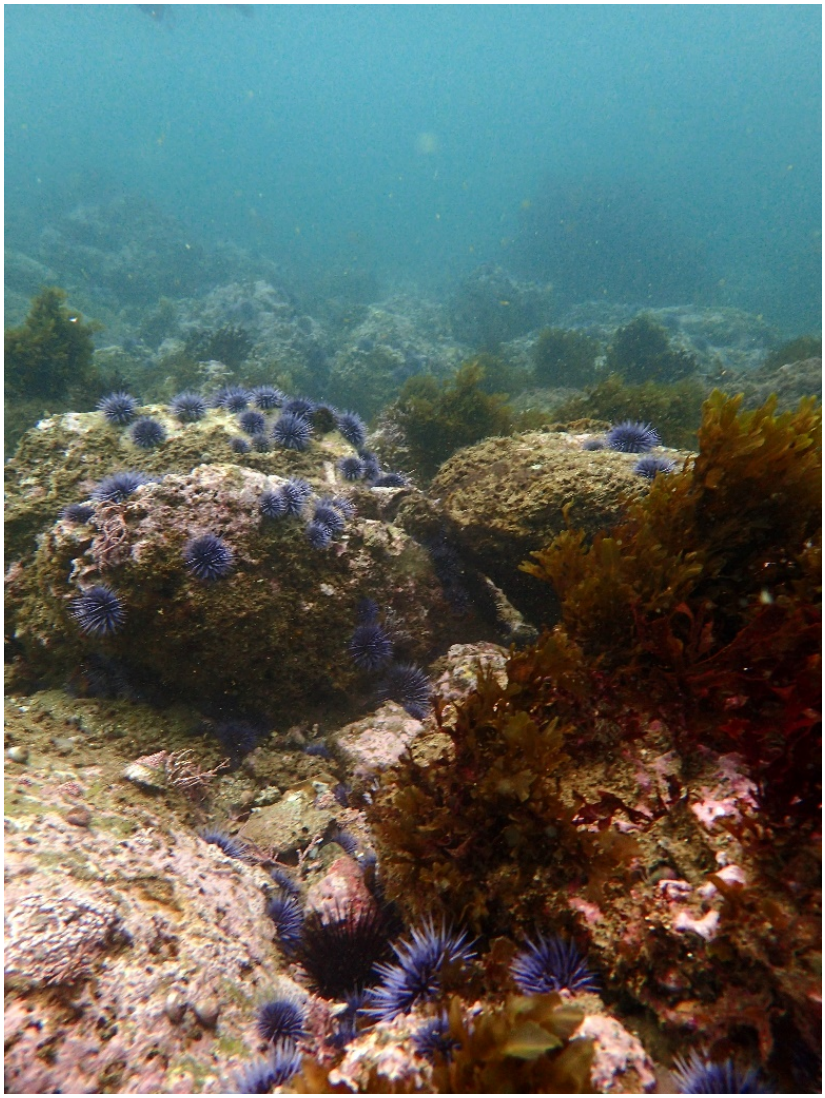


UWAC J1 07/18/18

UWAC J1 06/21/19

UWAC J1 07/24/20


UWAC J1 07/13/21



UWAC J1 08/18/22

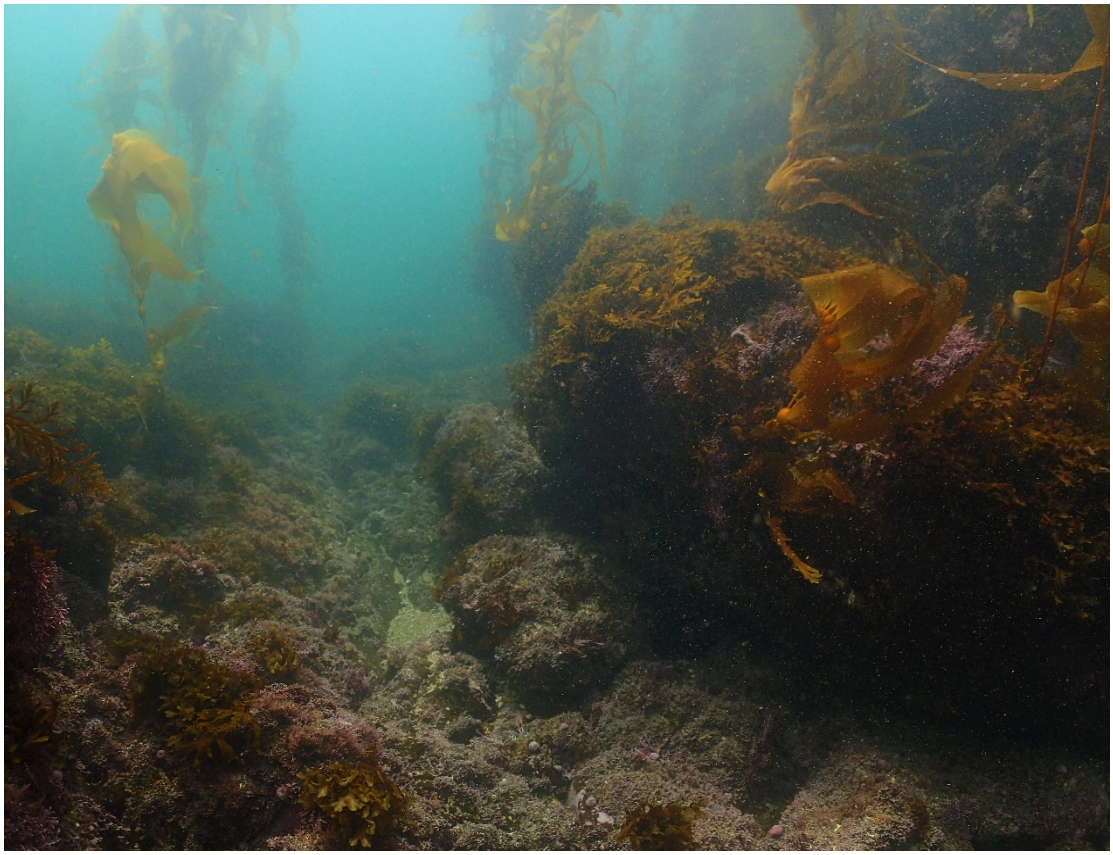
UWAC J2 was restored in July 2014. GPS: 33.7523302, -118.4151245

UWAC J2 PRE-RESTORATION 07/12/14

UWAC J2 08/14/14

UWAC J2 07/27/17

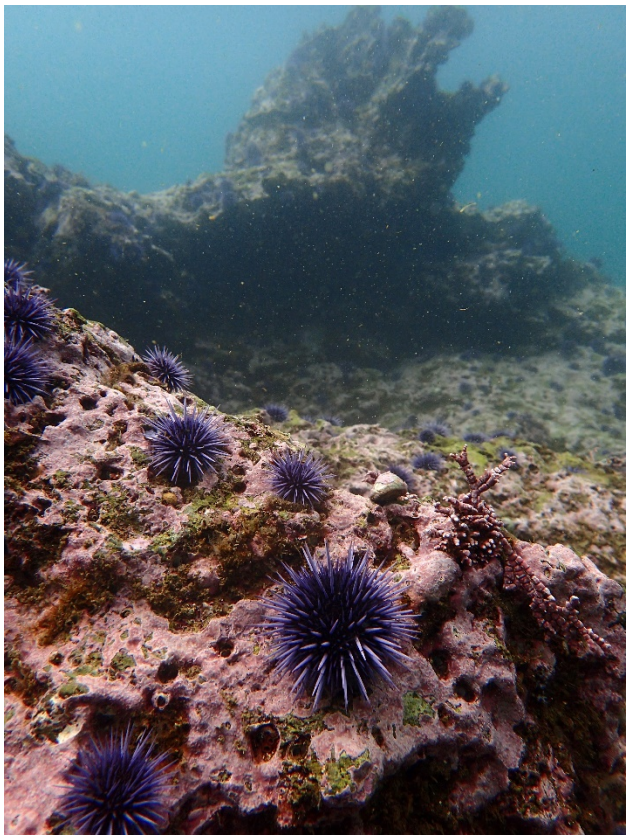
UWAC J2 07/18/18



UWAC J2 06/21/19

UWAC J2 07/24/20

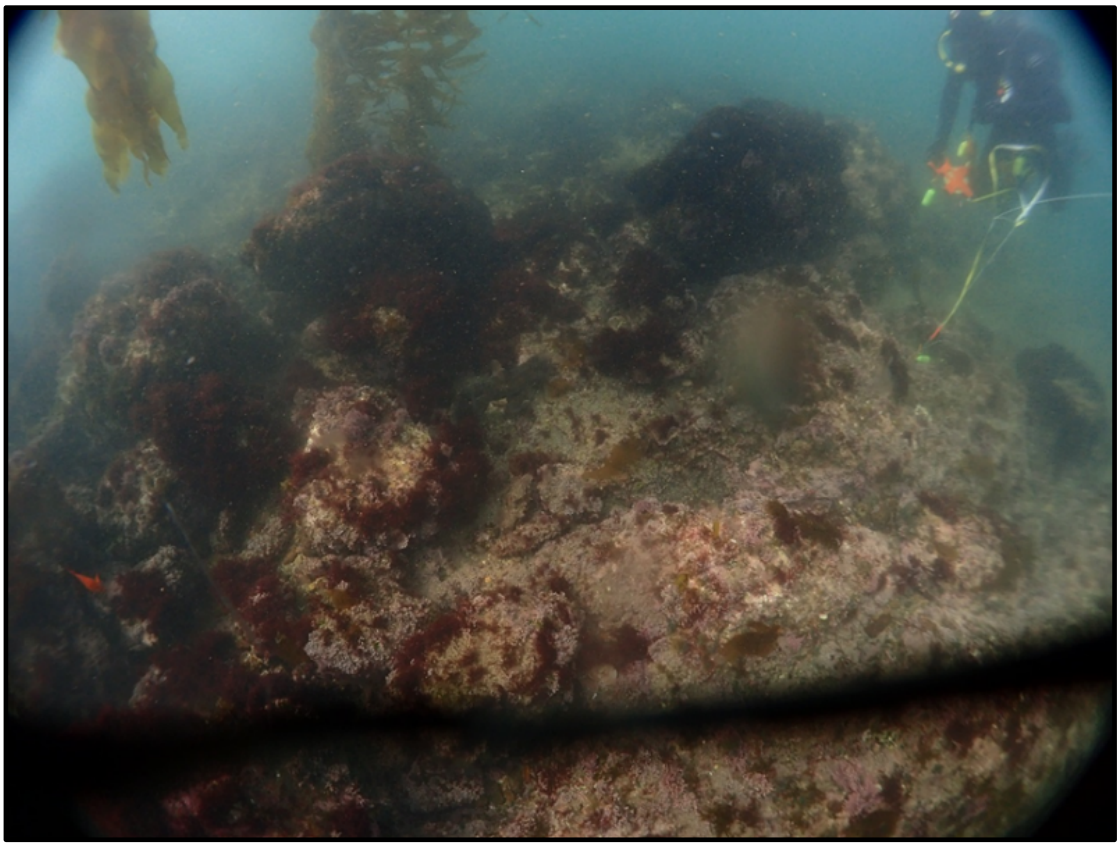
UWAC J2 07/13/21



UWAC J2 08/18/22

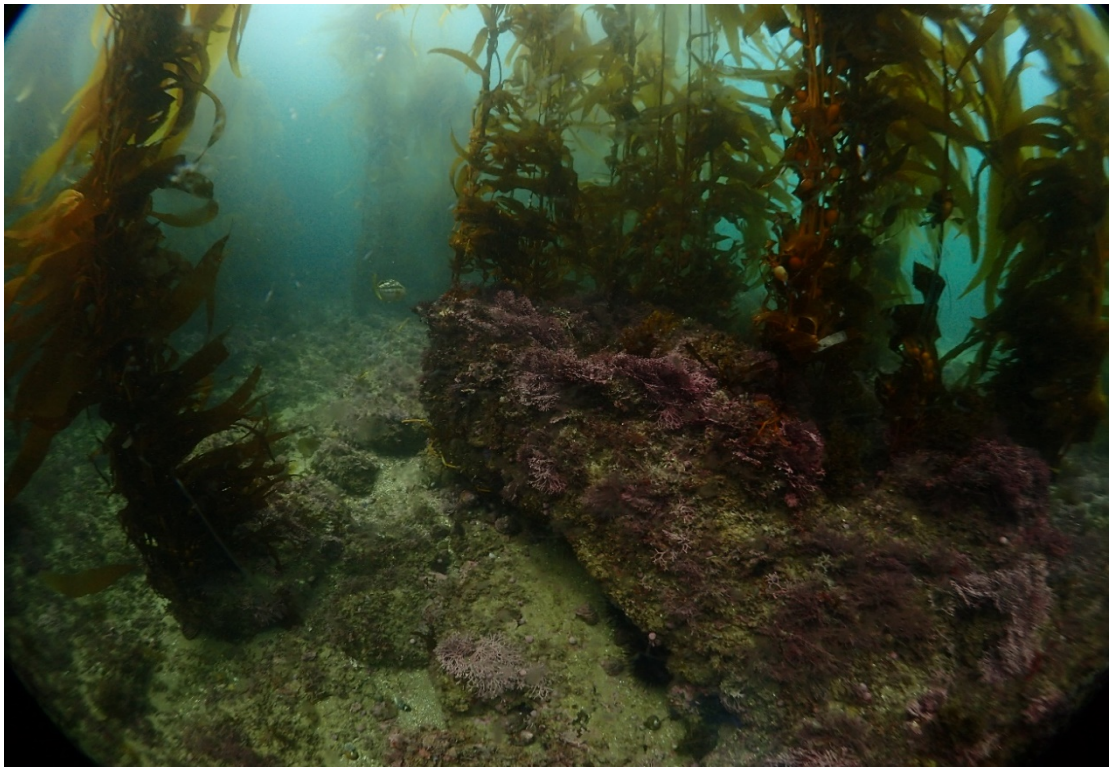
UWAC T7 was restored in September 2014. GPS: 33.7526, -118.414563

UWAC T7 PRE-RESTORATION 08/14/14



UWAC T7 07/07/16

UWAC T7 07/27/17

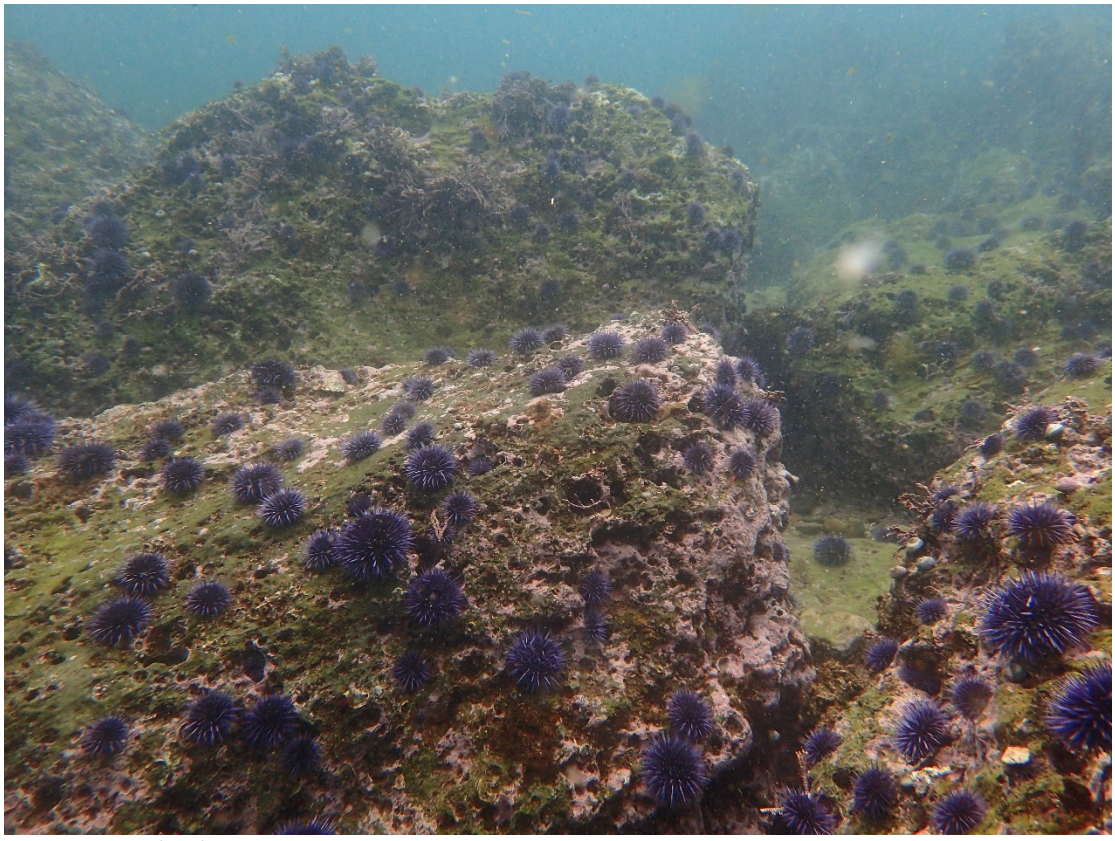


UWAC T7 07/18/18

UWAC T7 06/21/19

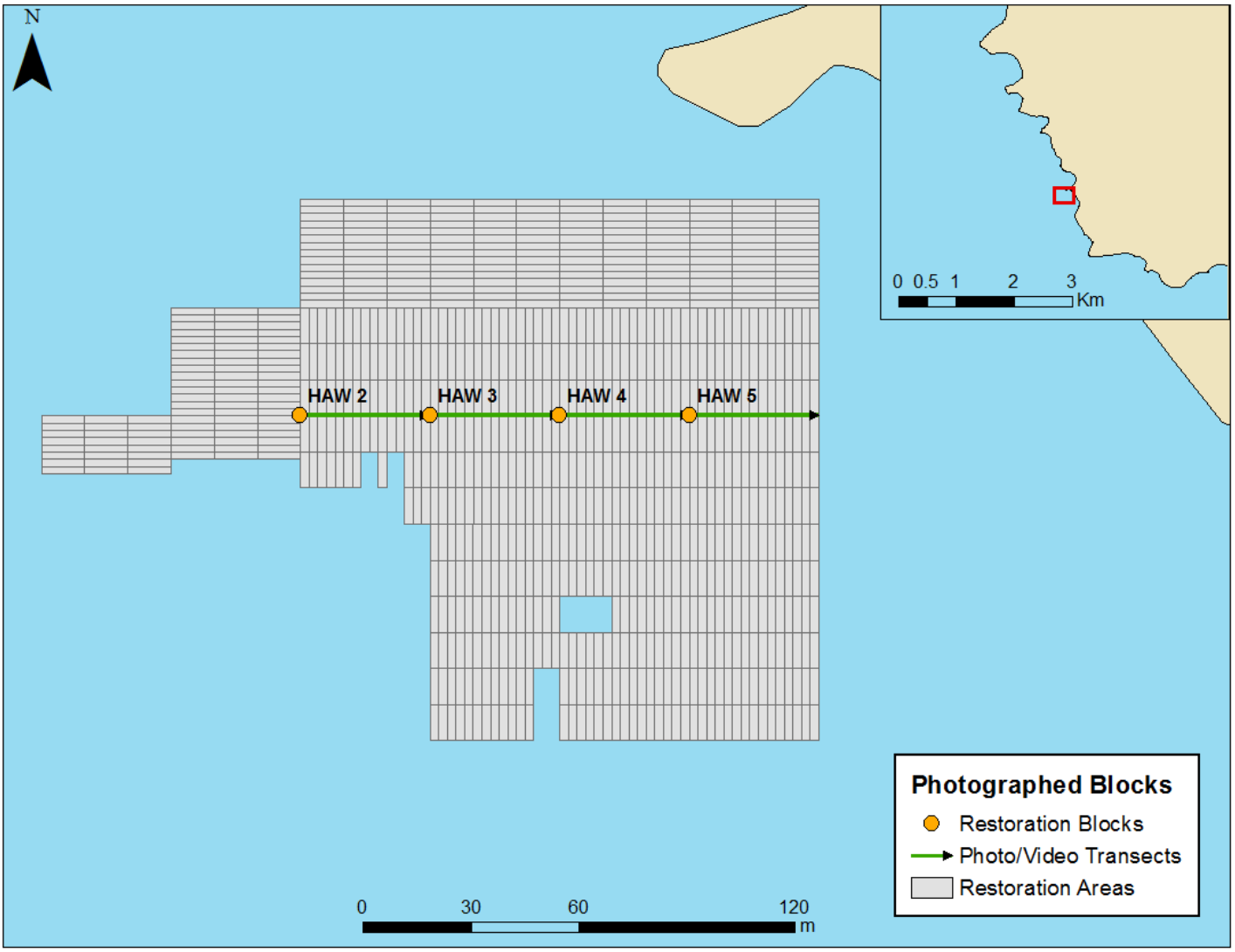
UWAC T7 07/24/20

UWAC T7 07/13/21

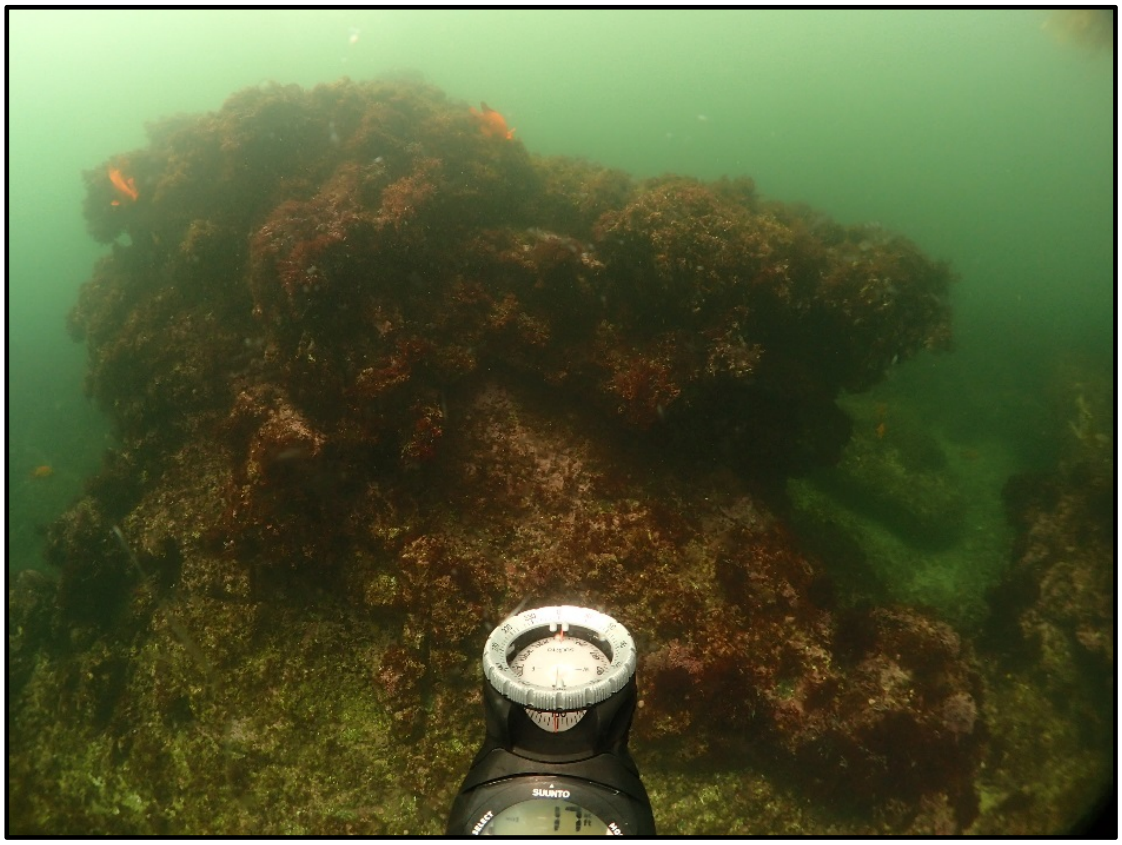


UWAC T7 08/18/22

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

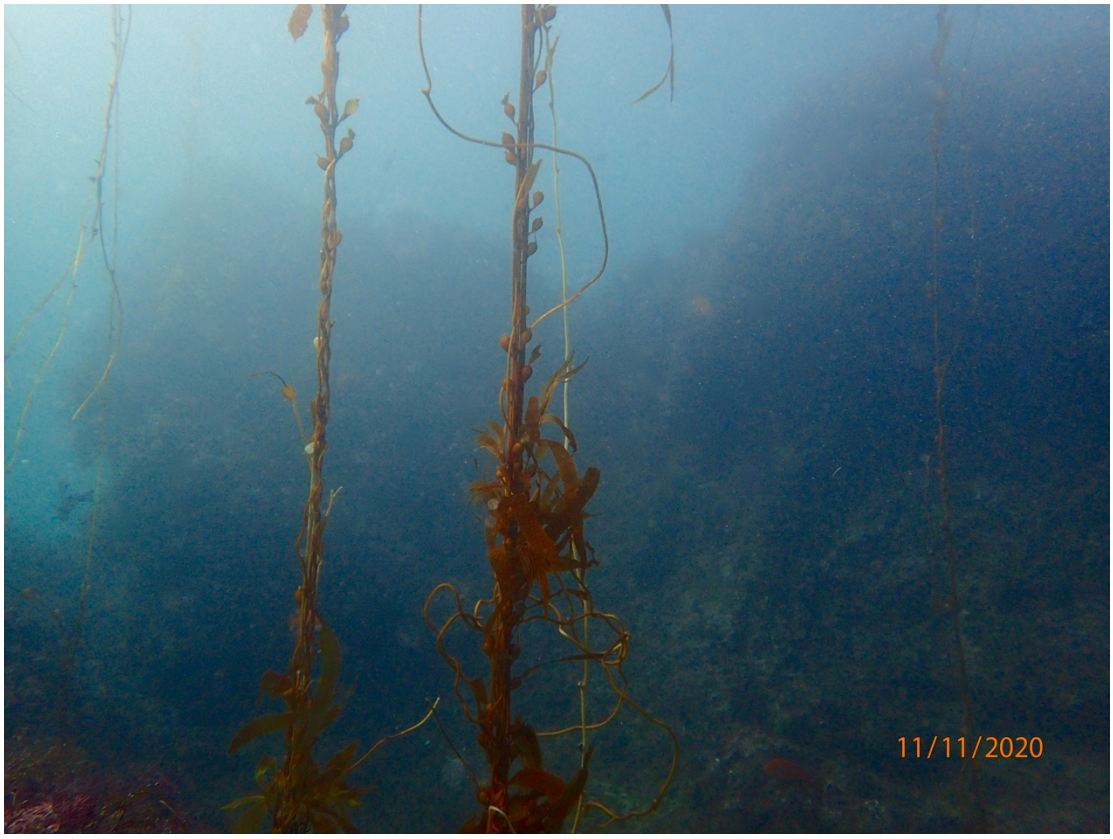


HAW 2 Heading 180 08/10/16

HAW 2 Heading 180 08/25/17

HAW 2 Heading 180 07/20/18

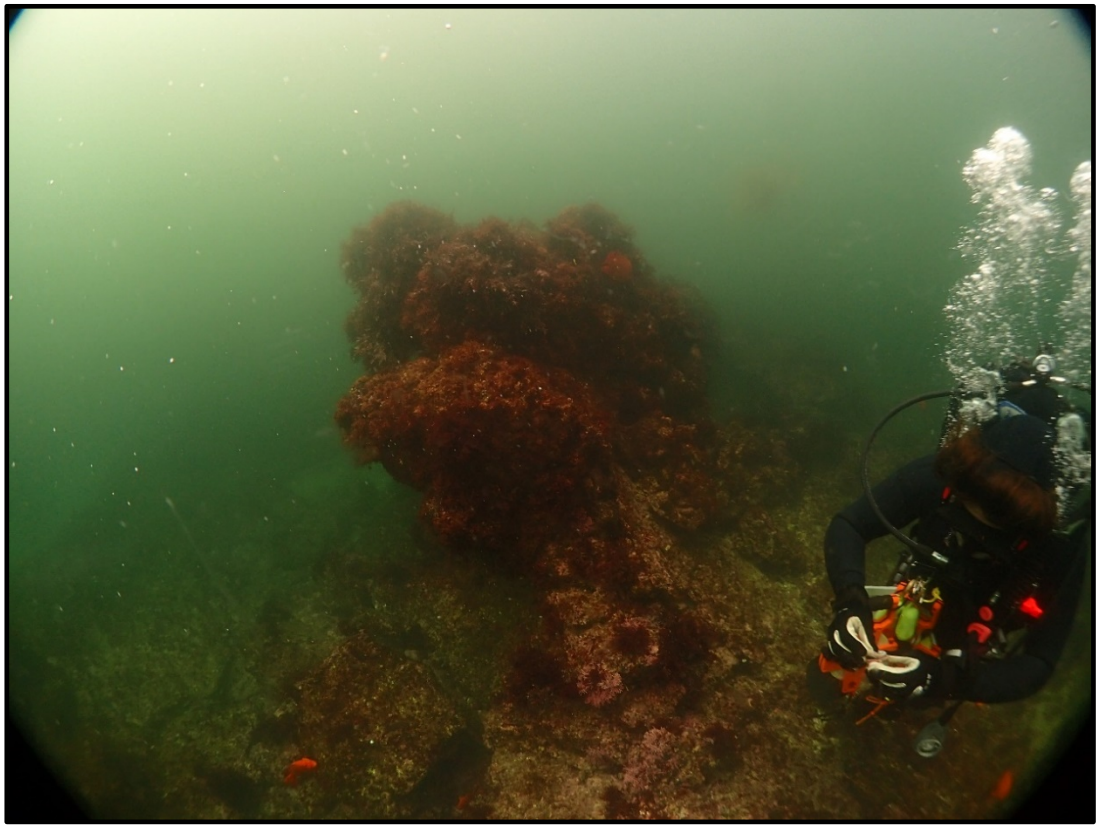
HAW 2 Heading 180 07/18/19



HAW 2 Heading 180 11/11/20

HAW 2 Heading 180 07/09/21

HAW 2 Heading 180 08/18/22

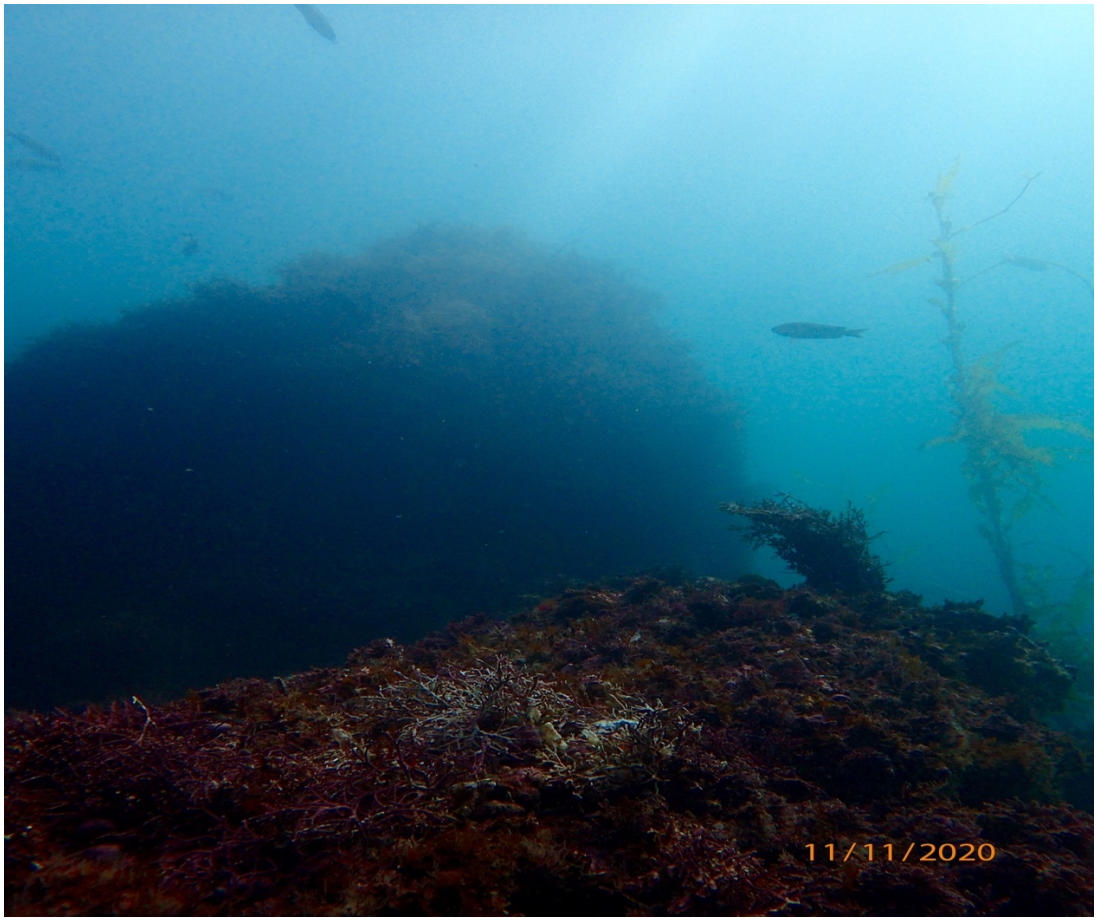


HAW 2 Heading 90 08/10/16

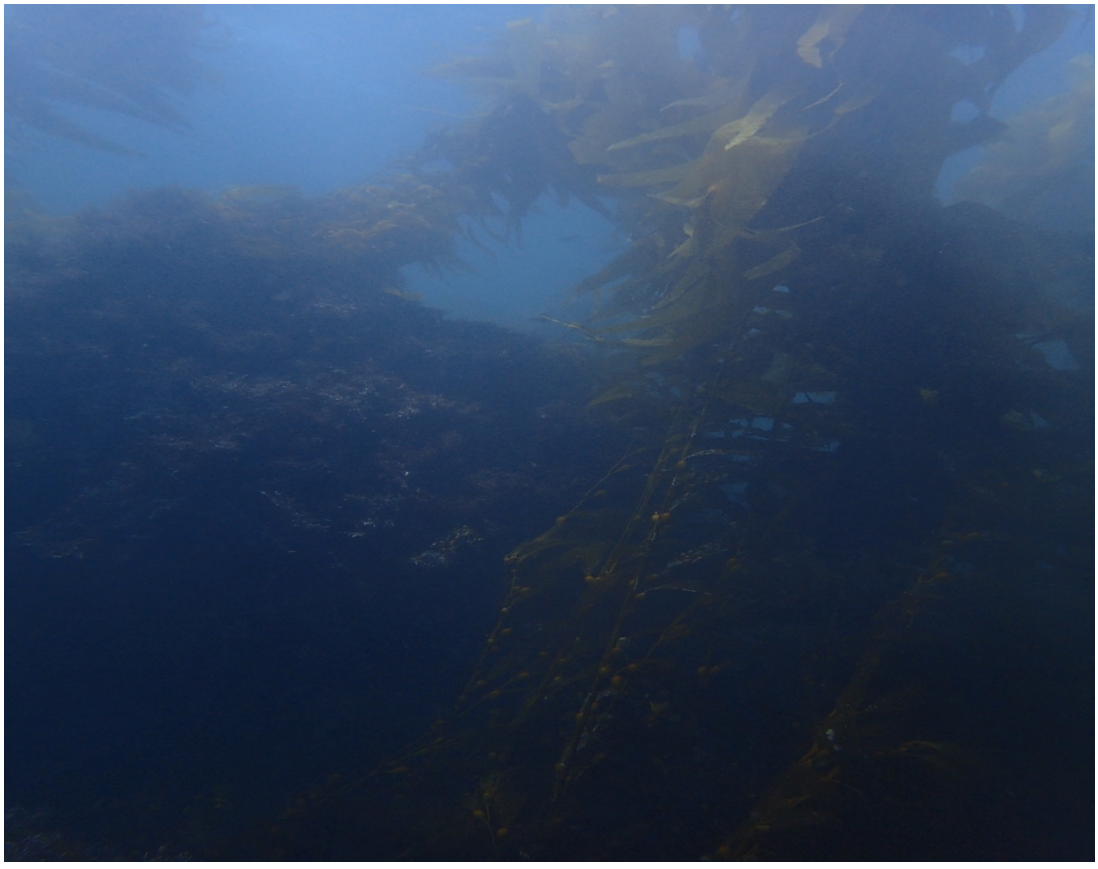
HAW 2 Heading 90 08/25/17

HAW 2 Heading 90 07/20/18

HAW 2 Heading 90 07/18/19

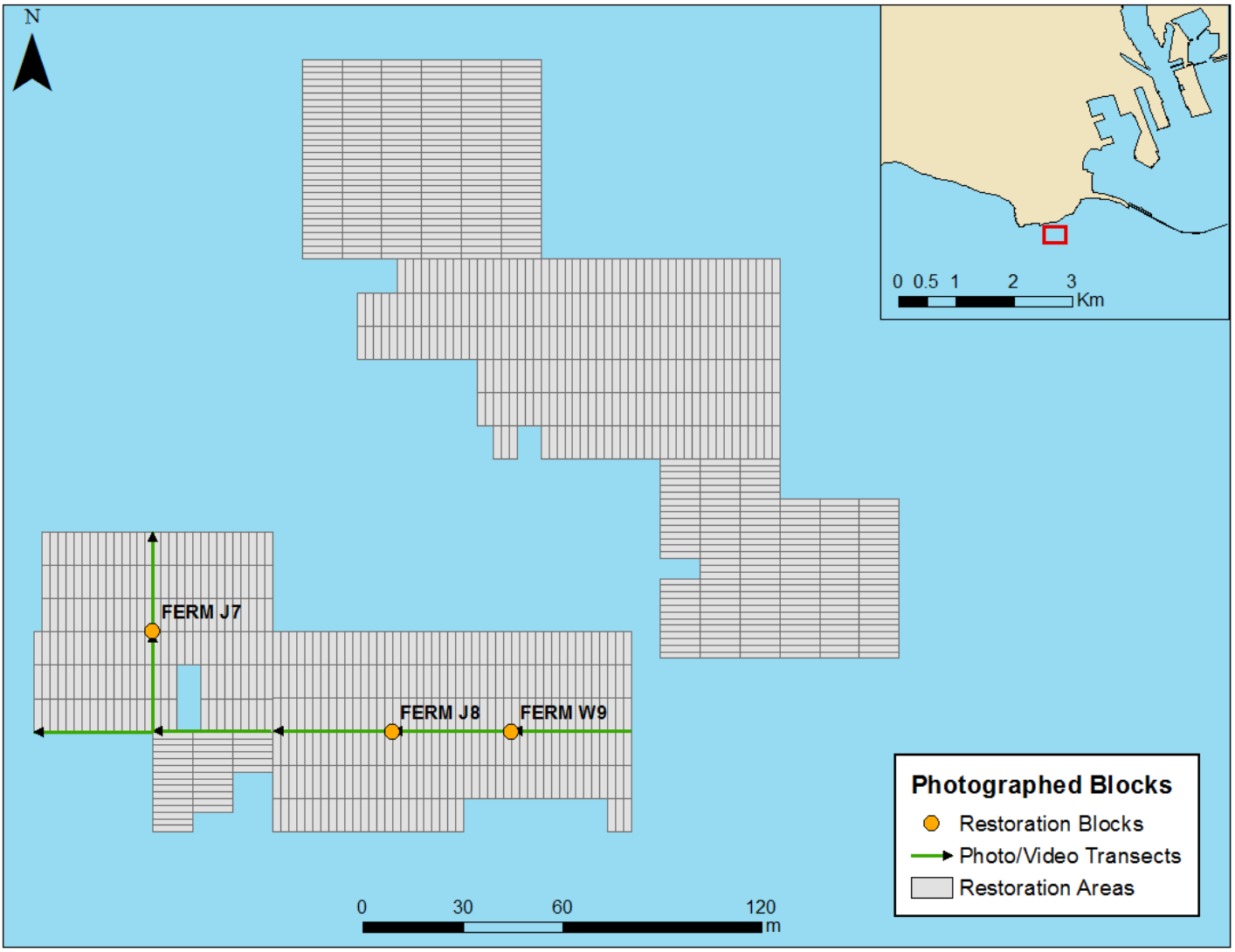


HAW 2 Heading 90 11/11/20


HAW 2 Heading 90 07/09/21

HAW 2 Heading 90 08/18/22

Point Fermin

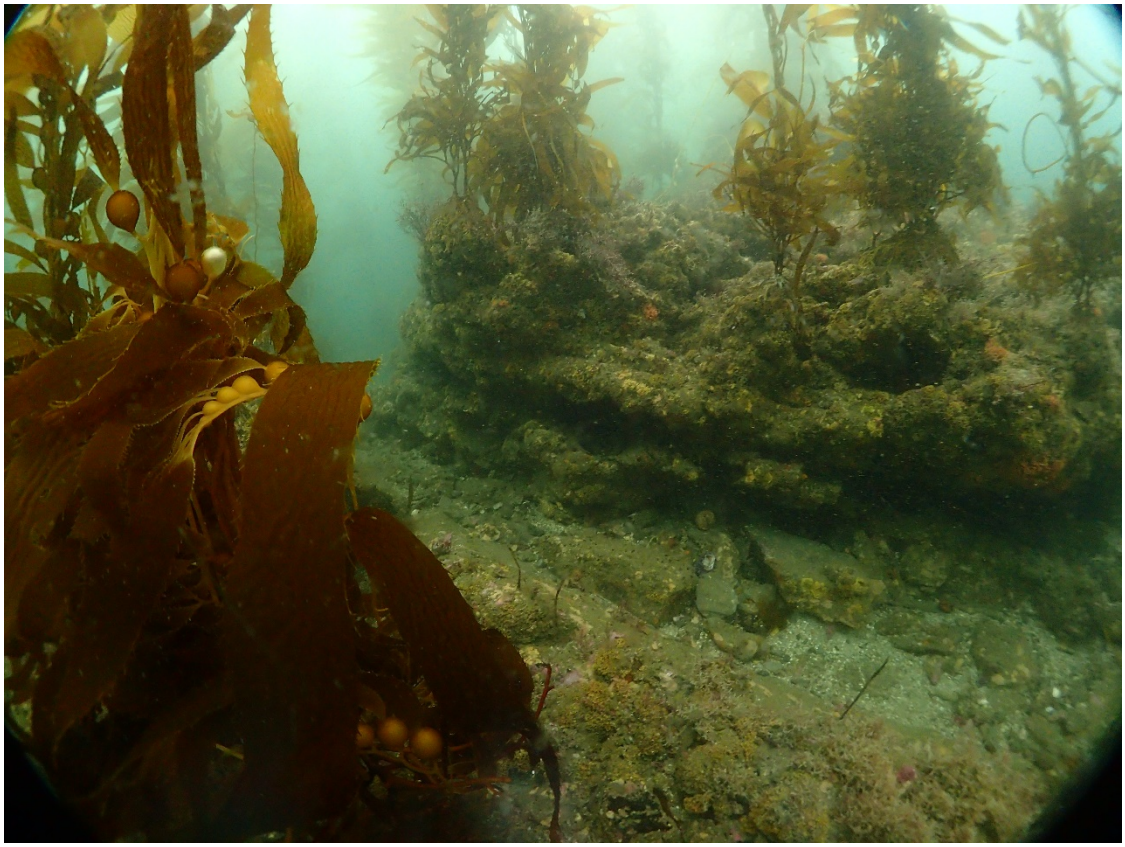


Point Fermin Block J7 (FERM J7) is a north-south running ridge that has been well documented with video footage pre and post restoration. GPS: 33.703028, -118.290167

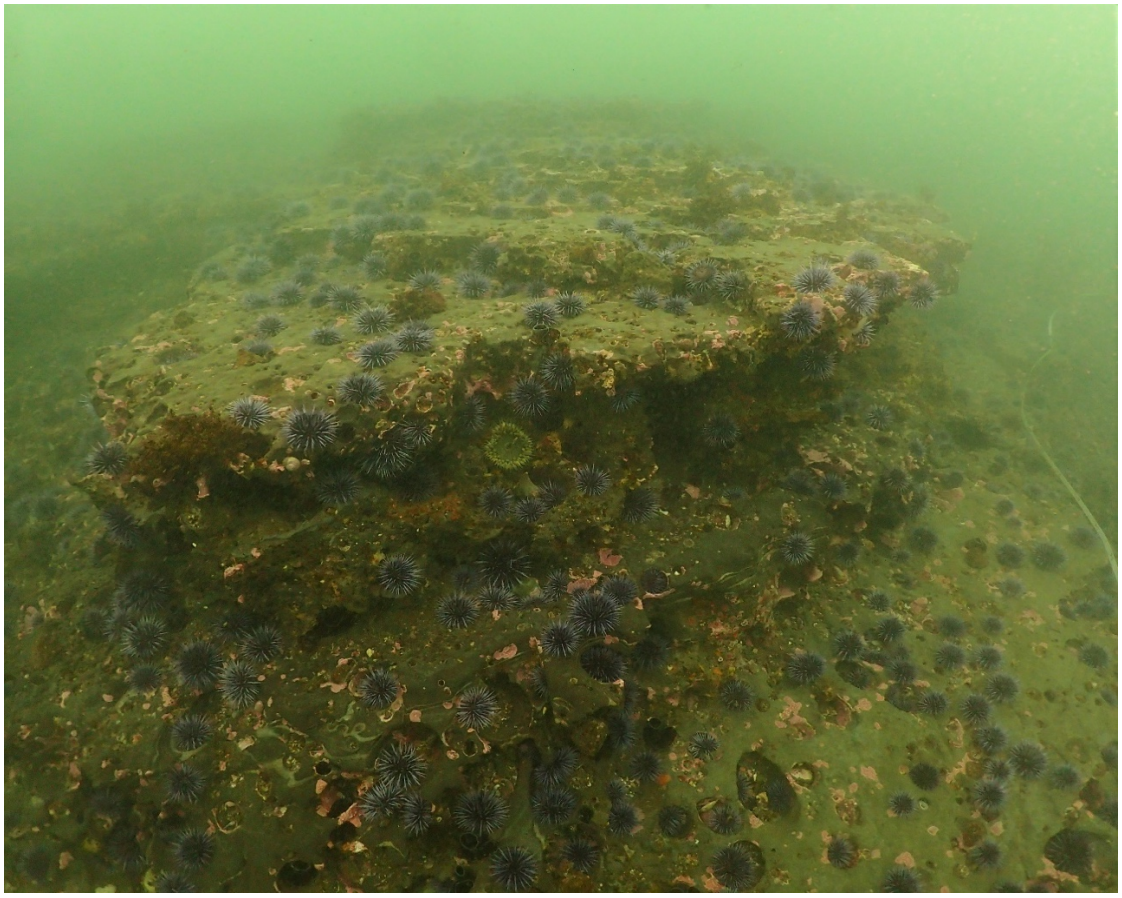
FERM J7 9/25/15

FERM J7 8/10/16

FERM J7 7/7/17



FERM J7 7/17/18



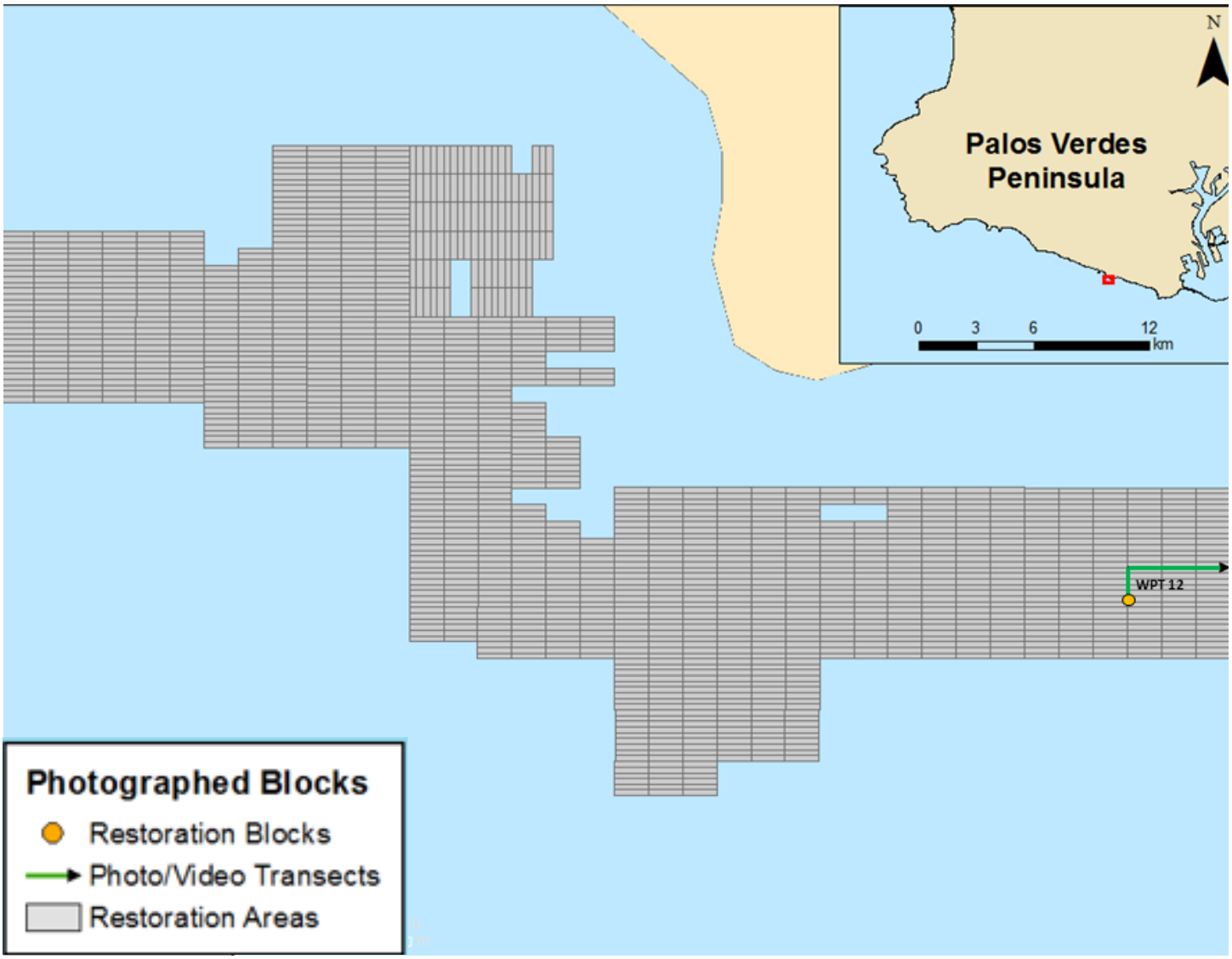
FERM J7 08/07/19

FERM J7 07/29/20

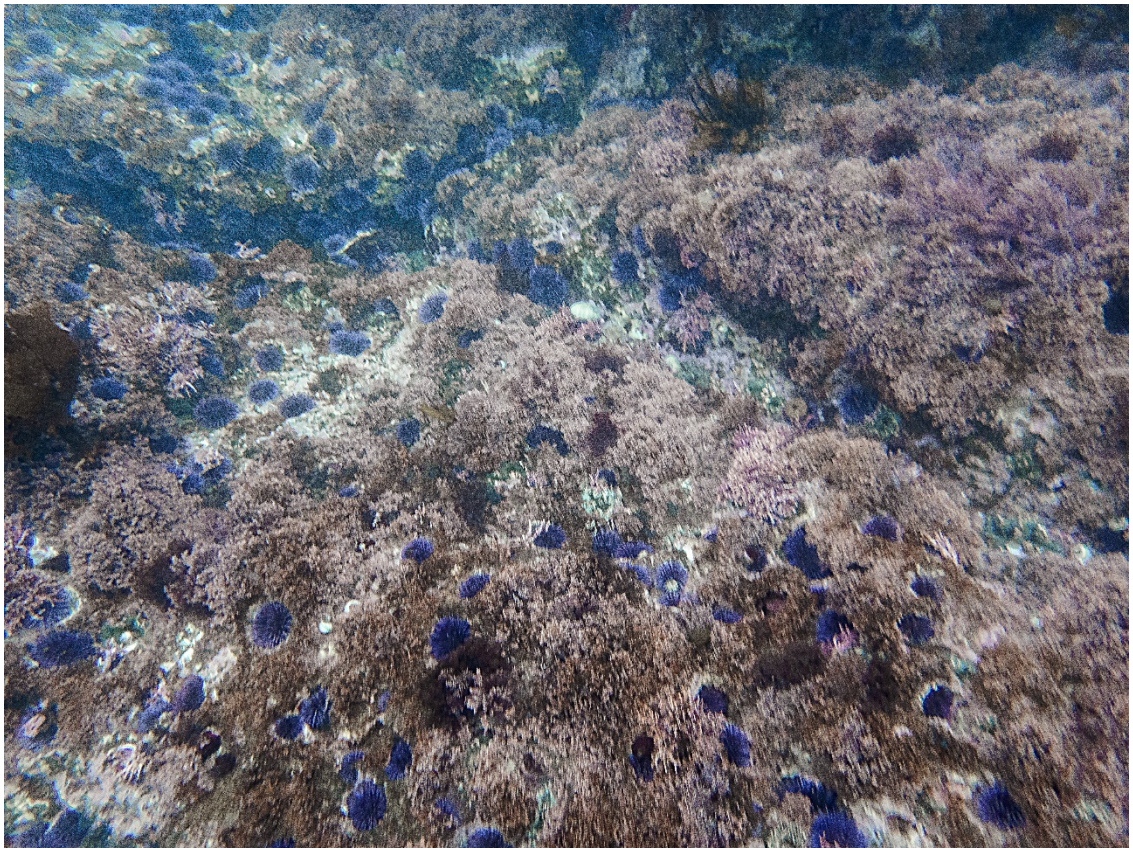
FERM J7 06/11/2021

FERM J7 08/04/22

White Point

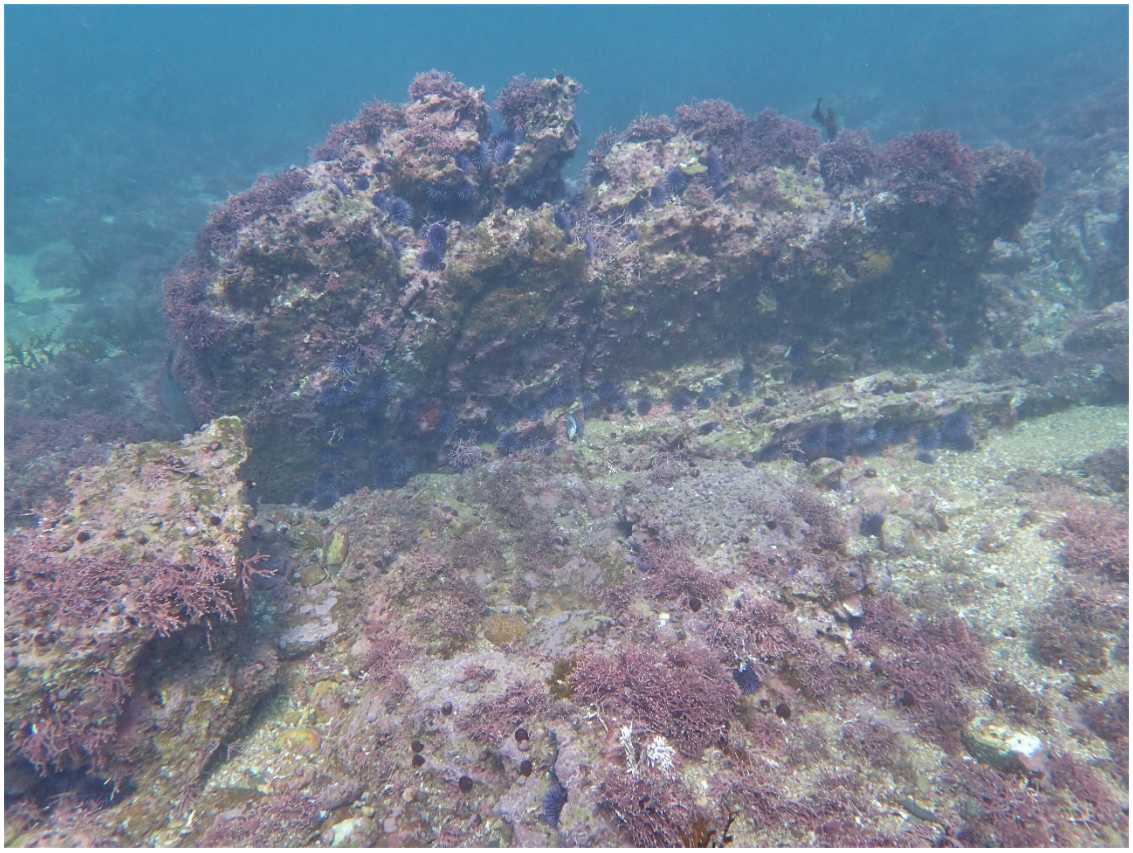


White Point Block 12 (WPT 12) video transect starts from the center of block 12 and goes 10-meters with a 0-degree heading. Then turns to a 90-degree heading and proceeds 30-meters. GPS: 33.71297, -118.3165



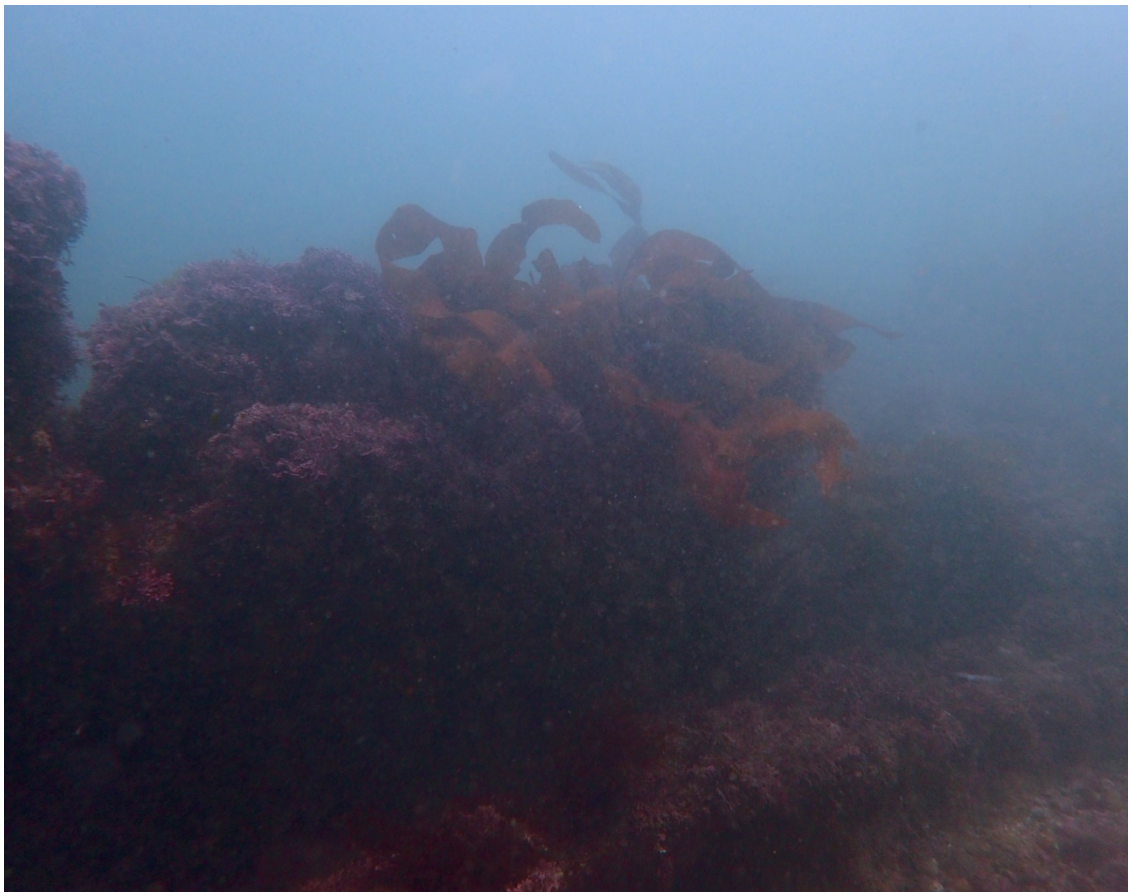
White Point. Shallow depth urchin density conditions. 01/17/2019

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

2022 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 conditions.

Files
Honeymoon Cove:
1.0_HoneymoonCove_Videotransect_2022

Underwater Arch Cove:
2_UnderwaterArch_006_Videotransect_2022
2.1_UnderwaterArch_T7-J11_Videotransect_2022

Marguerite:
3.0_Marguerite_T16_Videotransect_2022
3.1 Marguerite_T12_Videotransect_2022
3.2 Marguerite_T11_Videotransect_2022

Hawthorne:
4.0_Hawthorne_Videotransect_2022

Point Fermin:
5.0_PointFermin_Videotransect_2022

White Point:
6.0_Whitepoint_Videotransect_2022

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_2022

Underwater Arch:
2.2_Timelapse_UnderwaterArch_Videotransect_2022

Marguerite:
3.3_Timelapse_Marguerite_Videotransect_2022

Hawthorne:
4.1_Timelapse_Hawthorne_Videotransect_2022

Point Fermin:
5.1_Timelapse_PointFermin_Videotransect_2022

White Point
6.1_Timelapse_Whitepoint_Videotransect_2022