APPENDIX A

Preliminary Baseline Assessment of Reef Coral Community Structure in the Vicinity of the Wharf in Hāna Bay

PRELIMINARY BASELINE ASSESSMENT OF REEF CORAL COMMUNITY STRUCTURE IN THE VICINITY OF THE WHARF IN HANA BAY HANA, ISLAND OF MAUI

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INTRODUCTION

Hana Wharf is a large concrete pile-supported pier located in the southeastern corner of Hana Bay, located on the east side of the Island of Maui (Figure 1). The wharf is presently in a state of extreme disrepair and is closed for all access owing to safety. At present, planning is underway to consider options for repair or removal of the wharf. None of options considers actions that extend beyond the present footprint of the wharf. One important component of consideration for these repair options is the potential effects to existing communities of reef corals in the area of the Wharf. This document is intended to provide a preliminary baseline spatial assessment of these existing coral resources in the southeastern region of Hana Bay deemed to be within the influence of actions associated with alteration of the wharf structures. The purpose of this document is not to provide an exhaustive species list of marine organisms within the study area, or a quantitative evaluation of population structure of various coral species. Should mitigation of coral become a matter of concern, this report can provide a foundation for estimating the magnitude of required actions, but does not provide a quantitative enumeration of corals or associated valuation. Should such mitigative actions become a requirement, a future survey to enumerate corals will likely be required.

METHODS

All fieldwork was carried out on May 29, 2010 with divers working from a boat launched at the boat ramp. Sea conditions during the survey consisted of sunny skies, moderate easterly winds, with a small wind-generated swell resulting in surf of 1-3 feet breaking on

the shoreline. The baseline assessment was conducted by S. Dollar, assisted by C. Andrews and D. Rice.

To best complete the task of depicting coral community structure in Hana Bay with the limited available resources a uniform set of field data was collected that quantitatively describes benthic community structure. The resulting data set provides input data for application of remote sensing techniques designed to generate habitat maps of the subject reef areas. Thus a standard remote sensing mapping project, supported by field operations, provided the necessary calibration/validation (cal/val) data to construct the best maps possible.

Field operations consisted of assessing 57cal/val sites placed strategically throughout the survey area (Figure 2). Locations of cal/val sites were determined in the field based on investigator knowledge and visual interpretation of existing satellite "true-color" imagery with the intent of maximizing coverage of all reef areas within the survey areas. Exact site locations were defined during the course of field work using a GPS with a presumed accuracy of <2-5 m.

At each geo-located site, cal/val data was obtained by digitally recording the composition of the benthic surface using an underwater camera. To ensure uniformity of the area of data collection, the camera is mounted on a platform centered over a PVC frame by four legs similar to a tripod. The frame, or photo-quadrat, has dimensions of 1 m x 0.66 m, which is the same proportion as a photographic frame. Each cal/val site consists of 4-5 photo-quadrats arranged in a "cross" pattern ~5 m in diagonal, resulting in total reef surface area of 2.6 - 3.3 m^2, which encompasses an area of approximately 3-4 four pixels of remote sensing imagery. All photo-quadrats are shown in Appendix A.

Photo-quadrats were analyzed during using a rapid visual interpretive method in order to obtain a preliminary data set. The rapid visual interpretation consisted of investigators dividing the digital images into 10 sectors and estimating percentage cover of all benthos within each sector. Sector cover was then summed to provide cover for the entire image. The resulting data set provided the input for coral cover map included in the present document. All image cover data is shown in Appendix B.

Standard remote sensing practices for processing coral reef remote sensing imagery were employed for this study (e.g., Andréfouët et al. 2003, Green et al. 2000, Mumby et al. 1998). The most recent image set available from the WorldView-2 (WV2) satellite acquired on February 27, 2010. WV2 provides eight-band multispectral imagery at 2-m pixel resolution. Image data from the earlier Quickbird and Ikonos satellites have been repeatedly demonstrated to be useful for coral reef assessments. The eight bands and 2-m resolution of WV2 represent improvements over the four bands and 2.4-m to 4-m resolution of these earlier satellites. As a result, WV2 affords more detailed information of the benthic habitats at a higher accuracy.

Production of habitat maps followed a supervised classification approach, using the quantitative data describing benthic cover at each cal/val site as input to train a multivariate classifier. A classifier is simply a set of rules that a computer follows to assign appropriate labels to unknown observations. We applied the classifier to the entire image

to produce a thematic map showing the spatially-explicit, quantitative coral cover at each pixel.

Full cross-validation was utilized to evaluate accuracy of the habitat classification. In cross-validation, all but one data point are used to build a classifier, and the classifier is tested on the withheld point. This process is repeated on every point in the data set. The result is a matrix of classification rates, with correct classifications on the diagonal and incorrect classification off-diagonal. Because each classifier is tested on a data point that was not used to build the classifier, the result is unbiased. Also, because the test classifiers use almost all the available data points, they more closely represent that classifier actually used to generate the image product (which used all data points).

In Table 1, the matrix is the number of classifications. Correct classifications are on the diagonal, and incorrect classifications are off-diagonal. Table 2 shows classification rates, which is simply each matrix element divided by the column total. The overall accuracy of the classification (total correct classification divided by total number of data points) is 94.7%, which indicates high accuracy of the coral map. Photo-quadrat data analysis was performed by A. Hudon, and remote sensing maps produced by E. Hochberg.

RESULTS

Marine Biotic Community Structure

Hana Bay is a large semi-circular embayment on the easternmost region of Maui. The bay is approximately 900 meters (m) wide from headland to headland, with a maximum distance of approximately 800 m from the shoreline to the outer slope (Figure 3). The interior of the bay is generally shallow, with maximum depths of between 10 and 15 m at the outer margin (Figure 3). The region within the survey area for the present study does not extend beyond a depth of 10 m (33 feet).

Composition of the bottom, both in terms of living community structure and abiotic bottom types varies substantially throughout the study area. Distribution of coral throughout the survey area is shown in the map in Figure 4. It can be seen that coral cover is highest in the northeastern end of the study area with various zones of abundance throughout the area.

Based on quantitative estimates from calibration/validation photo-quadrats, mean coral cover was 23.8% of total bottom cover, while maximum cover at any single point was 66.4% (site 29). Four sites (19, 20, 21 and 47) had no coral present (Table 3). While algal turf was the most abundant bottom cover (mean cover of 30%, maximum cover of 82%), frondose macroalgae was conspicuously absent from the entire area, with mean cover of only 0.5% of the cal/val areas, and with maximum cover at any site of 9% (site 23). Sand and mud comprised a mean total of about 30% of bottom cover (Table 3)

Descriptions of the composition of each of the various major reef zones are presented below:

At the northeastern most end of the study area (Region A in Figure 5), community structure consists of a shallow calcium carbonate reef platform dominated by high coral cover, mainly consisting of large mound-shaped colonies of *Porites lobata* and encrustations of *Montipora capitata* and *M. flabellata* (Figures 6-8). Coral abundance in this area is high, with little signs of "stress" likely as a result of shelter from waves approaching from the northeast provided by the headland peninsula that defines the southern boundary of the bay (Figures 1-3). Percent cover of live coral in this area as determined by calibration/validation assessments ranged from about 35-50% (Table 3).

Moving toward the wharf on the outer edge of the reef platform, bottom angle slopes sharply to the sand channel floor (Region B in Figure 5). The reef slope is colonized by a variety of coral species, particularly "mats" of the short branched coral *Pavona duerdeni* (Figure 9). In addition, dominant coral species on the outer reef edge and slope are large dome-shaped colonies of Porites lobata, hemispherical branching colonies of *Pocillopora meandrina*, and extensive encrustations of *Montipora flabellata* (Figures 9 and 10). Percentage coral cover in this zone ranged from approximately 20-60% (Table 3).

In the area adjacent to the inner walkway to the main wharf (Region C in Figure 4), reef composition consists of large limestone mounds primarily covered with various growth forms of Montipora capitata (Figure 11). Within the area bounded by the outer section of the wharf and shoreline (Region D in Figure 4) coral mounds are interspersed within sand channels (Figure 12). In the center of this area (Region E in Figure 5) no corals occur and bottom composition consists entirely of coarse marine sands.

To the southwest of the wharf, a crescent-shaped shallow reef occurs between the beach and the outer sand channel (Region F in Figure 5). At low tide the upper surface of the reef is barely below the surface. While portions of the shallow reef are colonized by abundant coral, there are also areas of the reef that appear to be affected by sediment deposition (Figure 13).

Bottom composition adjacent to the northern face of the Hana Wharf consists of a narrow ledge of limestone that is bounded by the sand channel that extends through Hana Bay (Region G in Figure 5). The reef ledge adjoining the wharf is colonized by numerous flat encrusting colonies of *Montipora* spp. (Figures 14-16). In addition to live colonies, there are also abundant non-living plates that are recognizable as formed from living colonies of Montipora (Figure 17). All non-living surfaces of the reef in this area are covered with a layer of fine-grained sediment.

Many of the concrete piles on the outer northern side of the wharf are colonized by overlapping plates and flat encrustations of *Montipora capitata* that extend from near the surface to a depth of approximately 20 feet. Figures 18-21 show a variety of growth forms of this coral species on numerous pilings on the outer edge of the north side of the wharf. Pilings in the interior of the wharf are essentially barren of coral colonization owing to complete shading (Figure 22).

Coral encrustation on the pilings on the inner, southern edge of the wharf was completely different than on the outer face (Region H in Figure 5). While the predominant coral species was the same on both sides of the wharf (*Montipora capitata*), the overlapping plating growth form that was abundant on the northern outer face was essentially absent

on the southern inner face. Rather, coral occurred primarily as circular flat encrustations (Figures 22 and 23). However, non-living remnants of plates did occur on pilings located on the inner side of the wharf, particularly near the end of the wharf (Figures 25 and 26). The occurrence of numerous living plating corals on the outer face of the wharf, and only dead plates on the inner face suggest substantially different environmental stresses on each side of the wharf.

Off the end of the wharf there are large accumulations of various pieces of discarded materials, including pipes, piles, cables and various other forms of metal debris (Figure 27). Off the north side of the wharf, a series of large rubber tires are embedded in the sand.

SUMMARY AND CONCLUSIONS

Planning is underway to repair the existing Hana Wharf, located along the southern shoreline of Hana Bay in East Maui. Repair work is not intended to extend beyond the existing footprint of the wharf. One factor that may influence the selected alternative for repair is the effect to existing reef coral communities in the vicinity of the wharf. In order to evaluate the effects of various repair alternatives, a baseline assessment of the marine habitats, with particular emphasis of coral community structure in the vicinity of the wharf was completed in May 2010. Surveys were carried out using documented ground-truth methods to construct a coral habitat map utilizing remote sensing techniques. Fifty-eight calibration/validation sites were evaluated using digital photography to assemble a data set that provided the input classifications to construct a coral habitat map based on recently acquired high precision satellite imagery. The resultant map proved to be a highly reliable assessment of coral community structure with an overall accuracy of about 94%.

Average bottom cover within the survey area consisted of approximately 24% coral, 37% algal turf and encrusting calcareous algae, and 38% sand, mud, and bare limestone. Frondose algae was conspicuously absent from the entire survey area.

The reef surrounding the wharf consists of a relatively shallow limestone platform bounded by the shoreline to the south and a sloping reef face that terminates in the sand channel to the north. The highest coral cover communities occurred in the northeastern end of the survey area where the shallow reef platform is sheltered from waves by the southern headland that defines the corner of the bay. Corals in this area consisted mainly of flat encrusting and lobata species that showed little signs of environmental stress. On the reef slope facing the channel floor, coral growth was also abundant, consisting of relatively diverse communities of various encrusting, lobate and branching species.

Of particular interest are the coral communities in direct proximity to the wharf. On the inner side of the wharf, large coral mounds are interspersed with sand channels and patches. Fronting the outer, northern side of the wharf, the reef consists of a narrow limestone ledge that extends to the sand channel. The ledge is colonized with numerous flat circular plates of a single genus of coral (*Montipora*). While there are numerous live colonies, there is also an abundance of remnant dead and eroding plates of Montipora on the reef floor adjacent to the wharf.

A substantial portion of the vertical surfaces of the pilings on the outer edge of the wharf (visually estimated at ~20%) are colonized with extensive overlapping plates of *Montipora capitata*. Similar growth of the same species has been observed on submerged piling within Kahului Harbor. Pilings interior to the edge of the wharf are essentially barren of coral colonization, likely as a result of lack of exposure to light. Surprisingly, virtually no other macro-organisms were observed on any of the pilings. Pilings on the outer edge of the south side of the wharf were not colonized by overlapping plates of *Montipora;* rather this coral occurred in circular encrustations. Toward the end of the wharf, remnant dead and eroding plates were observed.

In summary, these results provide a baseline picture of coral community structure on submerged structures comprising the Hana Wharf, and surrounding area. Coral cover varies greatly in abundance, and mitigation of effects to these communities will be an essential part of the planning effort.

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Mumby, P. J., E. P. Green, C.D.Clark and A.J. Edwards. 1998. Digital analysis of multispectral airborne imagery of coral reefs. Coral Reefs 17: 59-69.

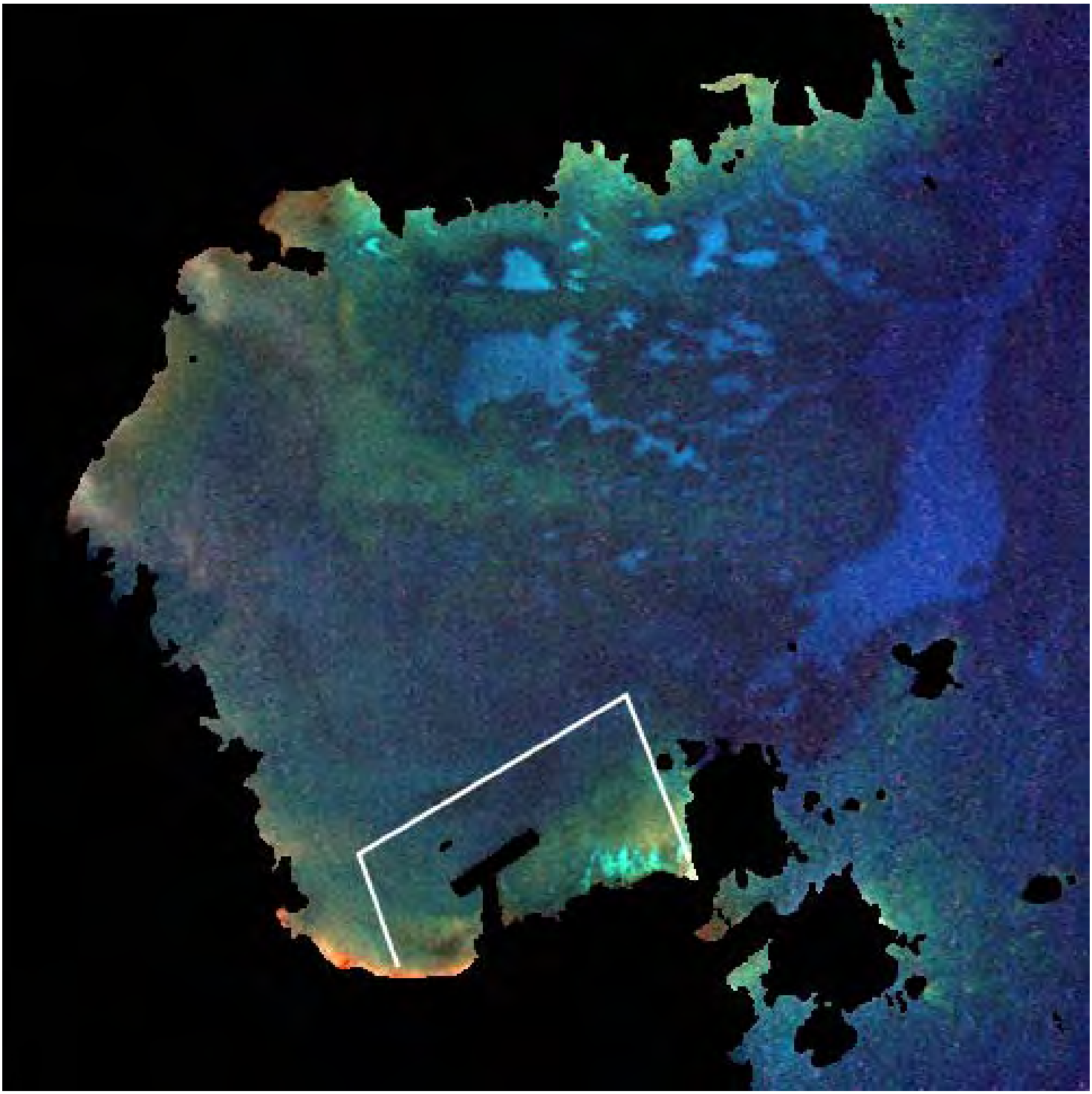


FIGURE 1. Worldview II satellite image of Hana Bay, Maui. White lines bound survey area surrounding Hana Wharf.

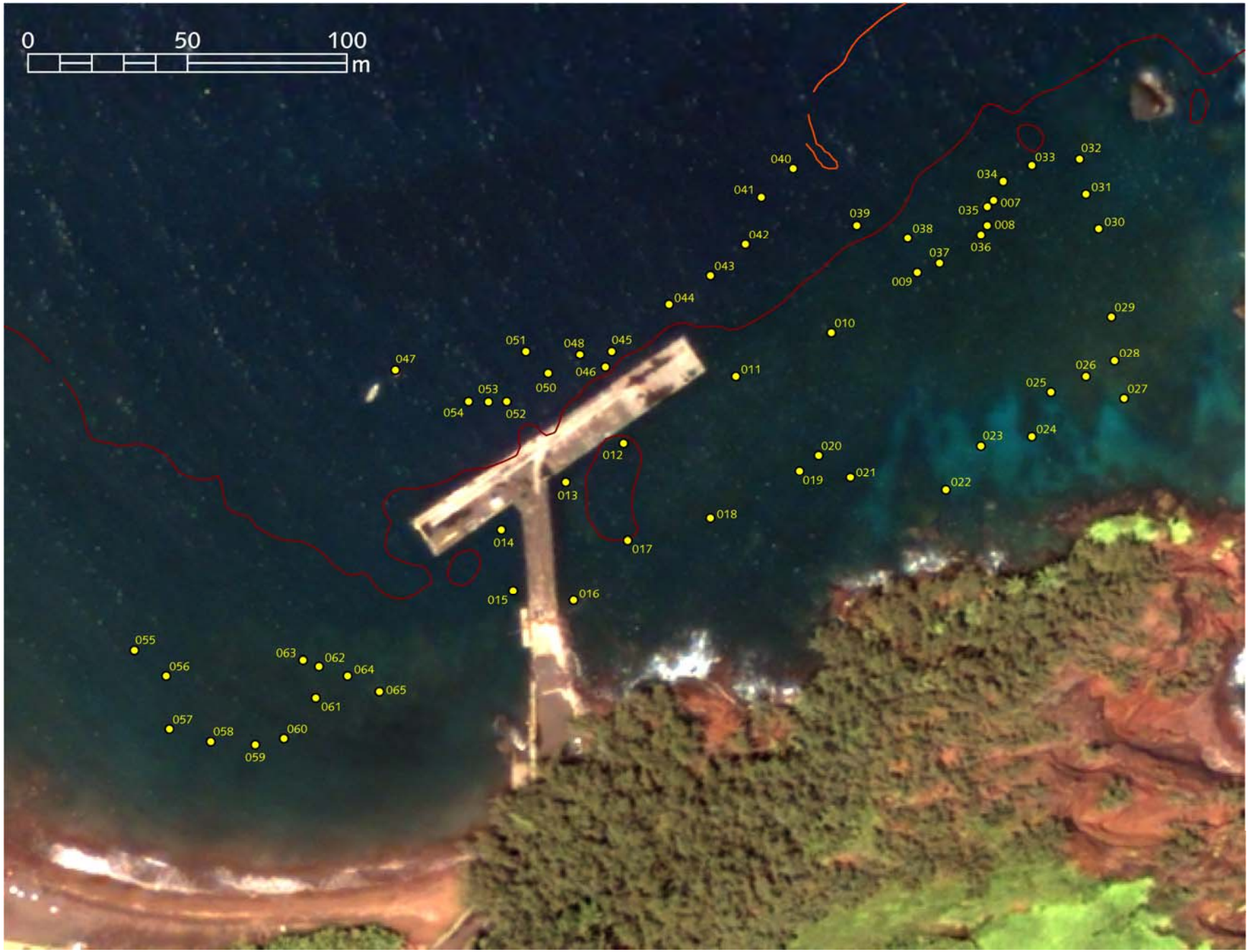


FIGURE 2. Worldview II satellite image of southeastern section of Hana Bay, Maui showing depth contours, and survey points.

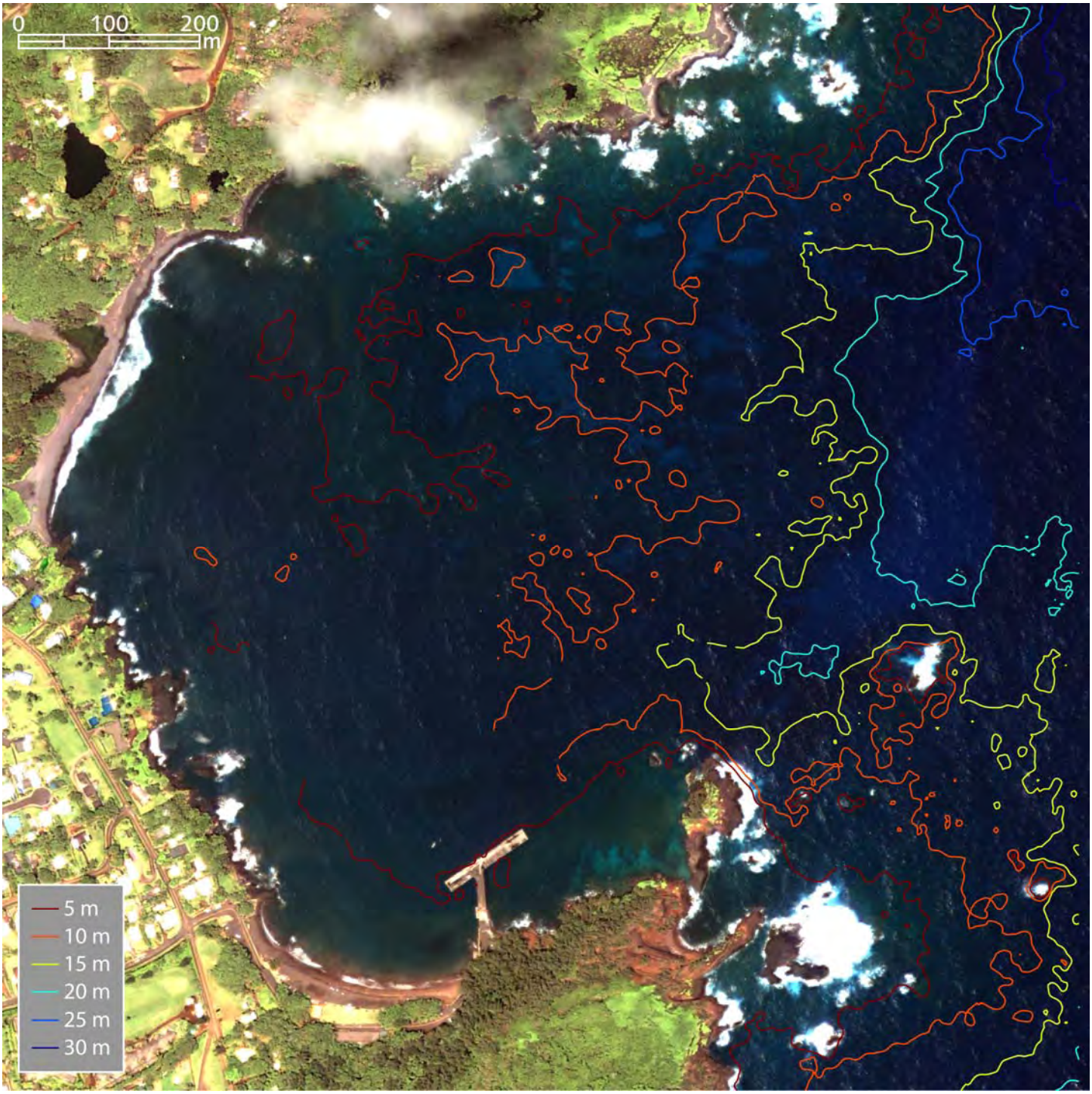


FIGURE 3. Worldview II satellite image of Hana Bay, Maui showing depth contours.

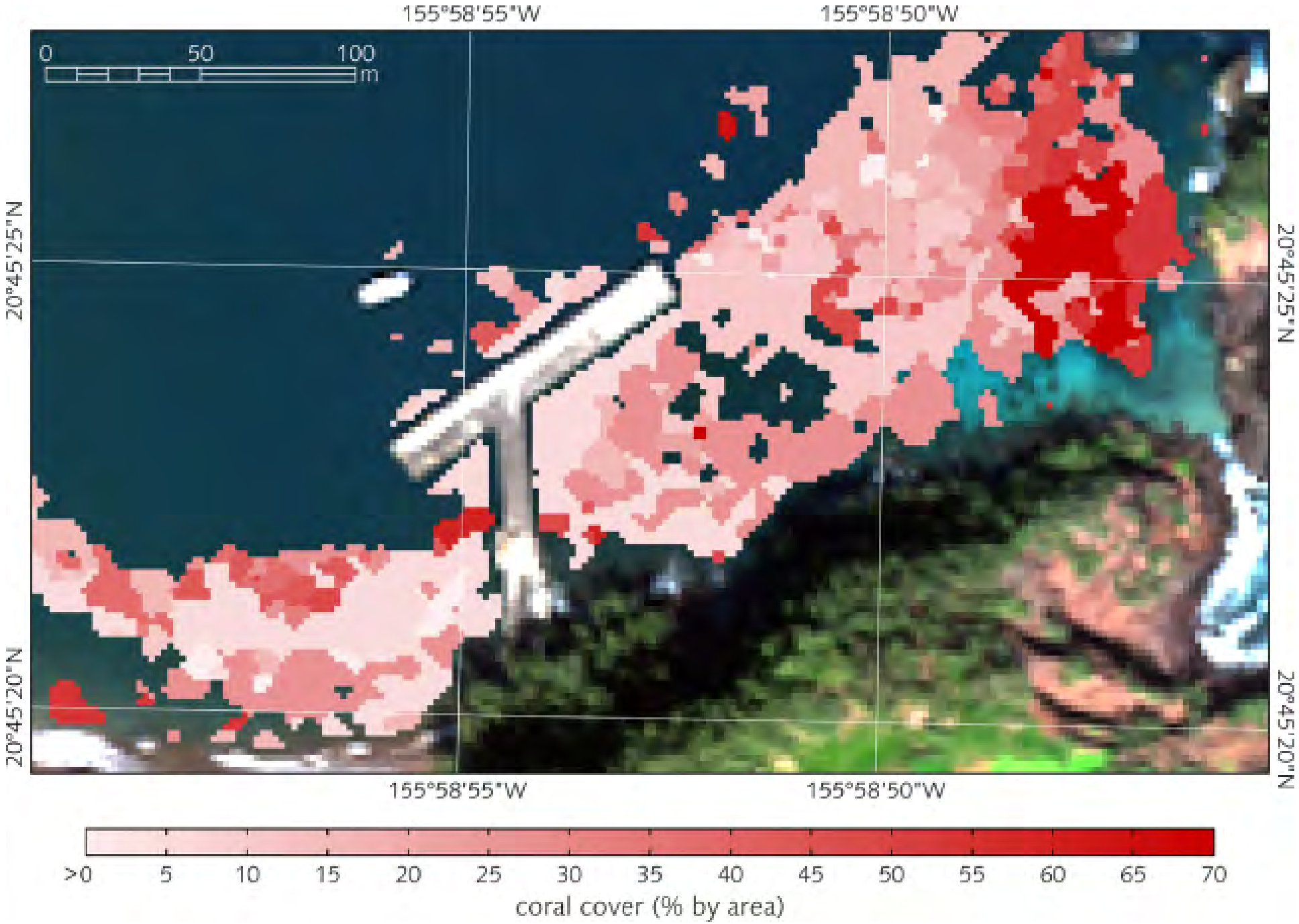


FIGURE 4. Worldview II satellite image of southeastern section of Hana Bay, Maui showing color-coded abundance of coral throughout survey area. Areas with no coral show as green; areas with coral show as shades of pink to red.

Table 1. Confusion matrix for Hana classification map. Values are counts.

		Actual Classes (Coral Percent Cover)														
		0	>0–5	5–10	10–15	15–20	20–25	25–30	30–35	35–40	40–45	45–50	50–55	55–60	60–65	65–70
Predicted Classes (Coral Percent Cover)	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0
	>0–5	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
	5–10	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0
	10–15	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0
	15–20	0	0	0	0	9	0	0	0	0	0	0	0	0	0	0
	20–25	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0
	25–30	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0
	30–35	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0
	35–40	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
	40–45	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0
	45–50	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0
	50–55	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
	55–60	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
	60–65	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	65–70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Table 2. Confusion matrix for Hana classification map. Values are percent classification rate.

		Actual Classes (Coral Percent Cover)														
		0	>0–5	5–10	10–15	15–20	20–25	25–30	30–35	35–40	40–45	45–50	50–55	55–60	60–65	65–70
Predicted Classes (Coral Percent Cover)	0	100	0	0	14.3	0	0	0	0	0	0	0	0	0	0	0
	>0–5	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0
	5–10	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0
	10–15	0	0	0	85.7	0	0	0	0	0	0	0	0	0	0	0
	15–20	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0
	20–25	0	0	0	0	0	100	20	0	0	0	0	0	0	0	0
	25–30	0	0	0	0	0	0	80	0	0	0	0	0	0	0	0
	30–35	0	0	0	0	0	0	0	100	0	0	0	0	0	0	0
	35–40	0	0	0	0	0	0	0	0	66.7	0	0	0	0	0	0
	40–45	0	0	0	0	0	0	0	0	33.3	100	0	0	0	0	0
	45–50	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0
	50–55	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0
	55–60	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0
	60–65	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0
	65–70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100

TABLE 3. Mean benthic cover from photo-quadrats that served as calibration-validation points for creation of coral map of Hana Bay, Maui. Abbreviations for bottom cover types are shown at bottom of table. Locations of site numbers can be seen in Figure 3. Total coral (TC) is shown in red; coral species are shown in blue.

SITE	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	AL	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV
007	0	10.0	0	0	0.6	18.0	0	0	0.6	29.2	0	44.8	1.0	0	0	0	12.0	13.0	0	0
008	0	3.6	0	0	0.4	16.0	3.0	0	0	23.0	0	51.0	5.0	0	0	0	10.0	11.0	0	0
009	0	3.4	0	0	0	16.0	0.0	0	0	19.4	0	0.0	1.0	0	0	0	4.0	75.0	0	0.6
010	0	5.0	0	4.5	0	1.3	0	0	0	10.8	0	53.0	0	0	0	0	18.8	17.5	0	0
011	0	1.4	0	1.8	0	10.4	0.6	0	0	14.2	0	44.2	0	0	0	0	13.0	28.6	0	0
012	0	2.3	0	0.8	0.3	6.3	0	0	0	9.5	1.3	66.0	1.3	0	0	0	22.0	0	0	0
013	2.0	2.5	0	0.0	0	4.8	0	0.8	0	10.0	0	0	5.0	0	70.0	0	15.0	0	0	0
014	7.5	0.8	0	0.0	0	0.0	0	0	0	8.3	0	0	0	91.8	0	0	0.0	0	0	0
015	30.0	2.0	0	0.0	0	24.4	0.6	0	0	57.0	0	0	0	1.0	17.0	5.0	0.0	0	20.0	0
016	16.7	26.7	0	0.0	0	5.0	0	0	0	48.3	0	0	0	0.0	13.3	0	1.7	0	36.7	0
017	0.3	0	6.8	0.0	0	6.8	0	3.8	0	17.5	0	0	0	6.3	32.5	0	20.0	5.0	18.8	0
018	0	0	15.0	0.0	0	8.0	0.4	0	0	23.4	0	0	0	0	58.6	0	18.0	0	0	0
019	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	100.0	0	0	0	0	0	0
020	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	100.0	0	0	0	0	0	0
021	0	0	0	0.0	0	0	0	0	0	0.0	0	0	0	100.0	0	0	0	0	0	0
022	6.3	2.5	12.5	0.0	0	2.0	1.8	0.3	0	25.3	0	0	0	13.8	25.0	0.8	0	8.8	26.5	0
023	0	0	0	1.8	0	12.5	0	0.3	0	14.5	9.0	75.0	1.5	0	0	0	0	0	0	0
024	0	0	0	16.5	0	8.0	0.5	0.5	0	25.5	4.5	66.5	3.5	0	0	0	0	0	0	0
025	0.6	0	0	2.2	0	11.6	0	0.2	0	14.6	5.0	63.4	5.0	0	0	0	12.0	0	0	0
026	6.0	10.2	0	2.2	2.0	2.6	0	0.2	0	23.2	0	0	1.2	0	0	0	0	0	75.6	0
027	11.0	8.0	19.0	0	0	14.0	0	0	0	52.0	0	0	0	13.0	0	0	0	8.0	27.0	0
028	6.6	3.0	6.0	0.4	0	1.4	0	0	0	17.4	0	0	0	24.0	0	1.0	0	0.0	57.6	0
029	0	1.0	19.0	1.4	0	44.4	0	0.6	0	66.4	3.6	0	0	0	0	0.0	0	0.0	30.0	0
030	10.6	15.6	10.4	1.0	0	14.4	0	0	0	52.0	1.0	44.0	1.0	0.0	0	2.0	0	0.0	0.0	0
031	5.0	13.0	27.5	0	0.5	1.5	0	0.0	0	47.5	0	0	0	0	0	0	0	0	52.5	0
032	3.6	8.2	3.0	0	0	15.4	5.2	0.6	1.6	35.6	0	33.4	6.0	0	0	0	23.0	0	0	0
033	3.0	10.6	0	0	0.2	13.0	4.0	0	14.2	45.0	0	40.0	4.0	0	0	0	11.0	0	0	0
034	1.0	12.4	0	0	0.2	14.8	0	2.6	1.0	32.0	0	40.0	3.0	0	0	0	23.0	2.0	0	0
035	2.0	9.0	0.3	0	0	9.8	0.5	1.0	0	22.5	0	55.0	5.0	0	0	0	17.5	0	0	0
036	0.4	0.8	0.6	0	0	16.2	0	0	0	18.0	0	61.6	3.4	0	0	0	17.0	0	0	0
037	1.2	0	0.2	0	0	3.8	0.8	0	0	6.0	0	47.0	2.0	0	0	0	45.0	0	0	0
038	0	0	0	0	0	4.0	0	0.6	0	4.6	0	77.2	2.0	0	0	0	10.8	5.0	0	0.4
039	0	5.3	8.8	5.0	0.3	2.5	0.8	0	0	17.8	0	72.3	0	0	0	0	10.0	0	0	0

TABLE 3. continued

SITE	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	AL	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV
040	0	0	3.8	19.3	0	0	0	0	0	23.0	0	77.0	0	0	0	0	0	0	0	0
041	57.5	0	4.0	0	0	0	0	1.3	0	62.8	0	0	0	0	0	0	0	0	37.3	0
042	1.0	0.0	6.3	7.8	0	2.5	0	0	0	17.5	0	82.5	0	0	0	0	0	0	0	0
043	1.3	8.8	3.3	2.8	0	8.0	0.3	10.0	0	33.5	0	59.5	0	0	0	0	6.3	0	0	0
044	38.8	6.3	1.3	0	0	3.8	0	4.0	0	54.0	0	46.0	0	0	0	0	0	0	0	0
045	0	6.4	5.2	0.4	0.8	0.6	0.2	0	0	13.6	3.8	68.4	0	0	6.0	0	8.0	0	0.0	0.2
046	0	0.5	1.3	2.5	0.3	6.8	0	0	0	11.3	0	75.0	0	0	3.8	0	10.0	0	0.0	0
047	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	100.0	0
048	6.0	0	0	0	0.2	0	0	3.4	0	9.6	0	0	0	0	0	0	0	0	90.4	0
050	3.5	0	21.0	0	0	0	0	2.0	0	26.5	0	16.0	0	0	0	0	20.0	0	37.3	0.3
051	0	0	0	0	0	20.0	0	0.0	0	20.0	0	0	0	0	0	0	0	0	80.0	0
052	25.0	0	10.0	0	0	0	0	6.2	0	41.2	0	0	0	0	0	0	2.0	0	56.8	0
053	0	0	0	0	0	0	0	0	0	0.0	0.3	0	0.7	0	0	0	0	0	99.0	0
054	0	0	0	0	0	0	0	0	0	0.0	0	0	0	0	0	0	0	0	100.0	0
055	0	9.8	0	0	0.5	22.5	0	5.8	0	37.3	0	56.8	0	0	0	1.8	3.0	0	0.0	0
056	0	3.8	0.2	2.2	0.2	8.0	0	0.8	0	15.2	0	77.8	0	0	0	0	7.0	0	0.0	0
057	14.0	0	0	0	0	0.5	0	0.3	0	14.8	0	0	0	0	0	0	1.0	0	84.3	0
058	0	0	0	0	0	0	0	0.5	1.5	2.0	0	0	0	0	0	0	2.5	0	95.5	0
059	0.3	10.0	0	0	0	15.0	3.8	0	0	29.0	0	53.8	0	0	0	0	3.8	0	13.5	0
060	1.0	0	2.0	0.7	0	14.3	0	0	0	18.0	0	0.0	0	0	0	0	1.7	0	80.3	0
061	1.4	0	0	0.8	0.2	26.2	0	1.4	0.8	30.8	0	53.2	0	0	0	0	16.0	0	0.0	0
062	2.8	0	6.3	3.3	0.5	28.8	0.8	0.5	0	42.5	0	41.0	0	12.5	0	0	3.8	0	0.0	0
063	0	5.8	25.0	0	0	5.0	0	1.3	0	37.0	0	58.8	0	0	0	0	3.8	0	0.0	0.5
064	22.5	2.3	5.0	0	0	15.3	0	0.3	0	45.3	0	53.5	0	0	0	0	1.3	0	0.0	0
065	0	0	0	0	0	6.3	0	0	0	6.3	0	0.0	0	0	0	0	0	0	93.8	0
Mean	5.0	3.7	3.9	1.3	0.1	8.5	0.4	0.8	0.3	23.8	0.5	30.2	0.9	8.0	3.9	0.2	6.8	3.0	22.6	0
Max	57.5	26.7	27.5	19.3	2.0	44.4	5.2	10.0	14.2	66.4	9.0	82.5	6.0	100.0	70.0	5.0	45.0	75.0	100.0	0.6
Min	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

"Mc" = "Montipora capitata"
"Mf" = Montipora flabellata
"Mp" = Montipora patula
"Pc" = "Porites compressa"
"Pd" = "Pocillopora damicornis"
"Pl" = "Porites lobata"
"Pm" = Pocillopora meandrina
"Pv" = "Pavona varians"
"ZO" = "Zoanthus"
"TC" = "Total Coral Cover"

"AL" = "Algae"
"TUR" = "Turf"
"SP" = "Sponge"
"SA" = "Sand"
"LS" = "Limestone"
"DC" = "Dead Coral"
"CCA" = Crustose Corraline A"
"RU" = "Rubble"
"TBS" = Mud/Turf-Bound-Sediment
"INV" = "Invertebrate"

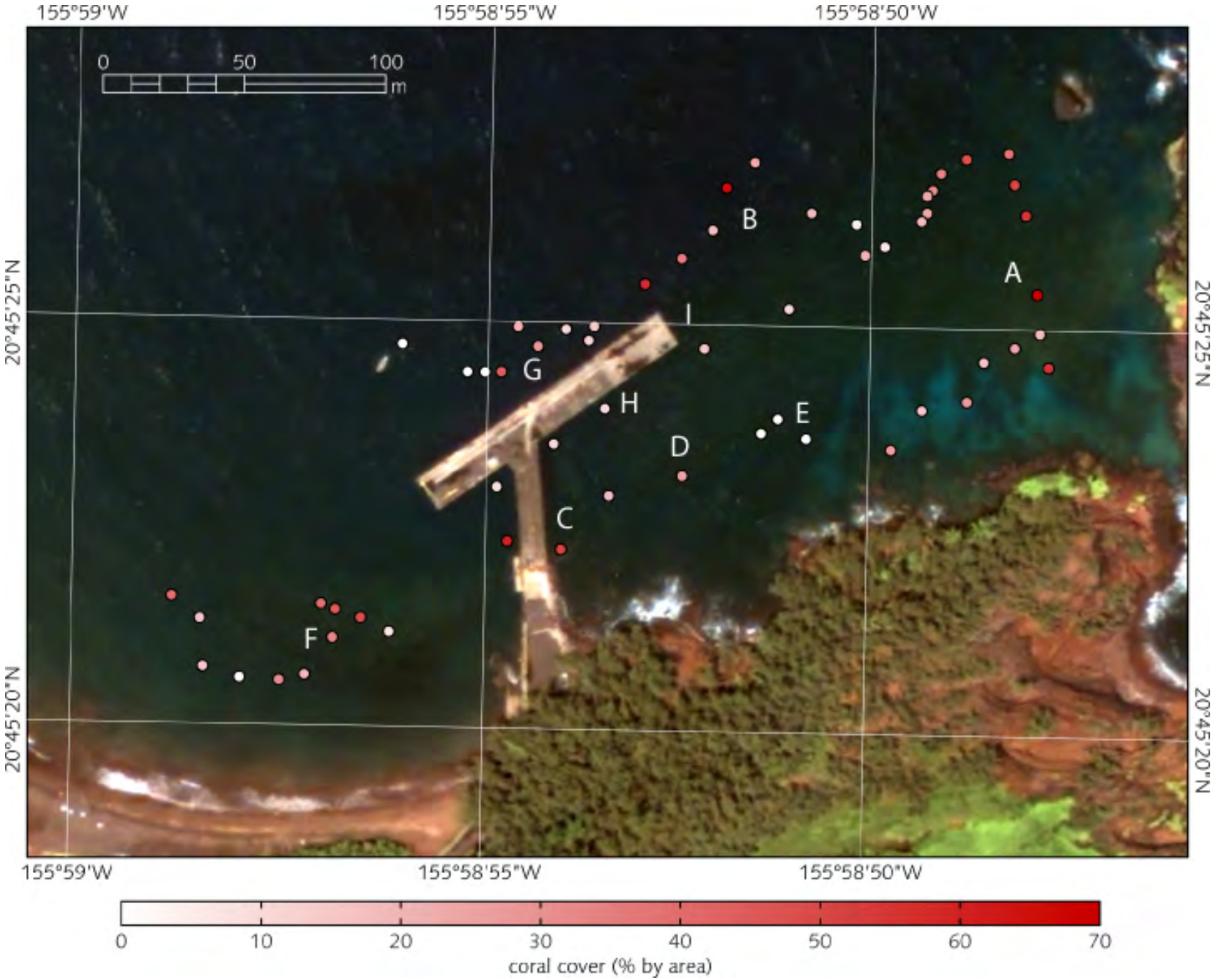


FIGURE 5. Satellite image of southeastern region of Hana Bay showing wharf and surrounding reef areas. Circles show locations of survey calibration/validation points color coded to indicate percentage coverage of the bottom with living coral. Letters A-F designate various benthic zones discussed in text.

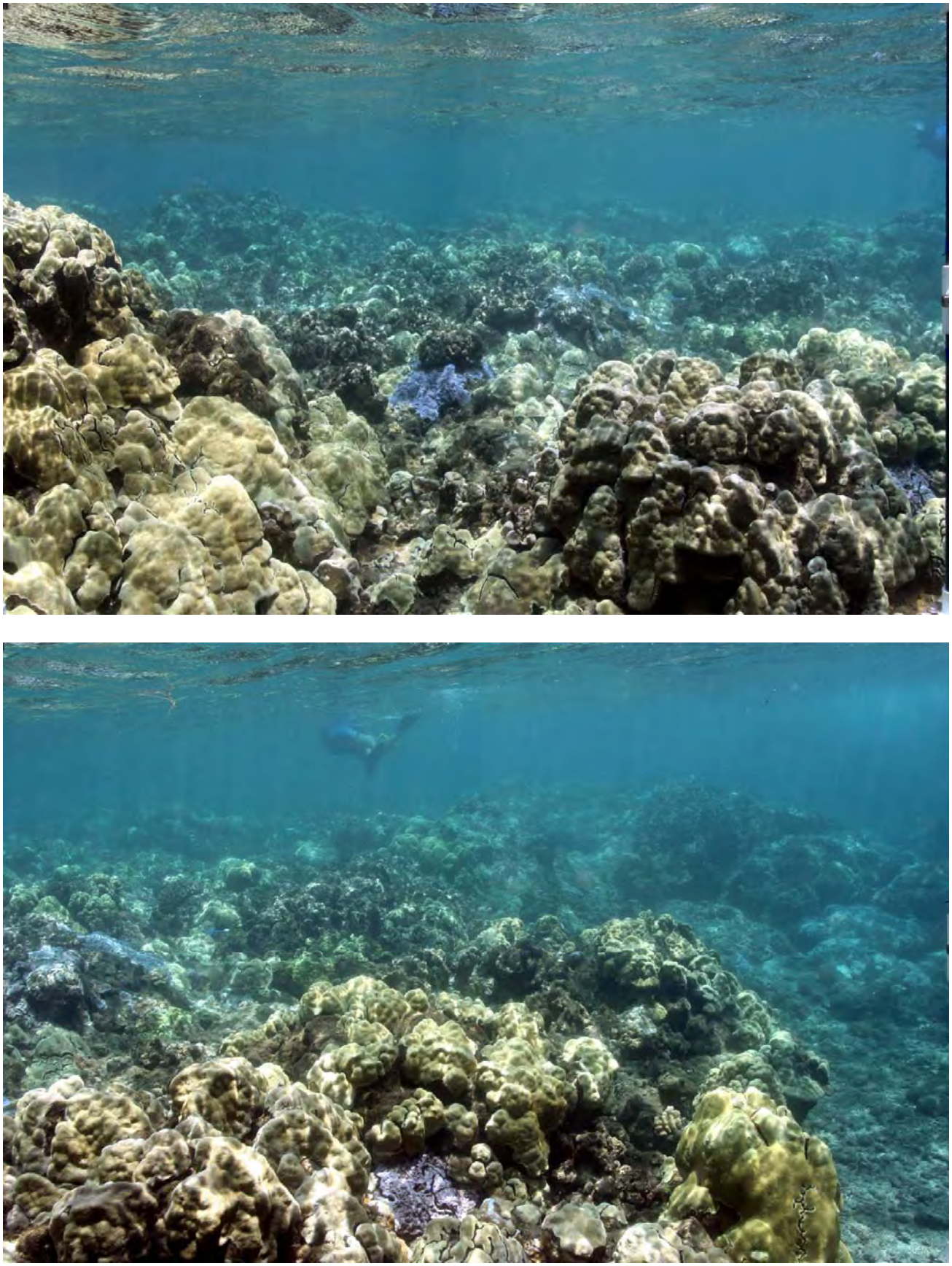


FIGURE 6. Two views of reef flat northeast of wharf in Hana Bay, Maui (Region A in Figure 5). Water depth is approximately 2-3 feet.

FIGURE 7. Shallow reef flat northeast of wharf in Hana Bay, Maui (Region A in Figure 5). Water depth is approximately 2-3 feet.

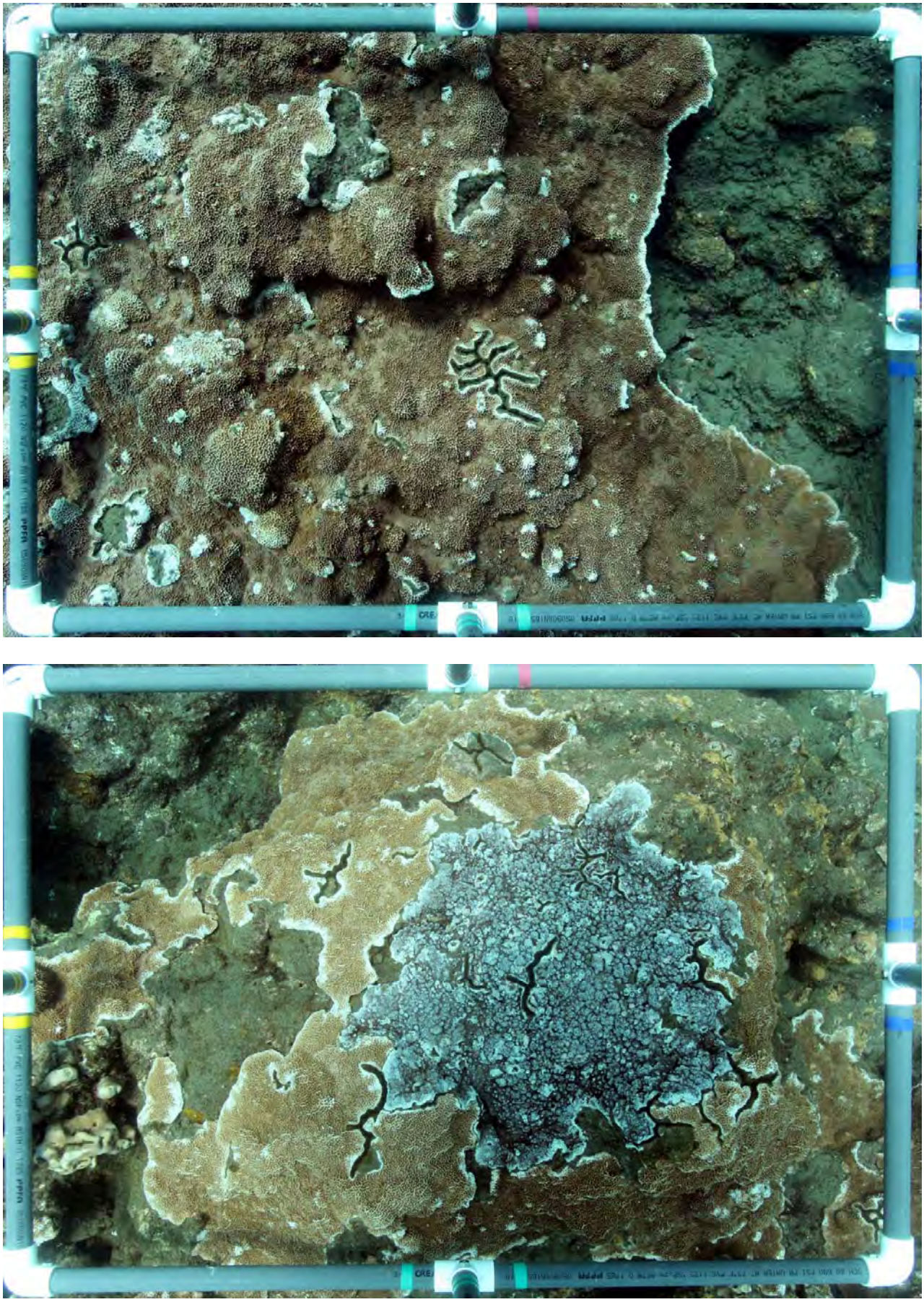


FIGURE 8. Two photo-quadrats showing encrusting colonies of *Montipora capitata* (brown) and *Montipora flabellata* (blue). Photo-quadrats were collected at sites off the west side of wharf in Hana Bay, Maui (Region G in Figure 5).

FIGURE 9. Two views of outer reef slope northeast of wharf in Hana Bay (Region B in Figure 5). Large green mound-shaped coral colonies in upper photo are *Porites lobata;* short-branched mats of coral in lower photo are *Pavona duerdeni*. Water depth is approximately 25 ft.

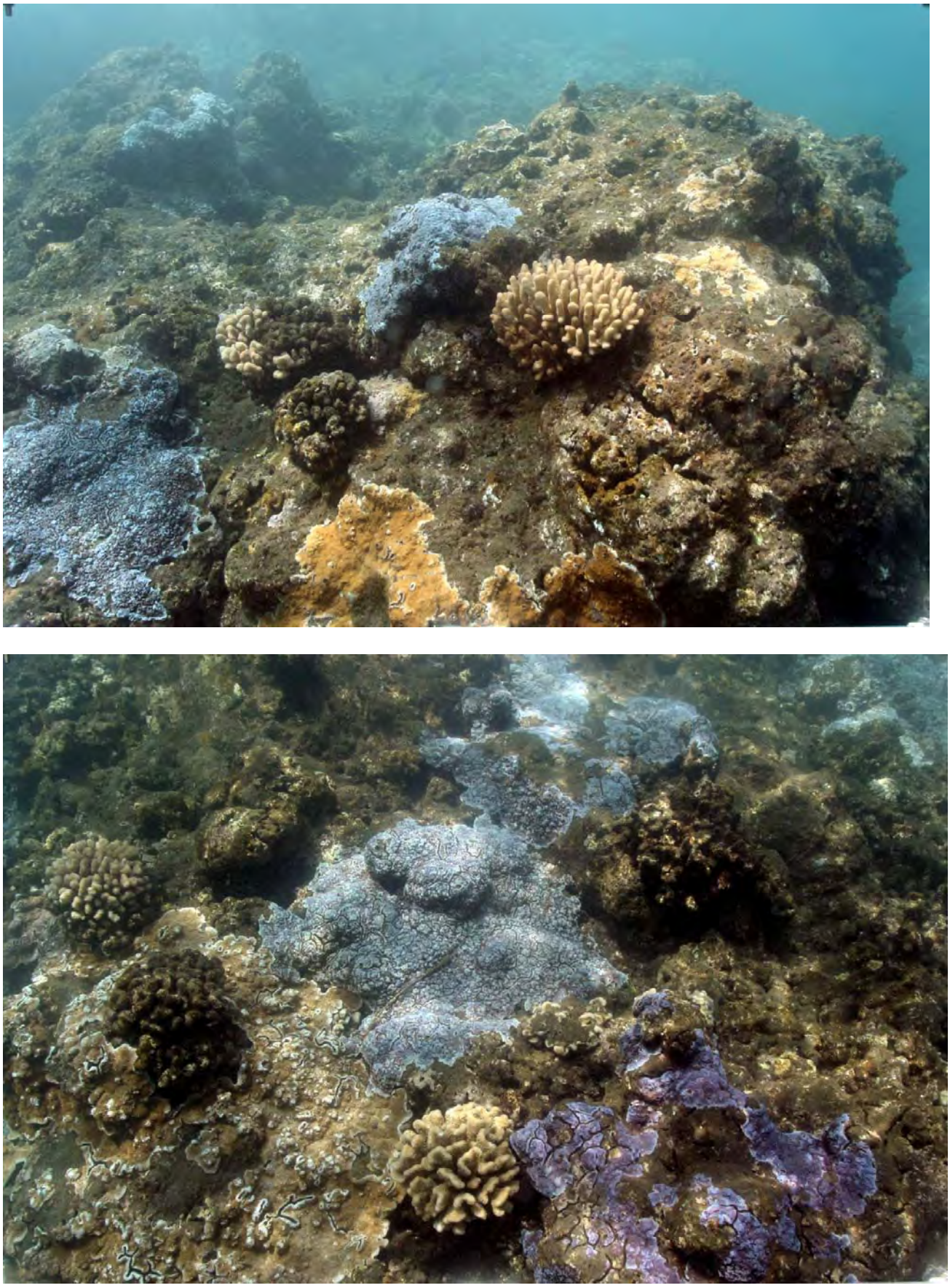


FIGURE 10. Edge of outer reef northeast of wharf in Hana Bay, Maui (Region B in Figure 5) Hemispherical branching coral in both photos is *Pocillopora meandrina;* purple encrusting coral if *Montipora flabellata*.

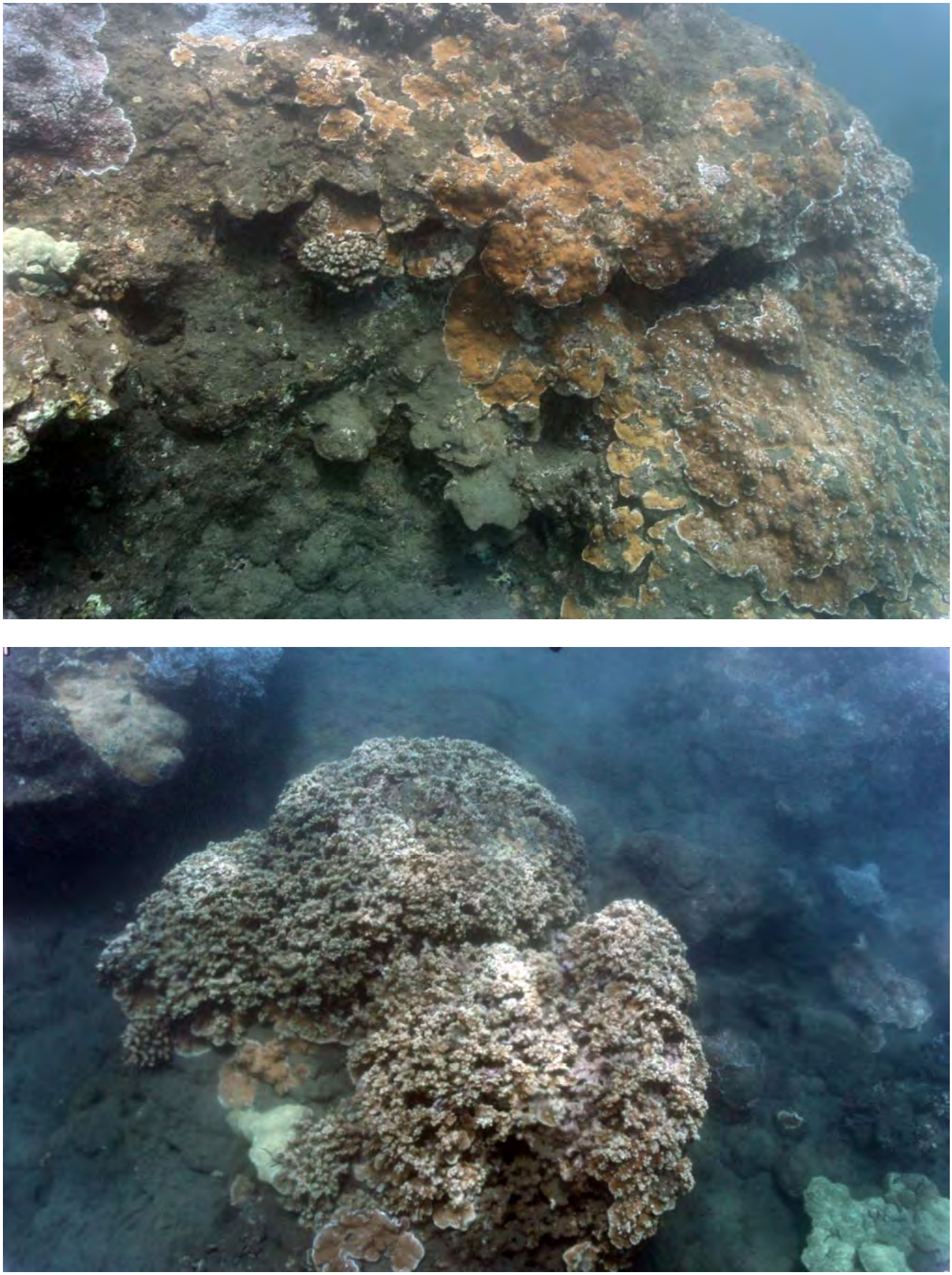


FIGURE 11. Two views of coral mounds located between Hana Wharf and shoreline (Region C in Figure 5). Dominant brown coral in both photos is *Montipora capitata*, occurring in two different growth forms.

FIGURE 12. Two views of coral mounds located between Hana Wharf and shoreline (Region D in Figure 5). This region consists of alternating coral mounds and sand channels.

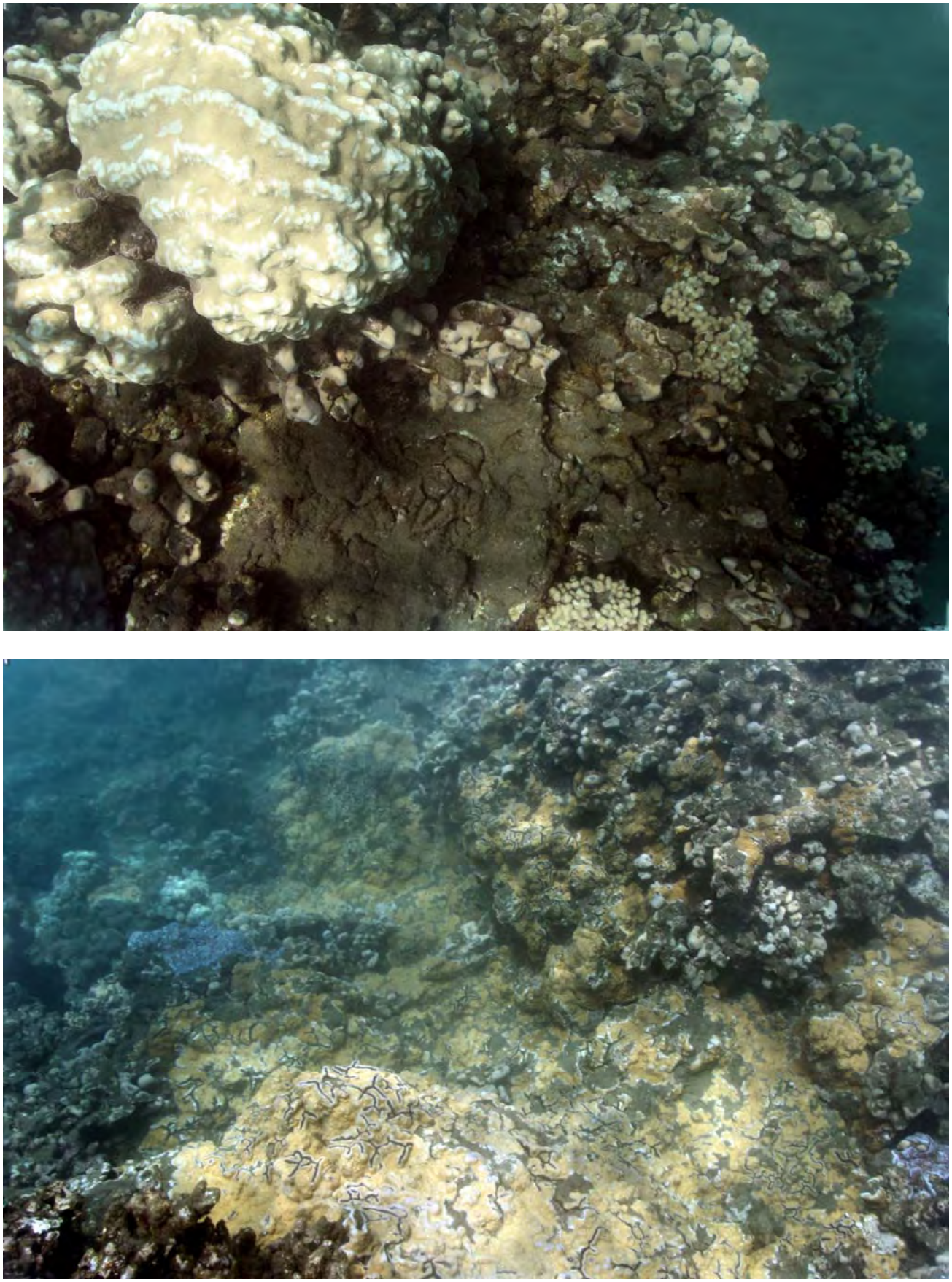


FIGURE 13. Two views of shallow reef between southwest end of Hana Wharf and shoreline (Region F in Figure 5). This region consists of a crescent-shaped reef surrounded by sand flats.

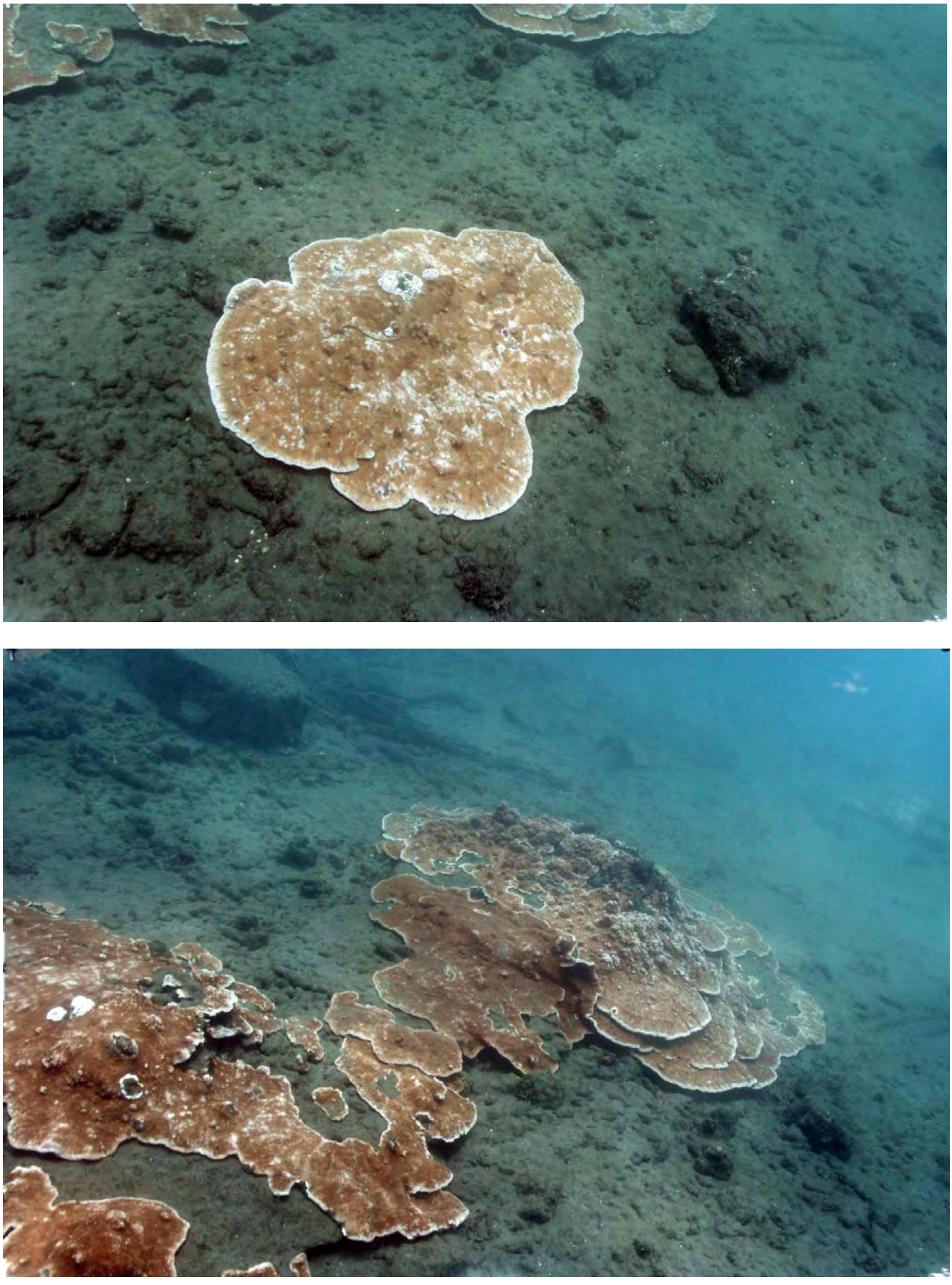


FIGURE 14. Colonies of *Montipora capitata* growing on reef platform adjacent to northwest side of wharf in Hana Bay, Maui (Region G in Figure 5). Water depth is approximately 20 feet.

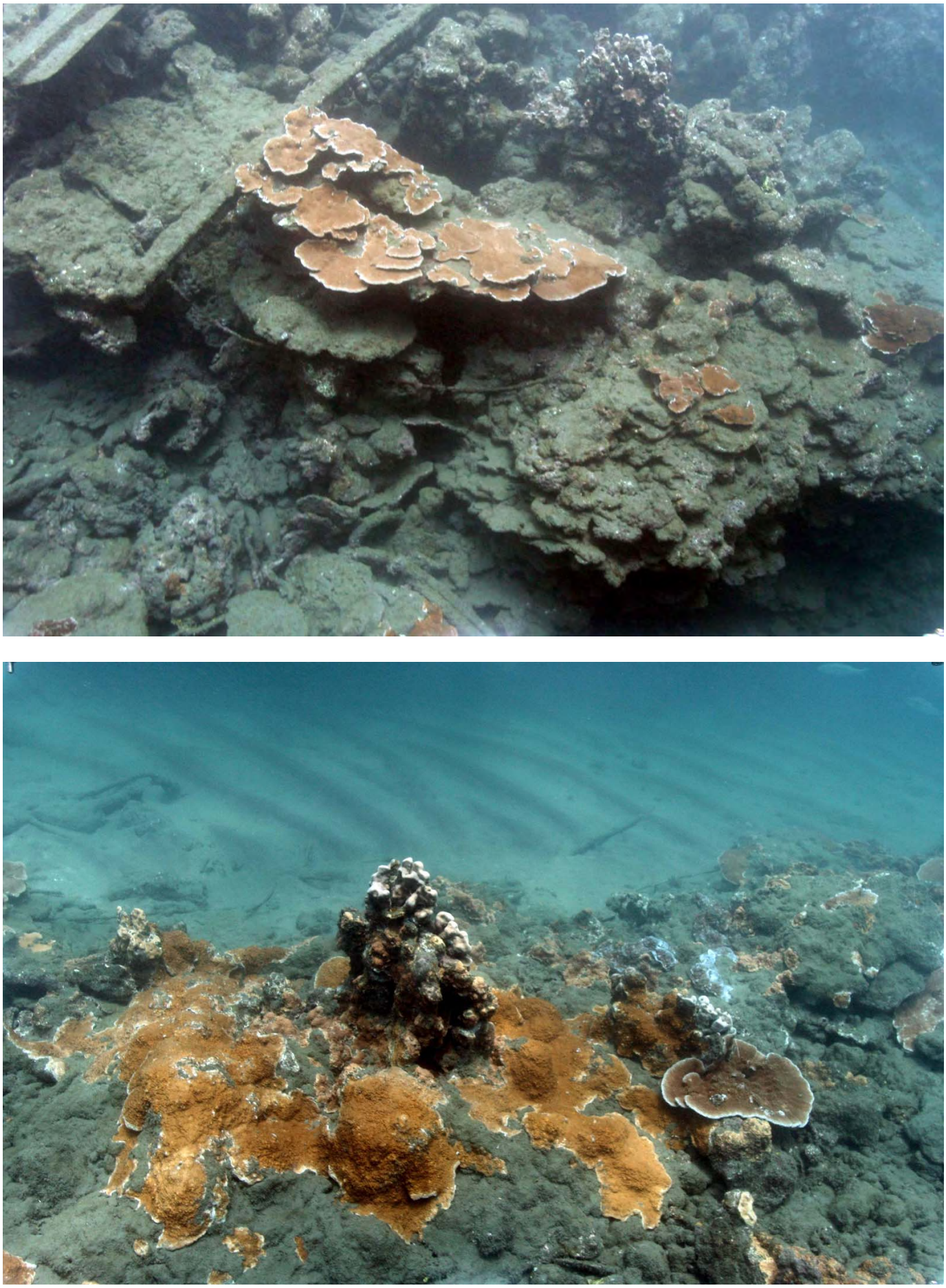


FIGURE 15. Edge of hard-bottom reef adjacent to sand bottom on northwest side of wharf in Hana Bay, Maui (Region G in Figure 5).

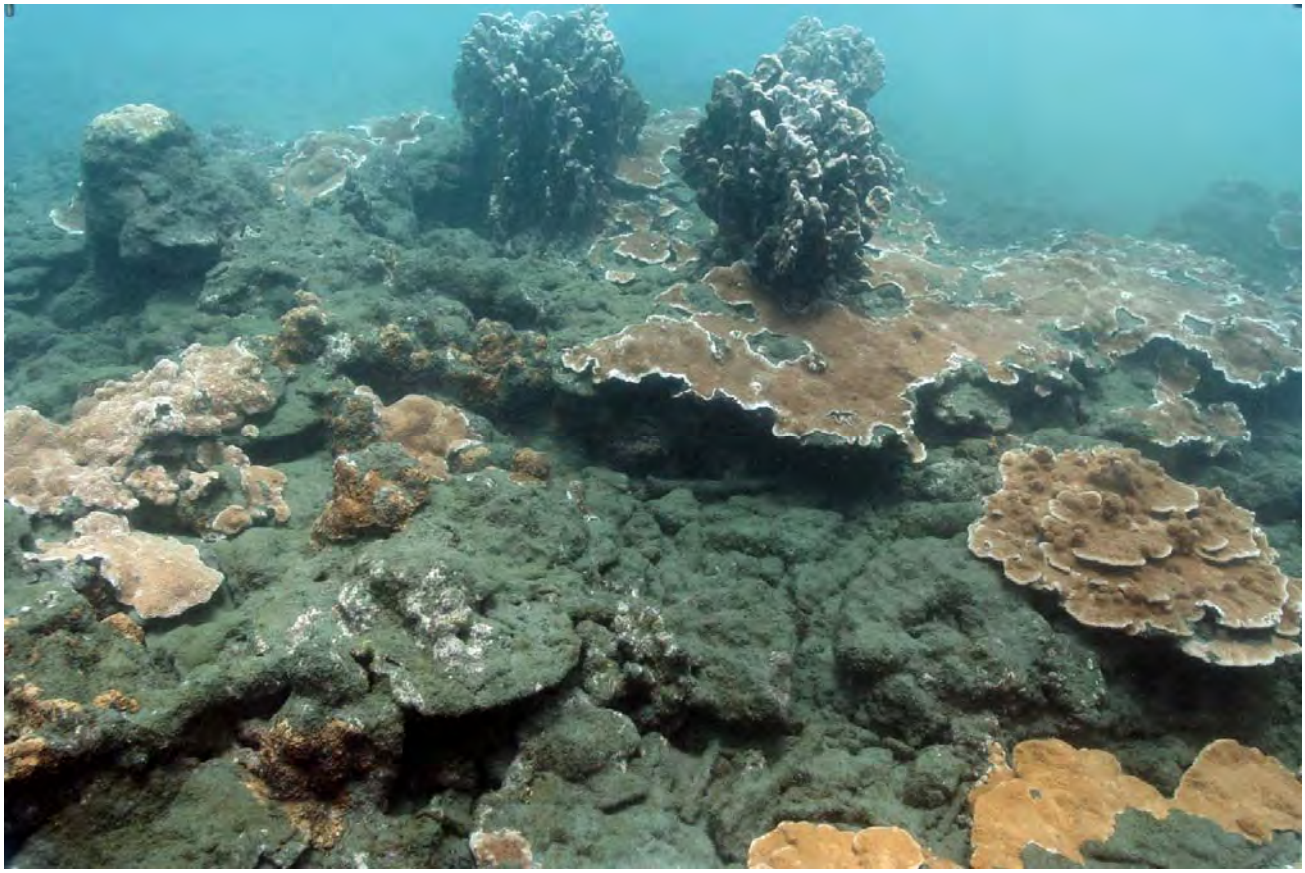


FIGURE 16. Two views of reef slope near northeast end of wharf in Hana Bay. Water depth is approximately 25 ft.

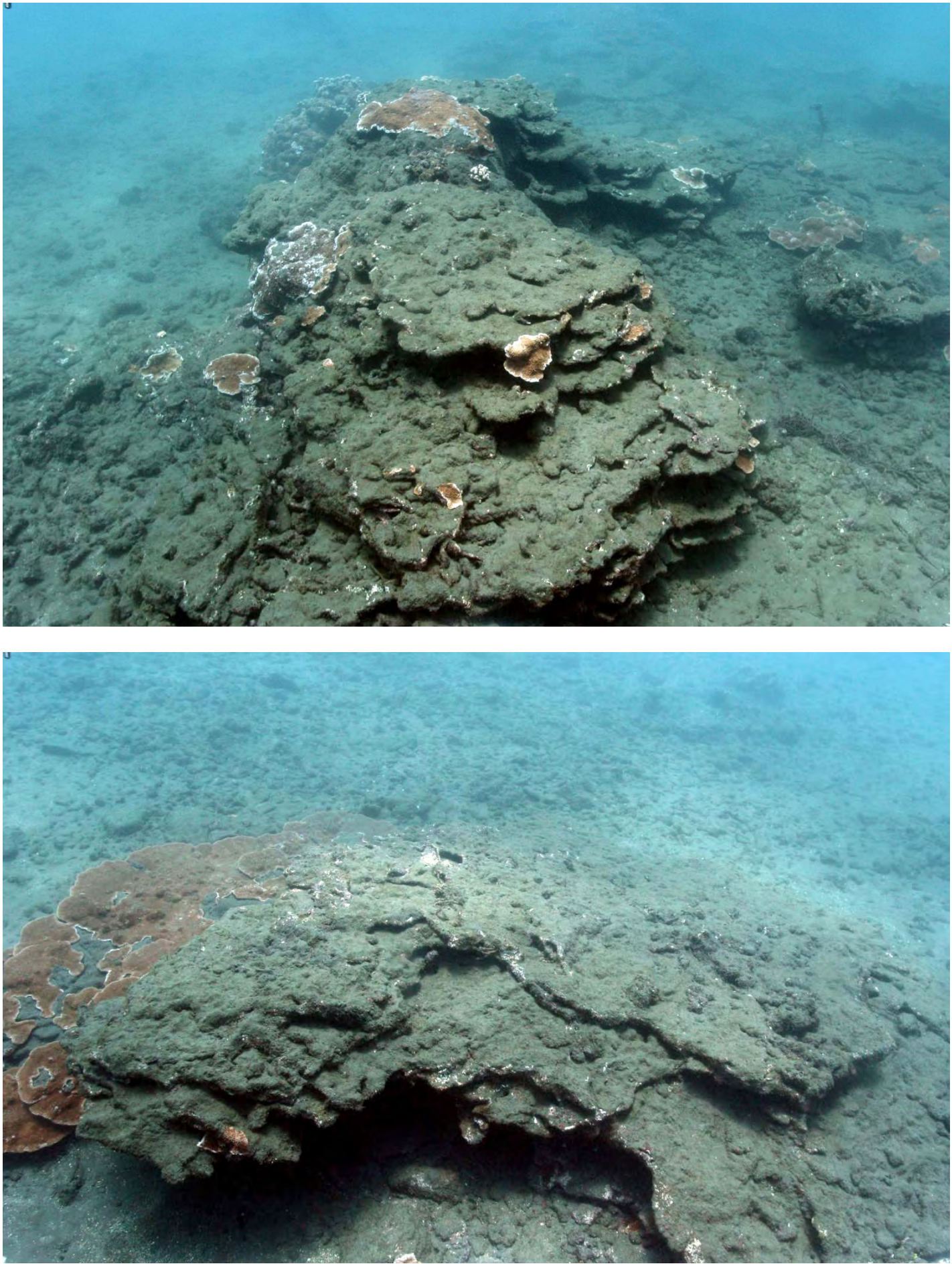


FIGURE 17. Two views of dead and sediment covered plates of *Montipora capitata* adjacent to northwest side of wharf in Hana Bay, Maui (Region G in Figure 5). Water depth is approximately 25 feet.

FIGURE 18. Two pilings on northwest side of wharf in Hana Bay, Maui showing overlapping plating coral *Montipora capitata*.

FIGURE 19. Two pilings on northwest side of wharf in Hana Bay, Maui showing overlapping plating coral *Montipora capitata*.

FIGURE 20. Two pilings on northwest side of wharf in Hana Bay, Maui showing overlapping plating coral *Montipora capitata*.

FIGURE 21. Two pilings on northwest side of wharf in Hana Bay, Maui showing *Montipora capitata* in overlapping plating growth form at left, and branching growth form at right.

FIGURE 22. View of bare pilings underneath wharf in Hana Harbor (top). Outer face of pilings at edge of south side of wharf are colonized with encrusting colonies of *Montipora capitata* and branching *Pocillopora meandrina* (bottom).

FIGURE 23. Two pilings located near the northwest end of the wharf in Hana Harbor, Maui. Circular brown encrusting corals in both photos is *Montipora capitata*. Yellow hemispherical branching coral in photo on right is *Pocillopora meandrina*.

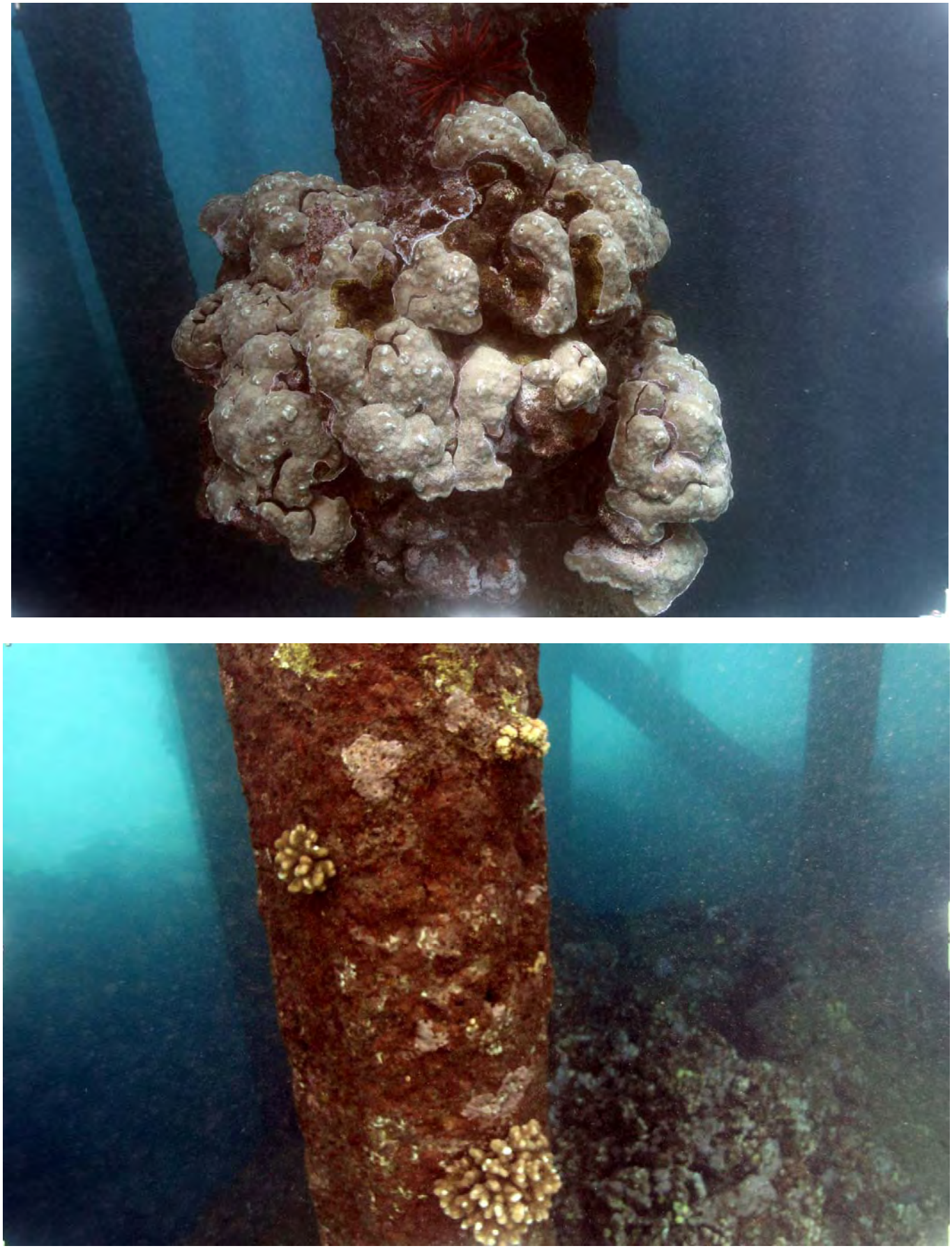


FIGURE 24. Multi-lobed colony of *Porites lobata* growing on piling on south side of wharf in Hana Harbor (top). *Porites lobata* was rare on piles. Several colonies of *Pocillopora meandrina* on piling on south side of pier (bottom).

FIGURE 25. Dead and eroding plates of *Montipora capitata* on south side of wharf in Hana Harbor, Maui.

FIGURE 26. Pilings on south side of wharf in Hana Bay showing dead plates of *Montipora capitata*.

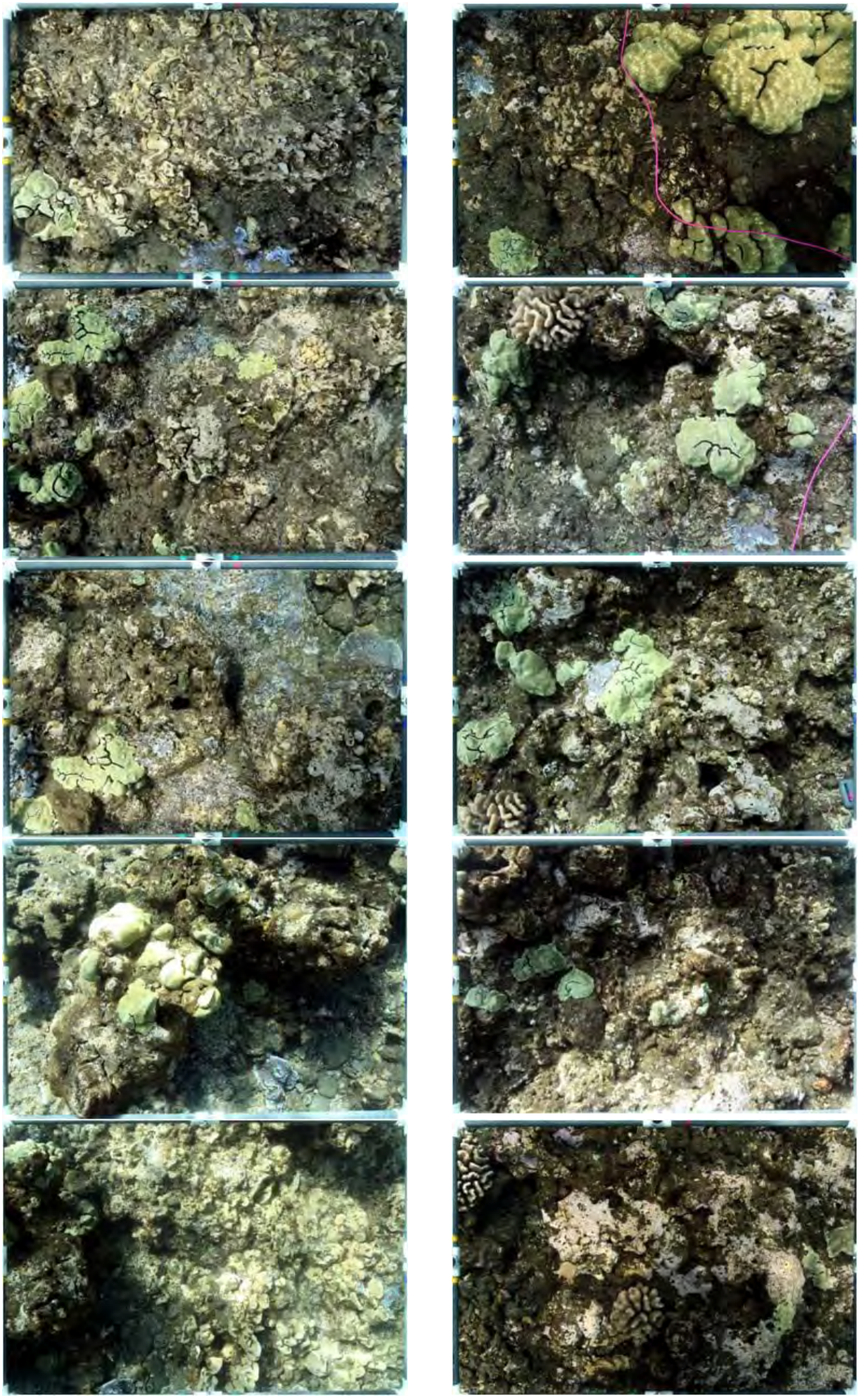
FIGURE 27. Assorted metal objects and debris, including broken pilings off end of wharf in Hana Bay, Maui.

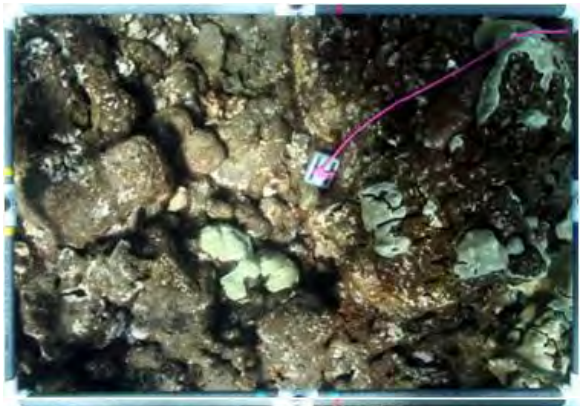
APPENDIX A

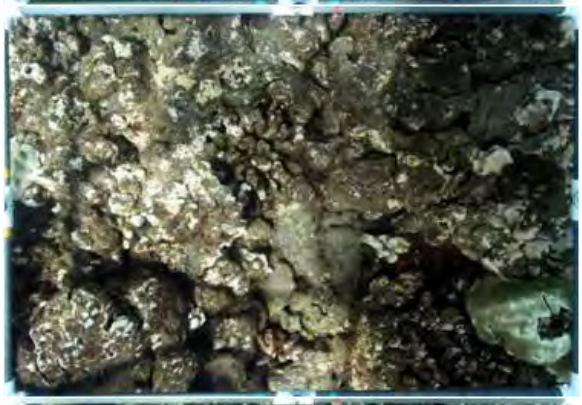
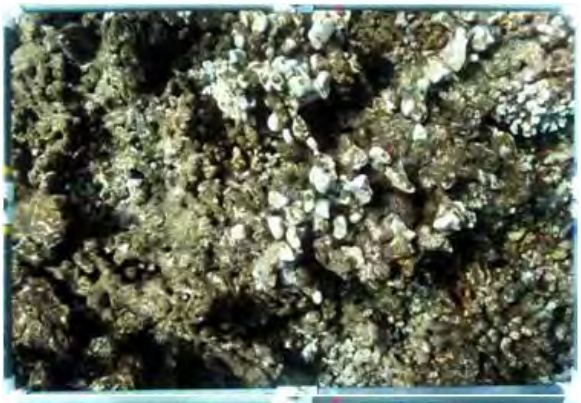
PHOTO-QUADRATS

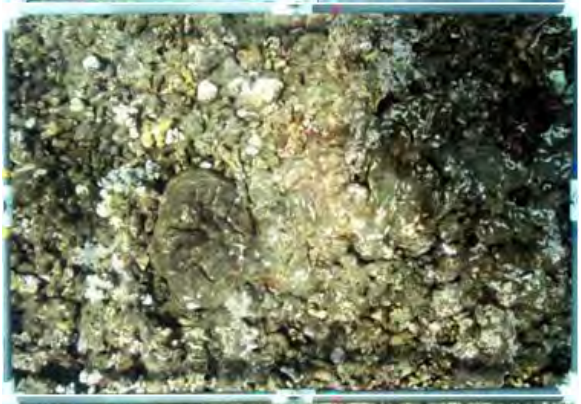
HANA BAY REEF CORAL COMMUNITY ASSESSMENT

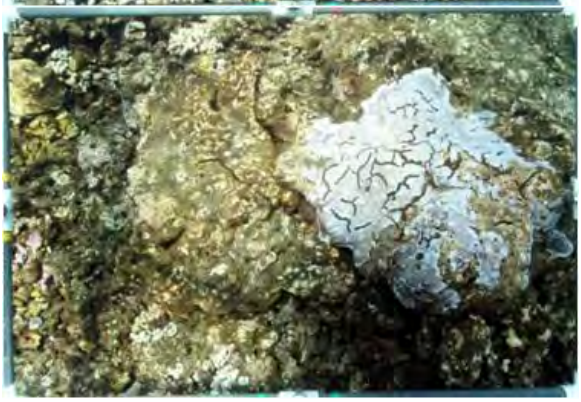
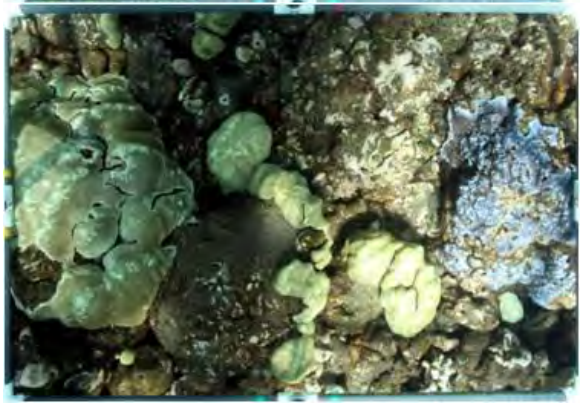
MAY 29, 2010

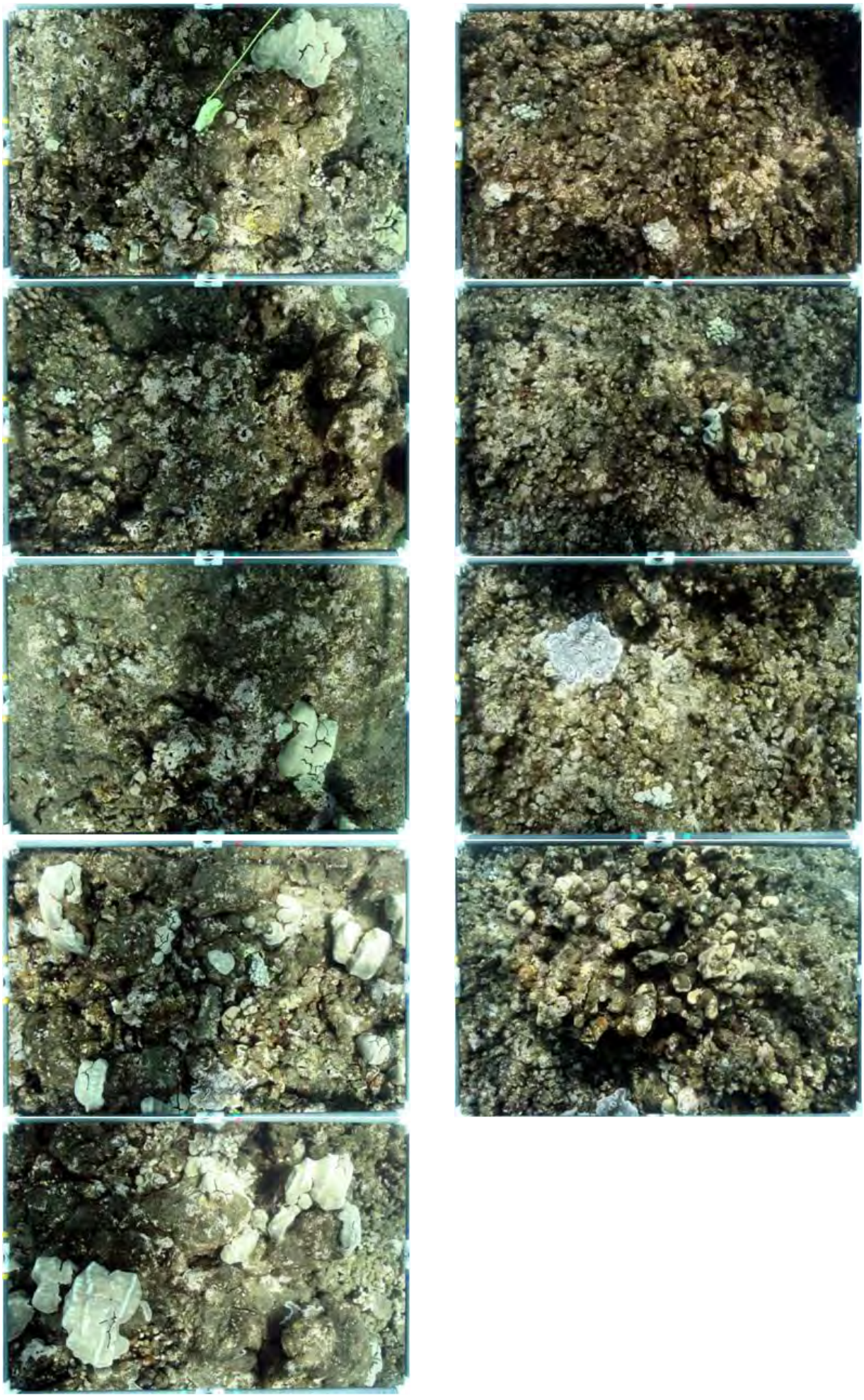


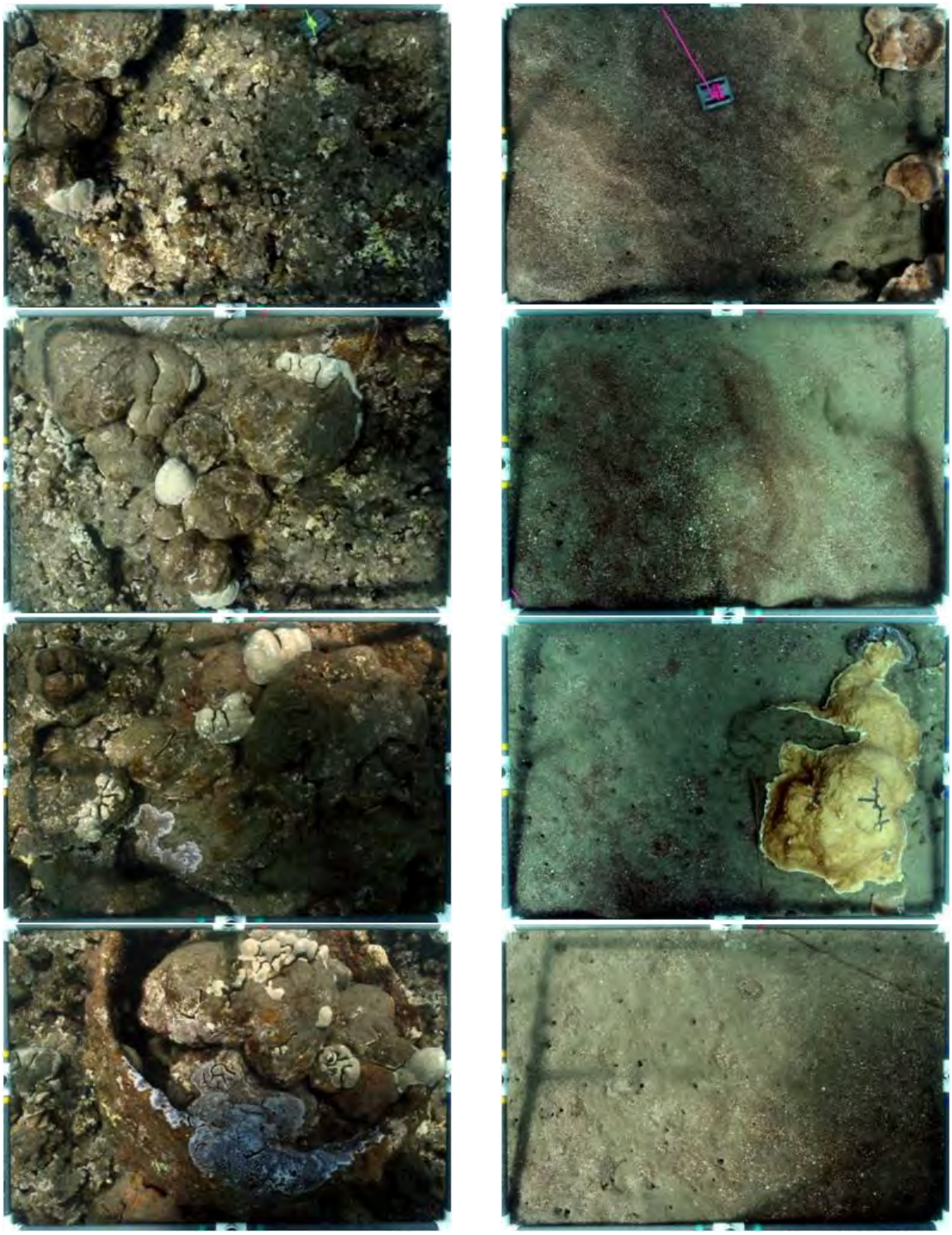


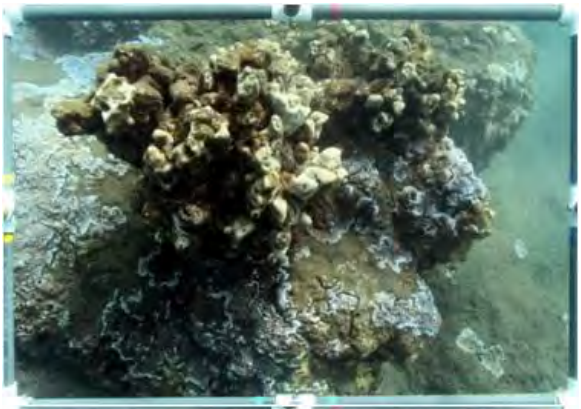
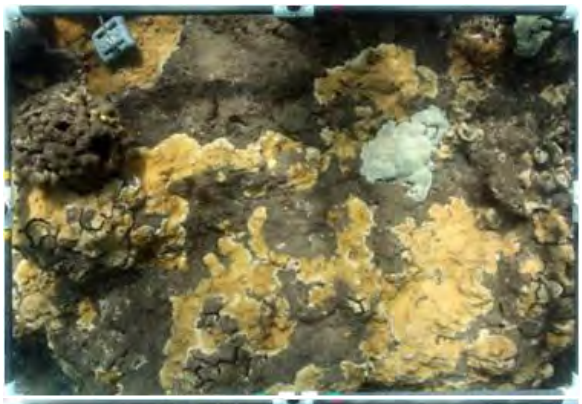
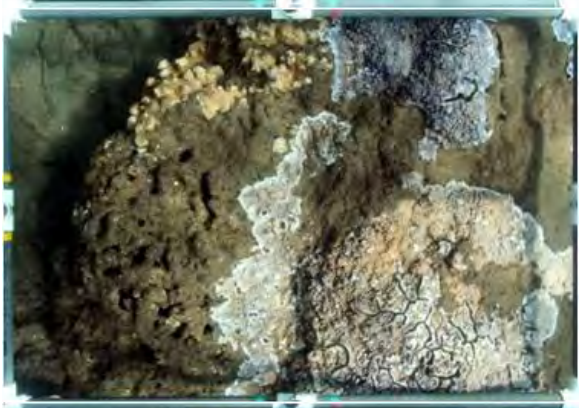
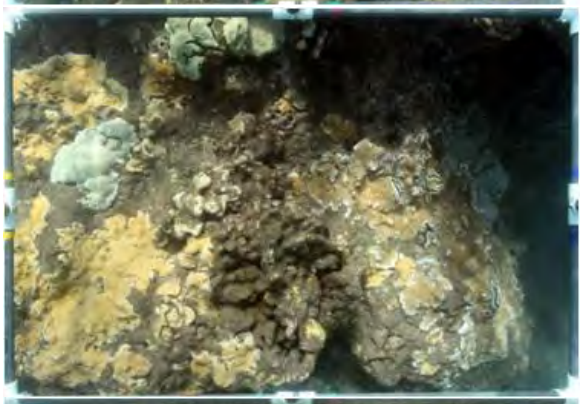
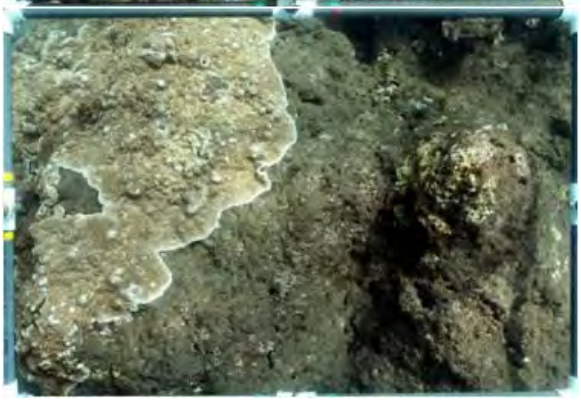
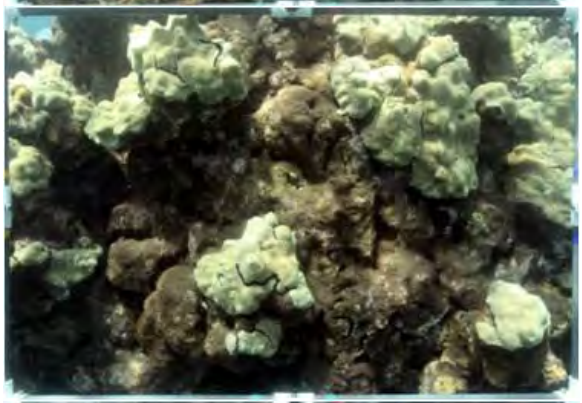
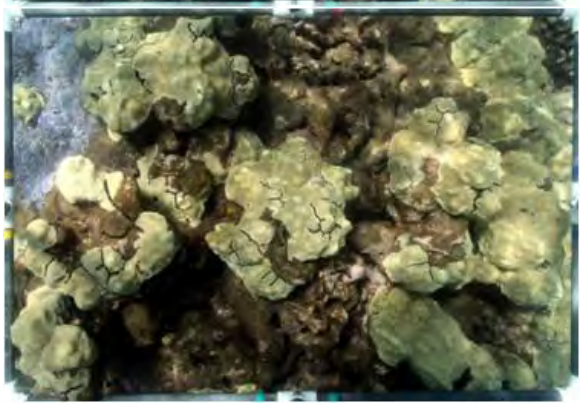



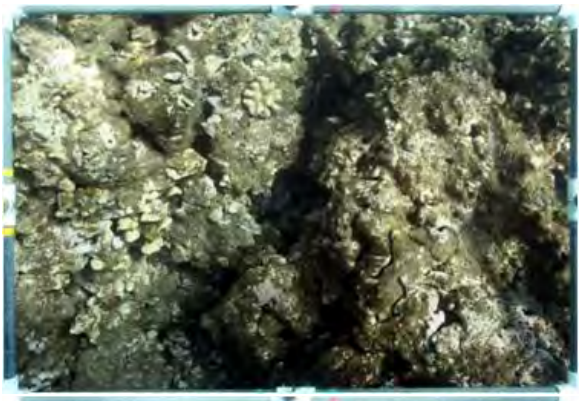
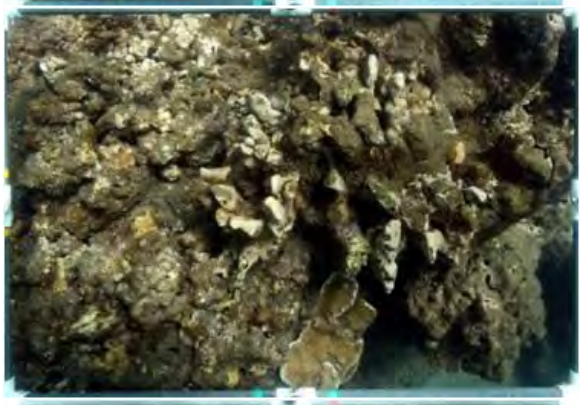
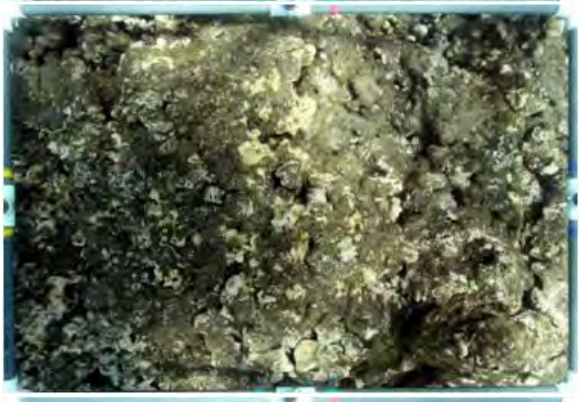
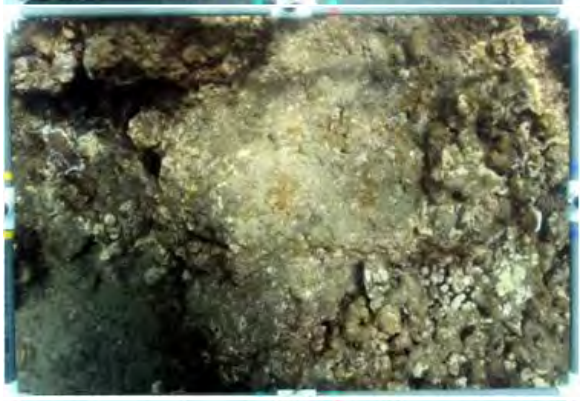
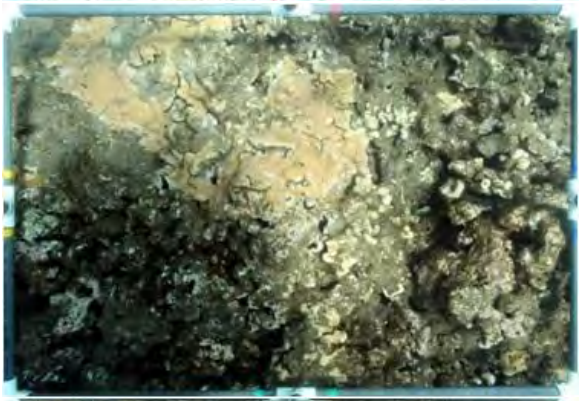
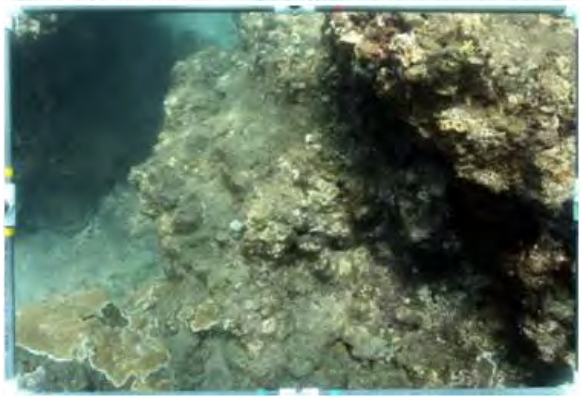
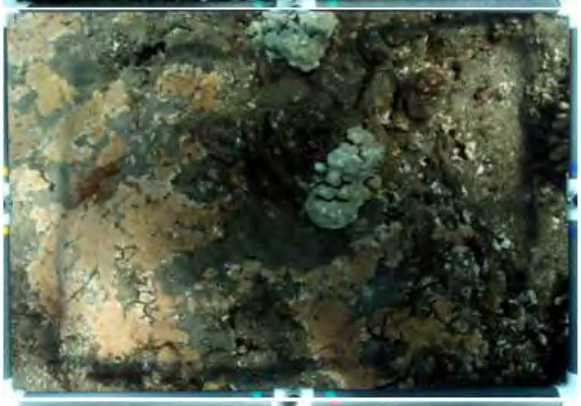


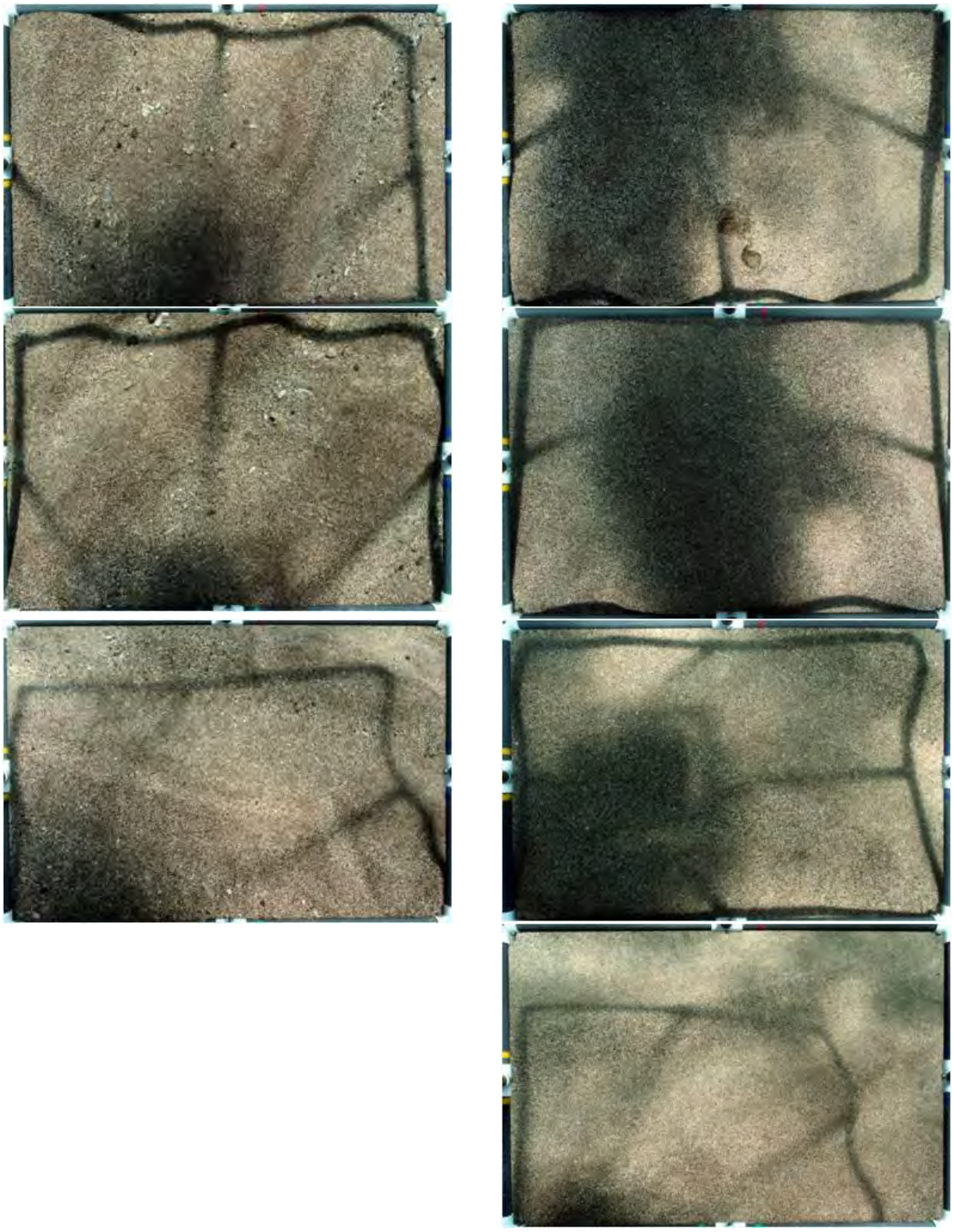



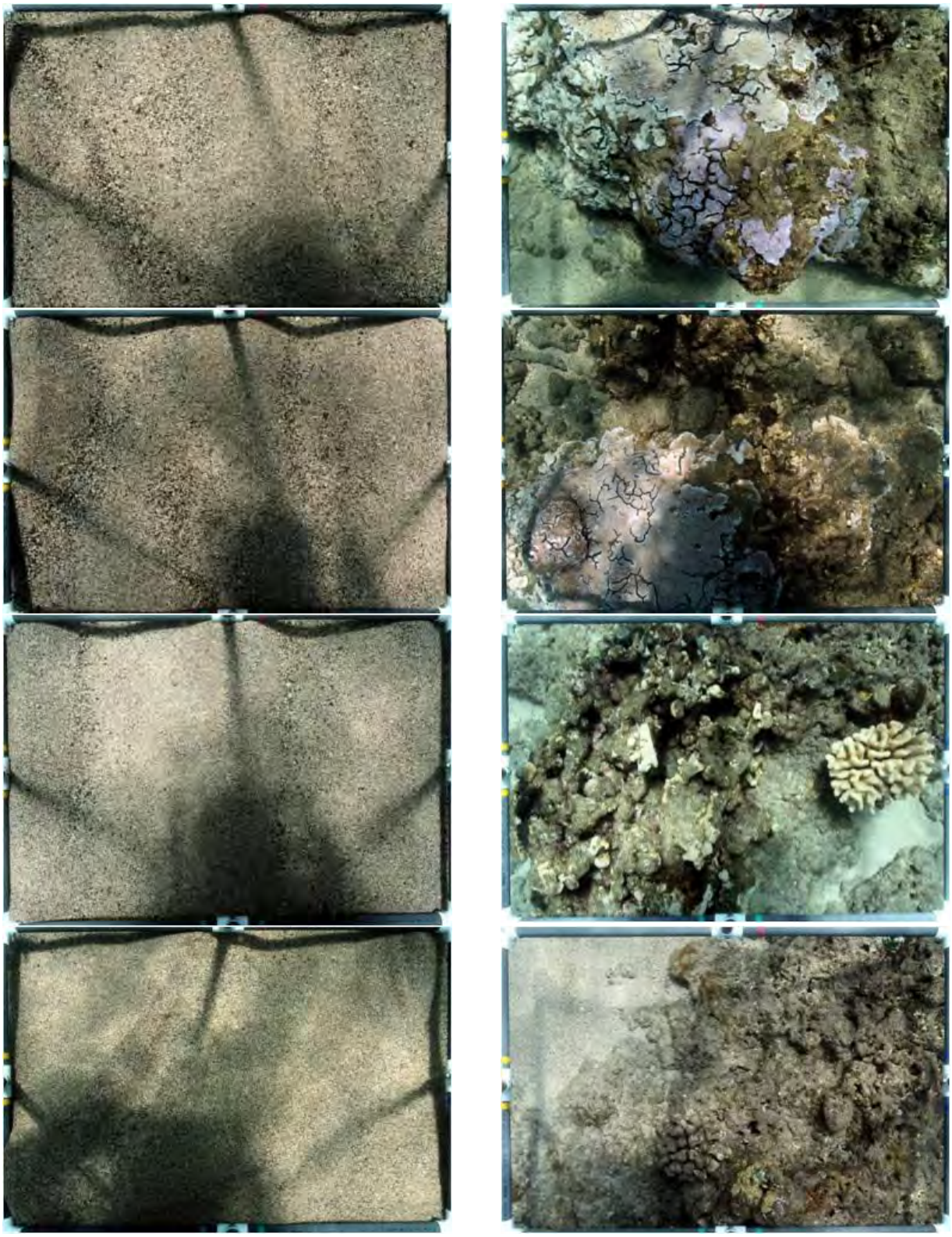


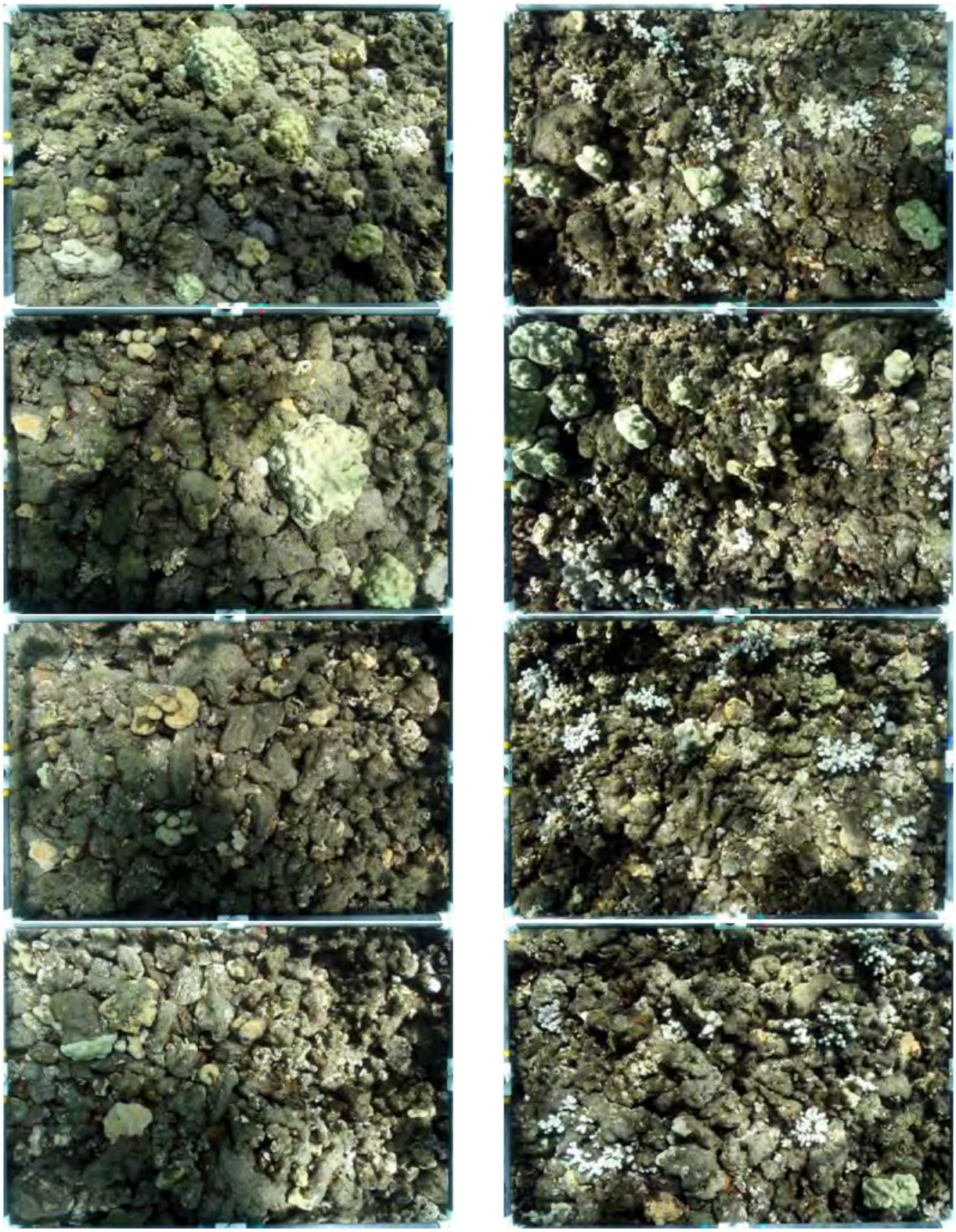


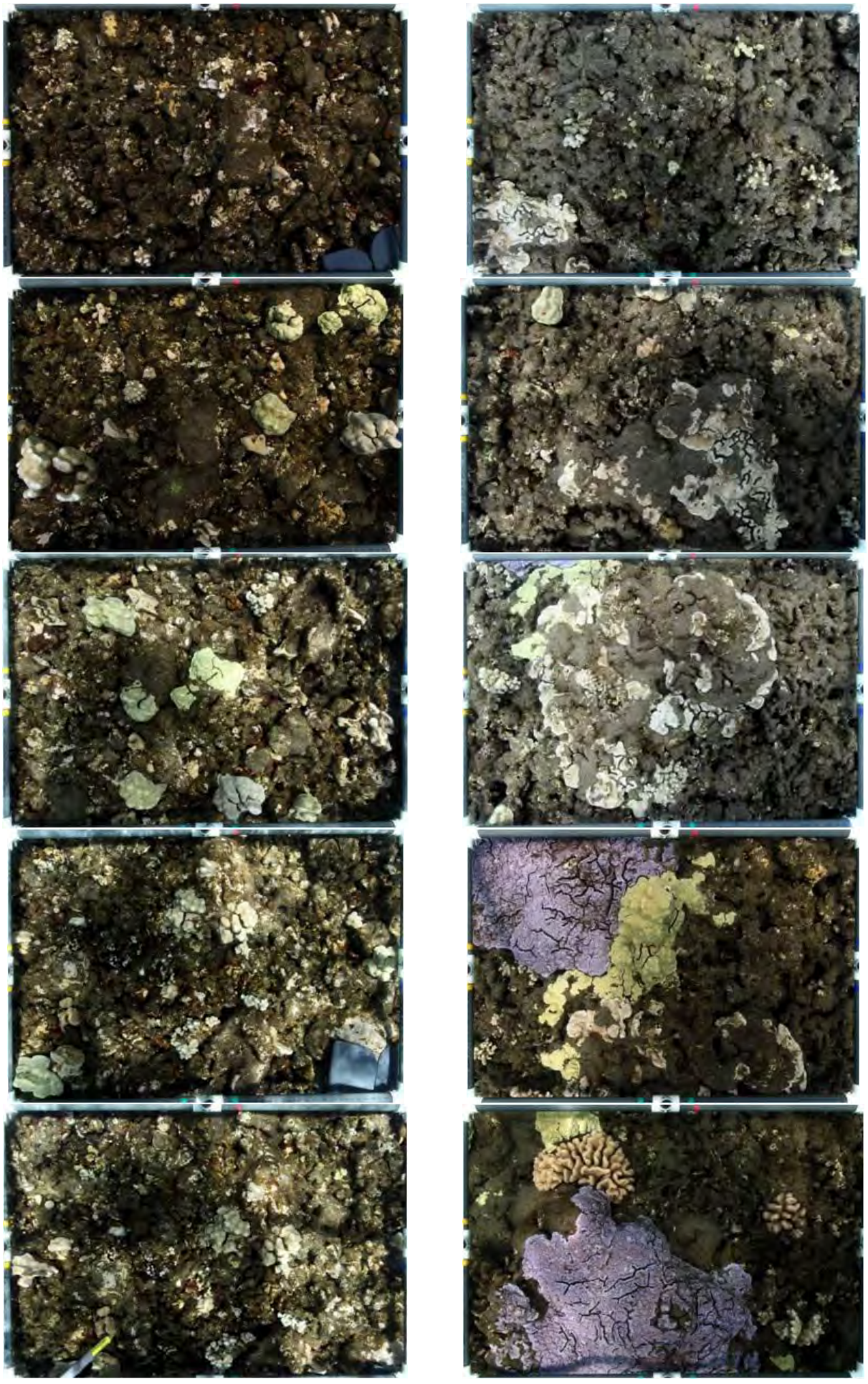















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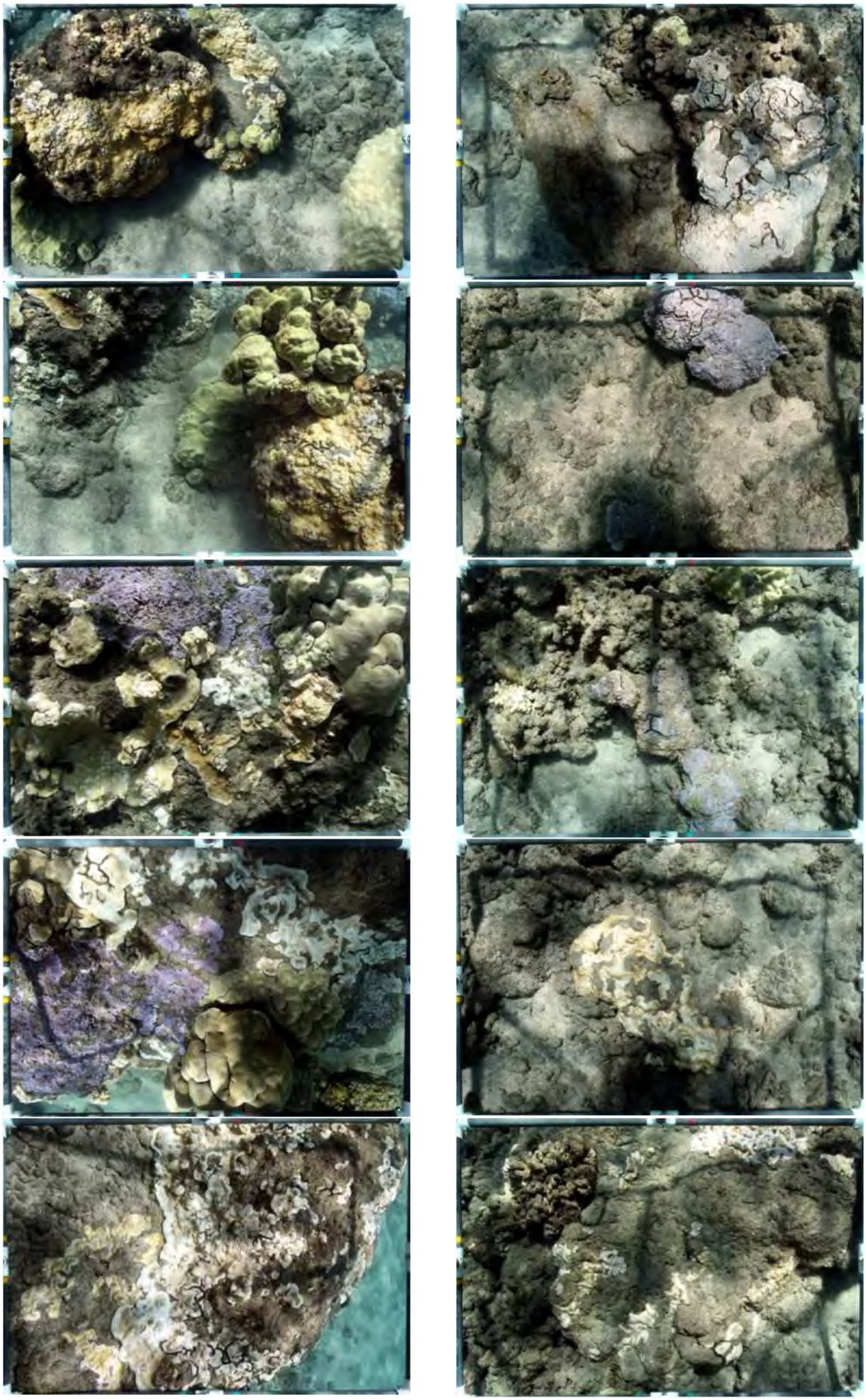

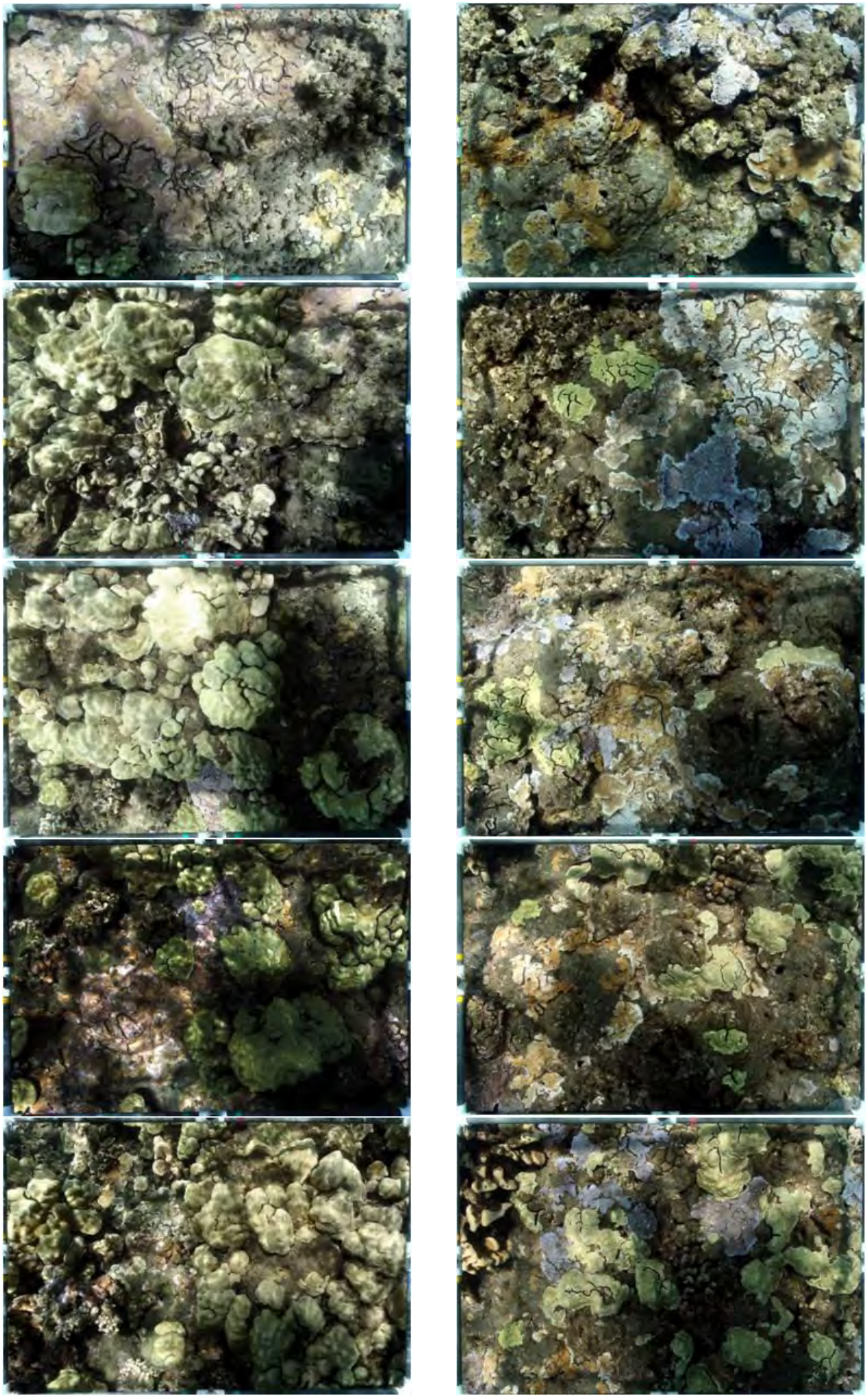

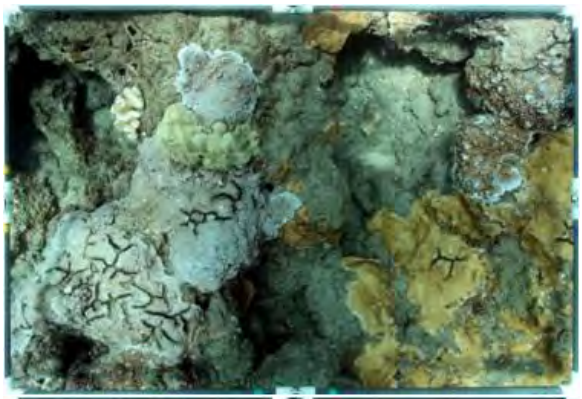

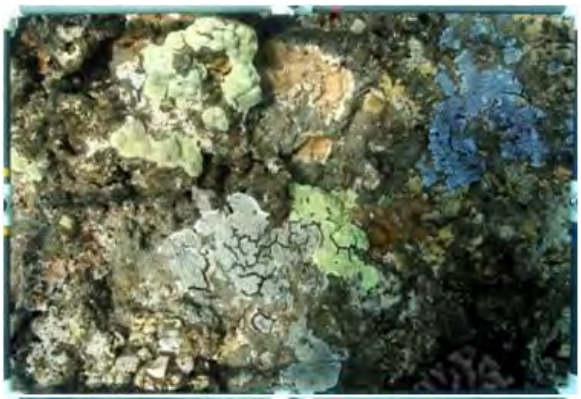

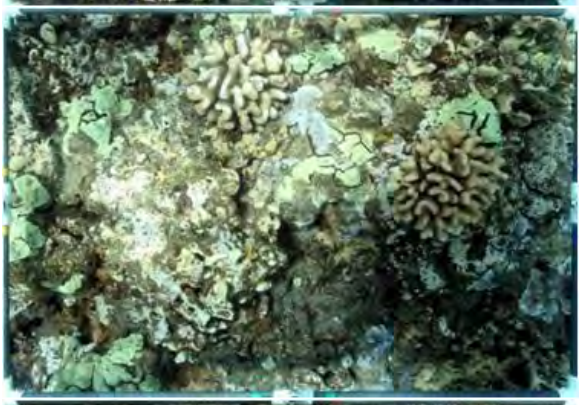

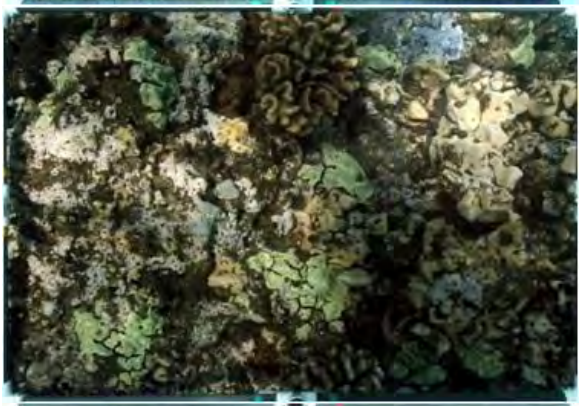

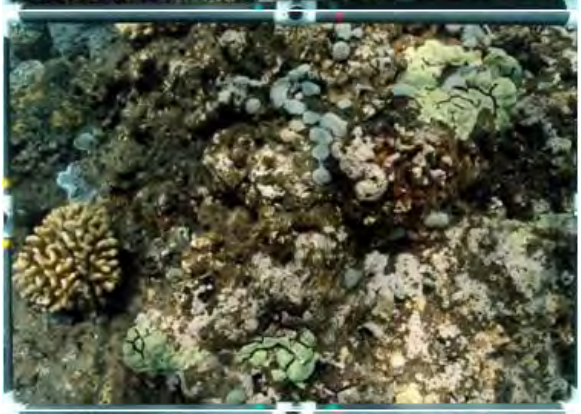

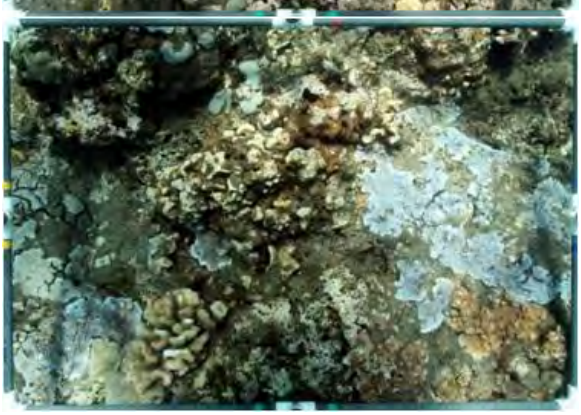

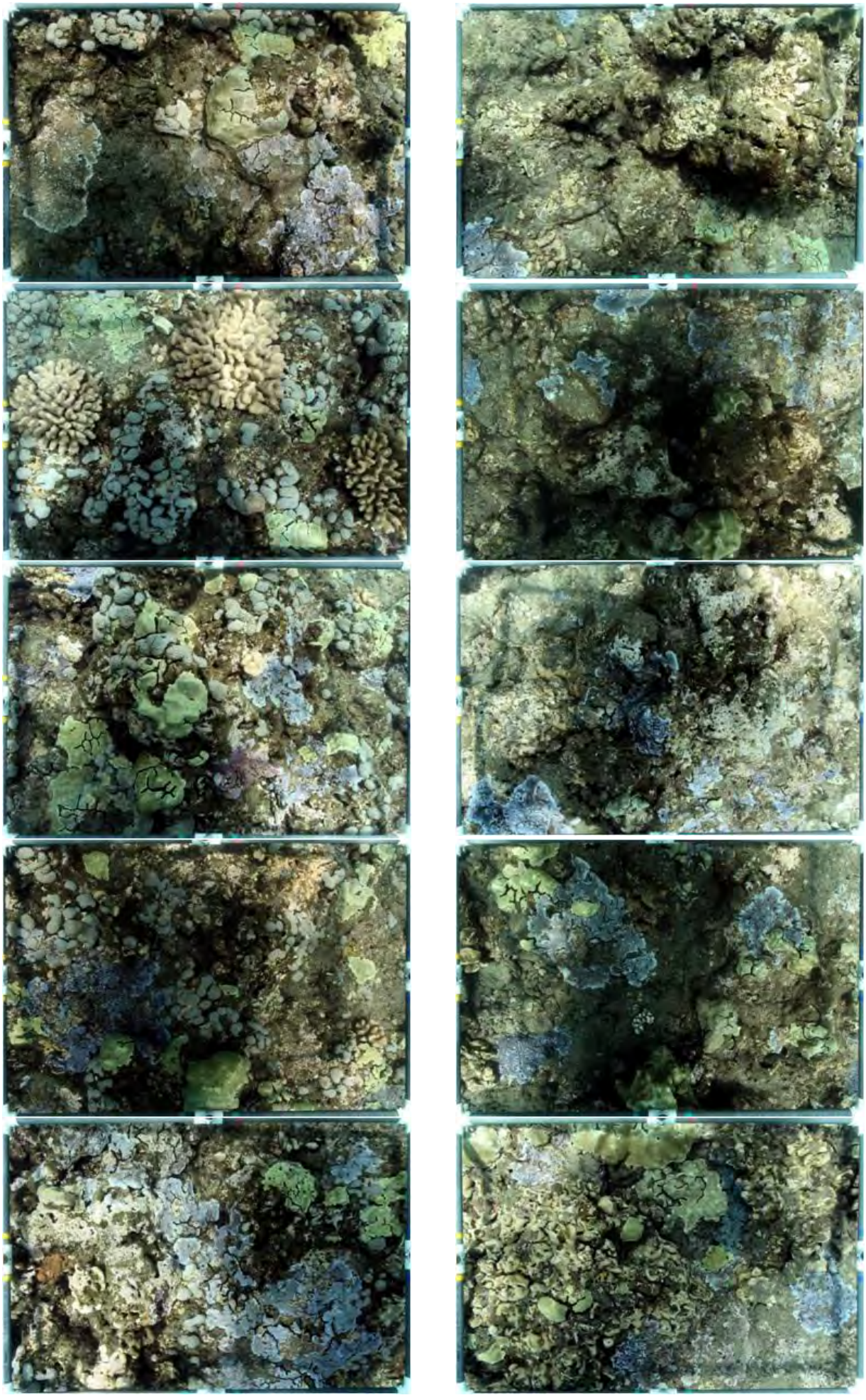

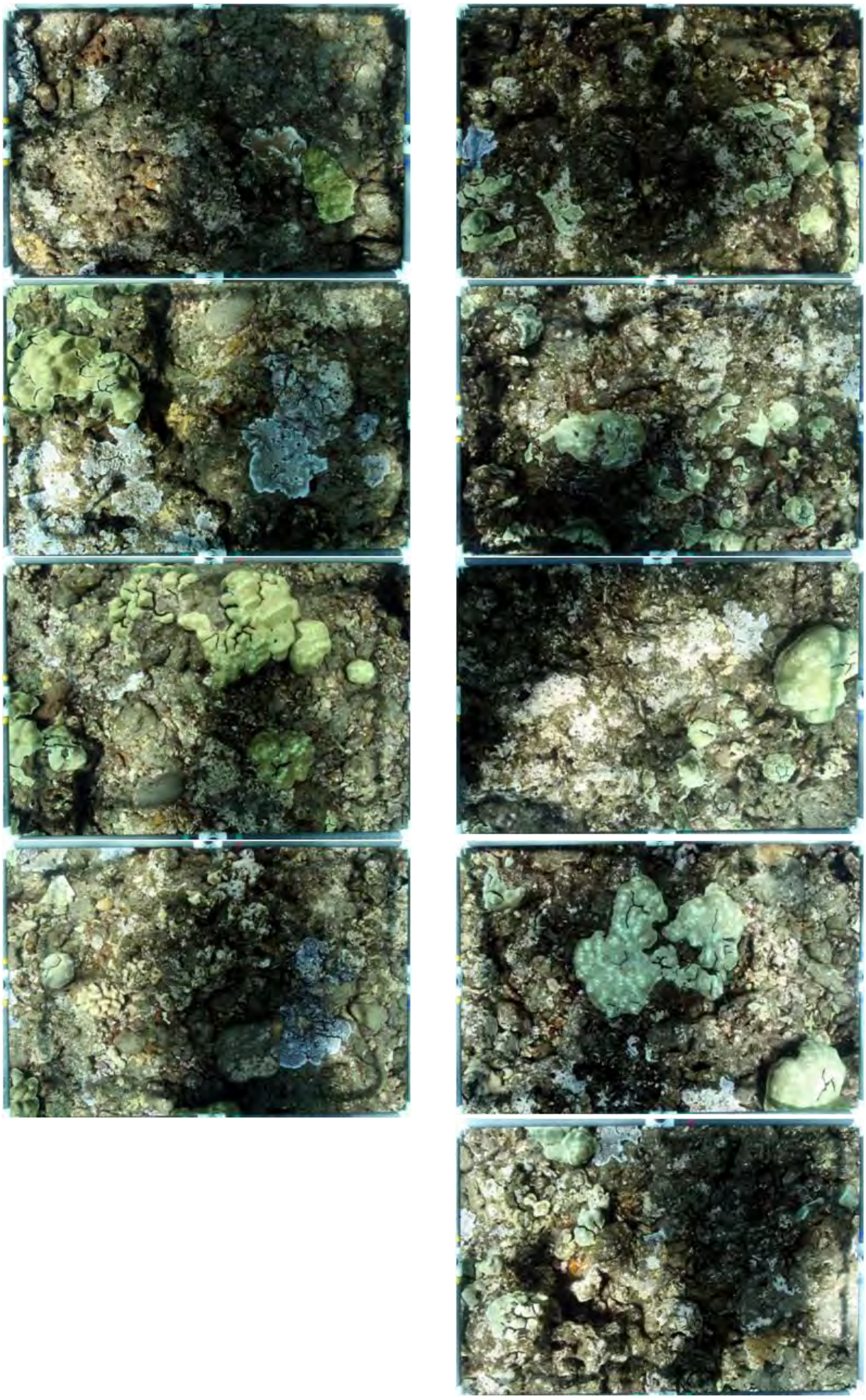

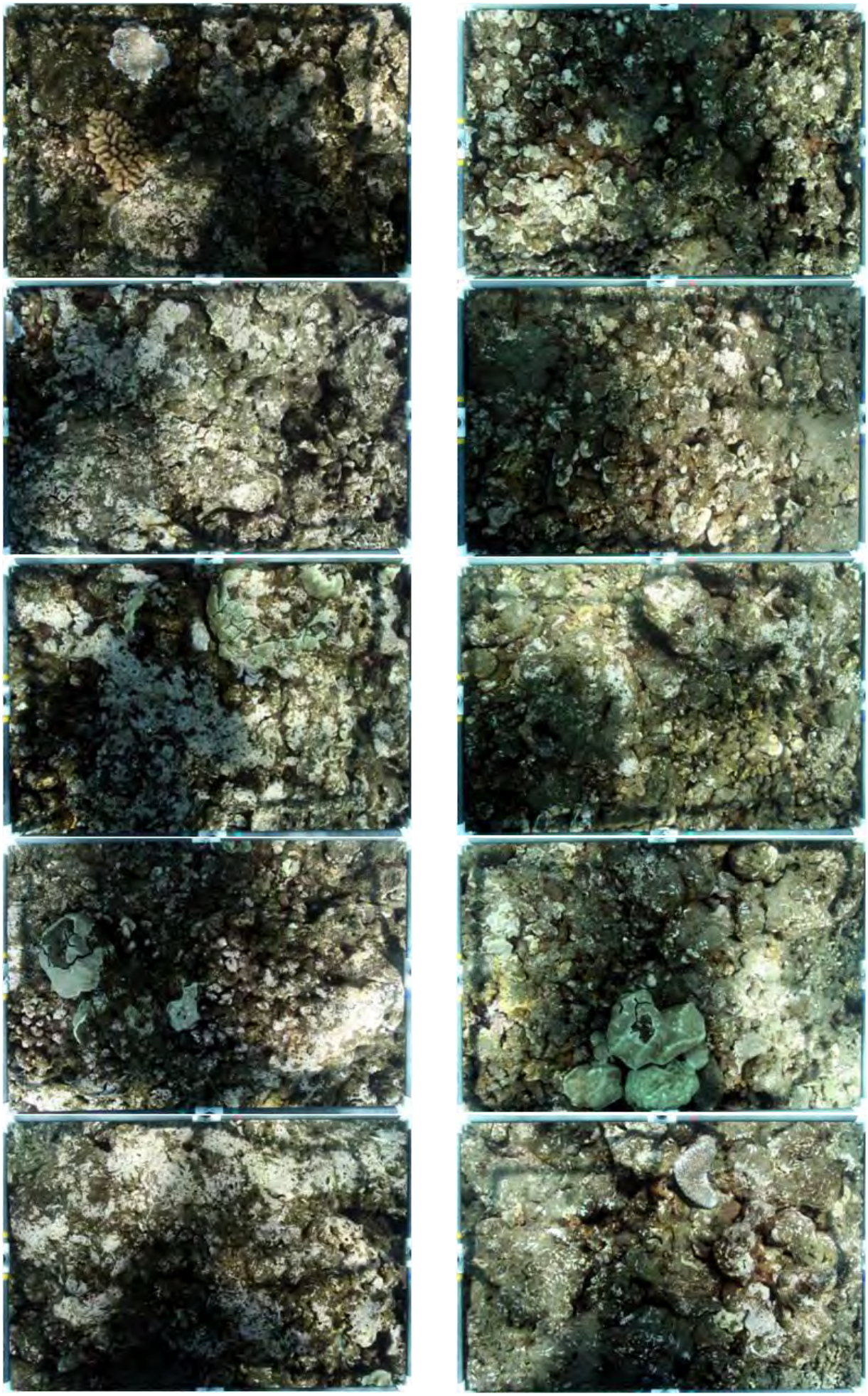

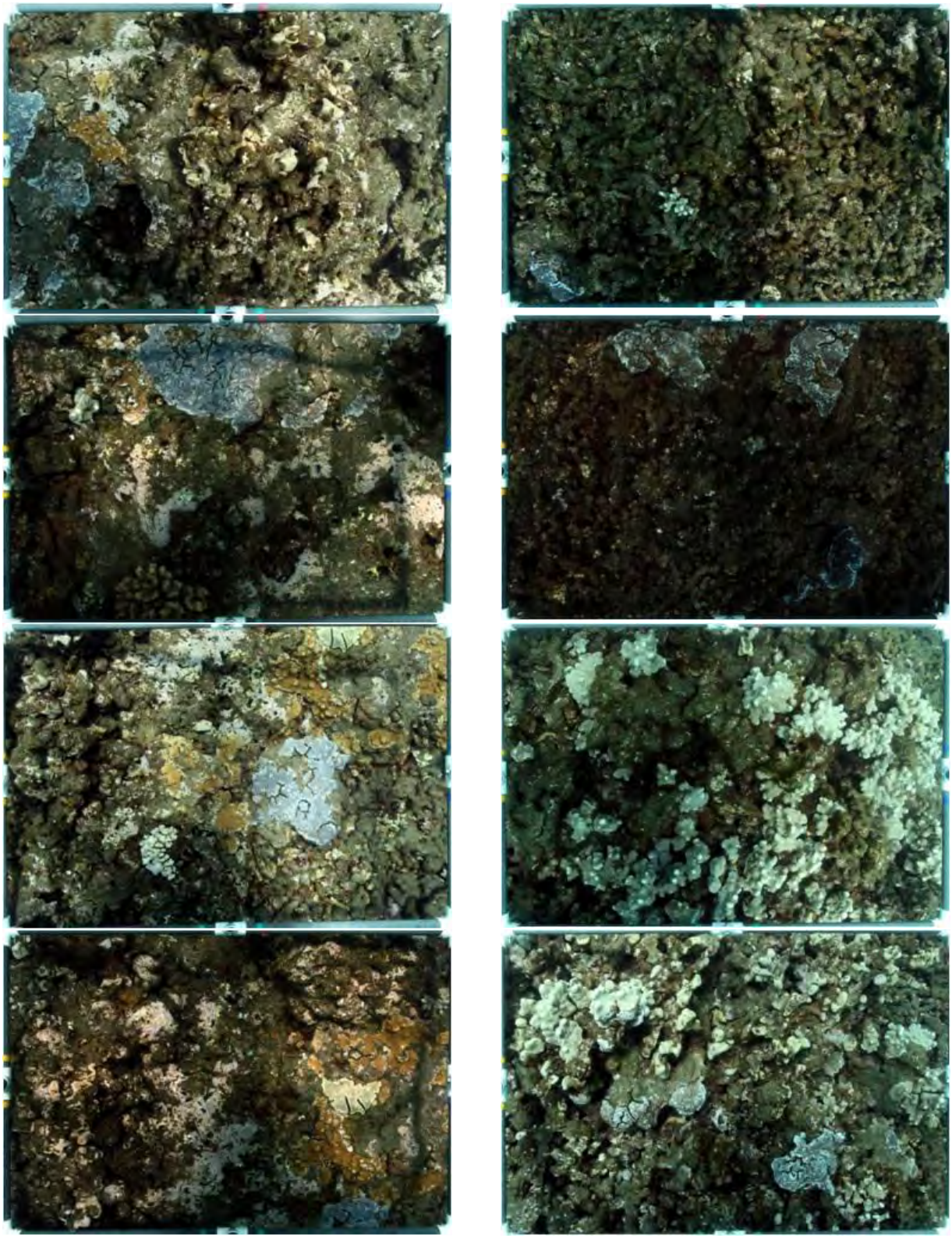

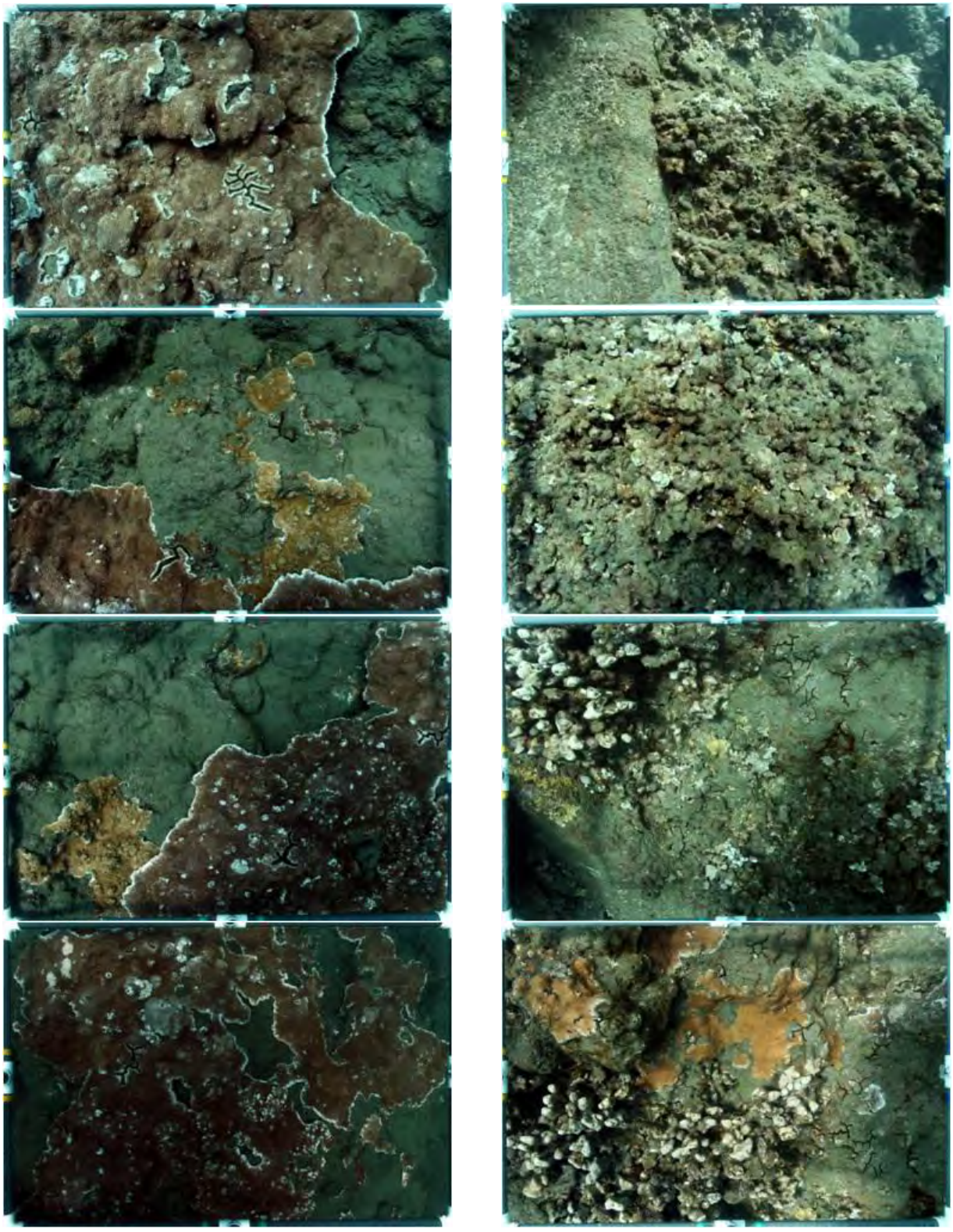

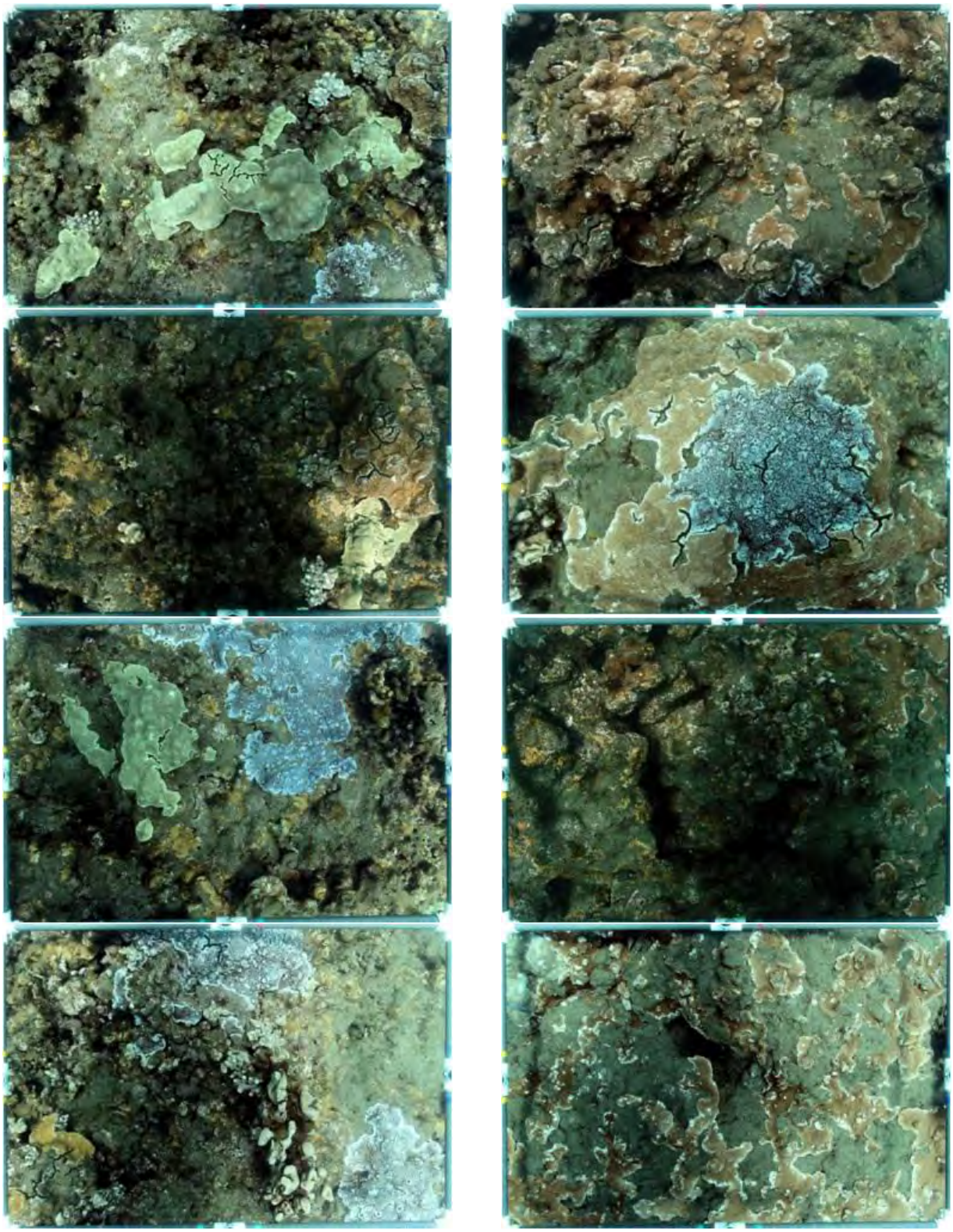


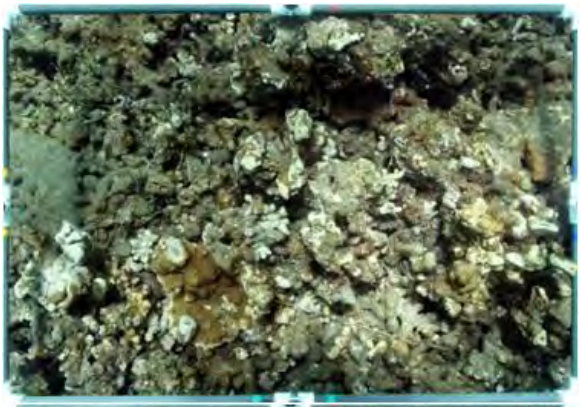
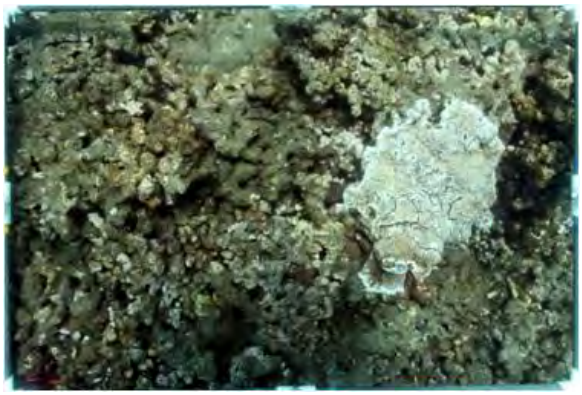
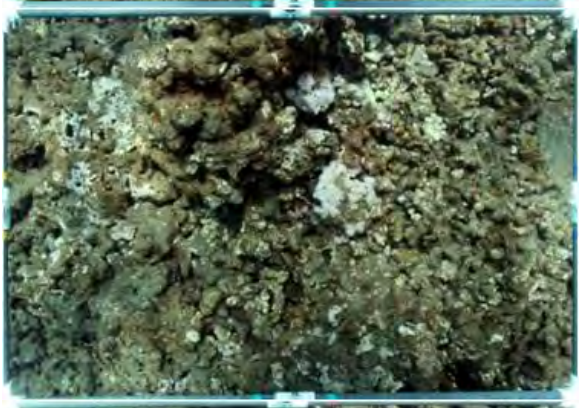
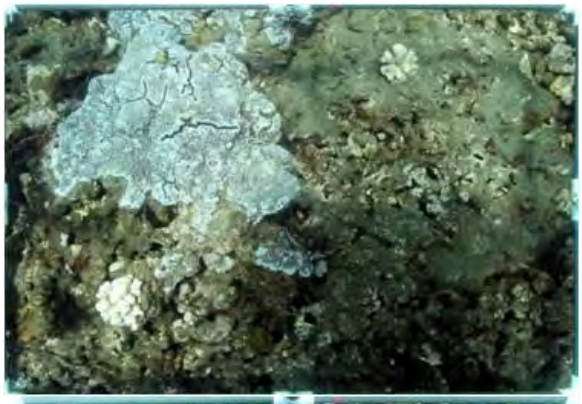
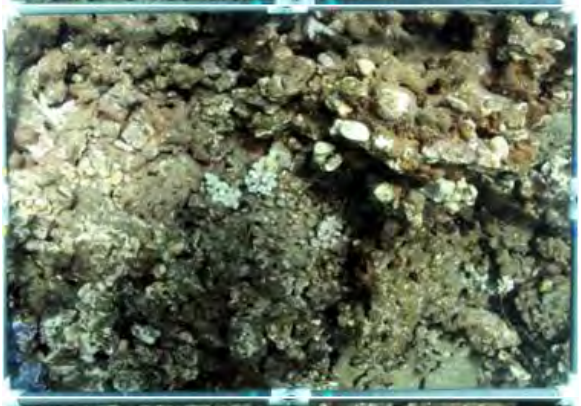
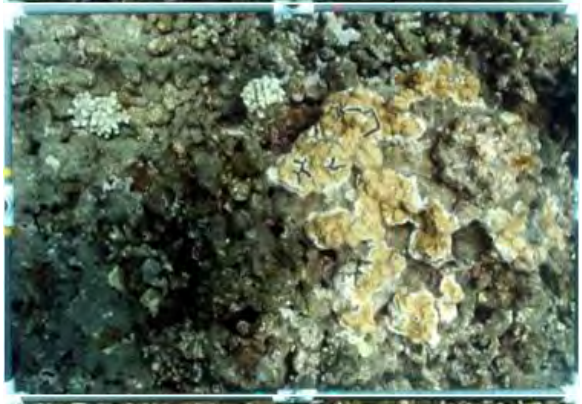
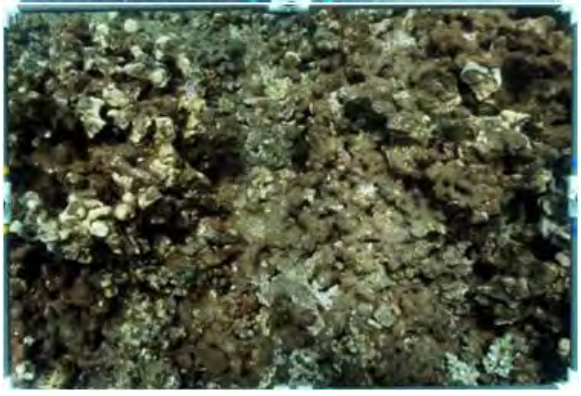
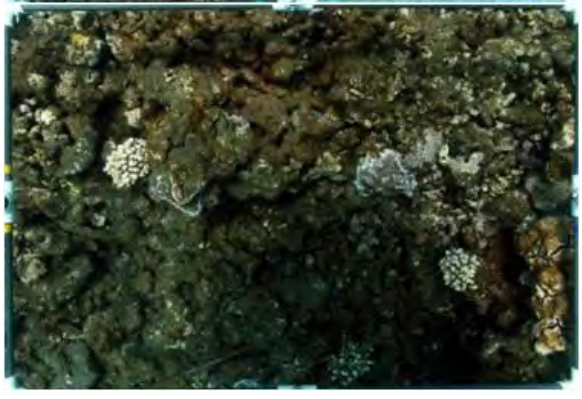


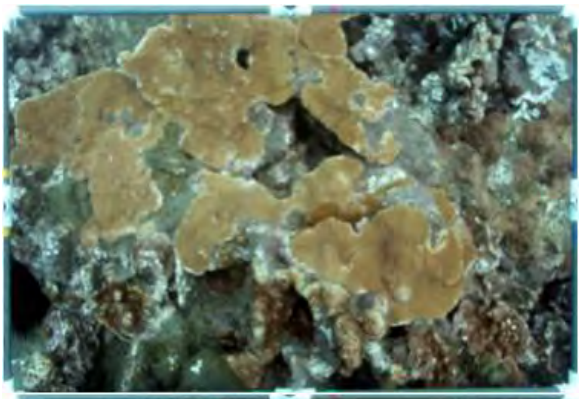
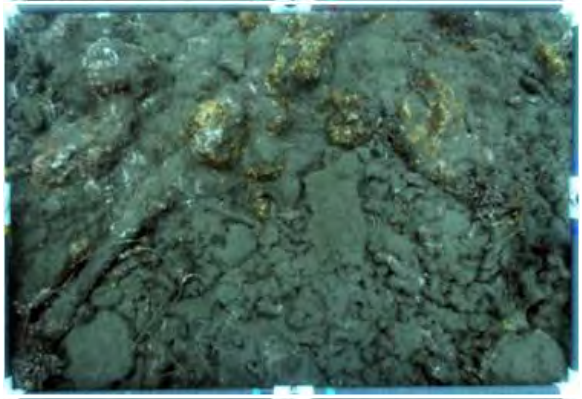


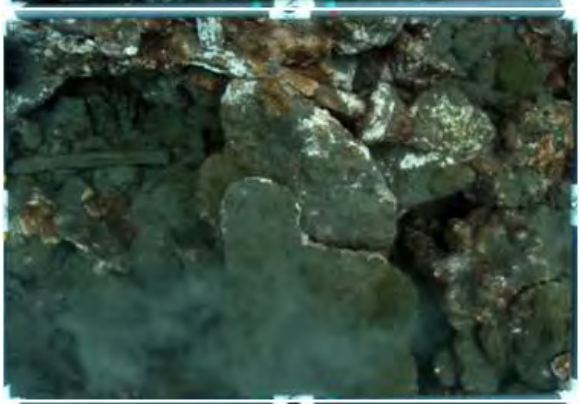


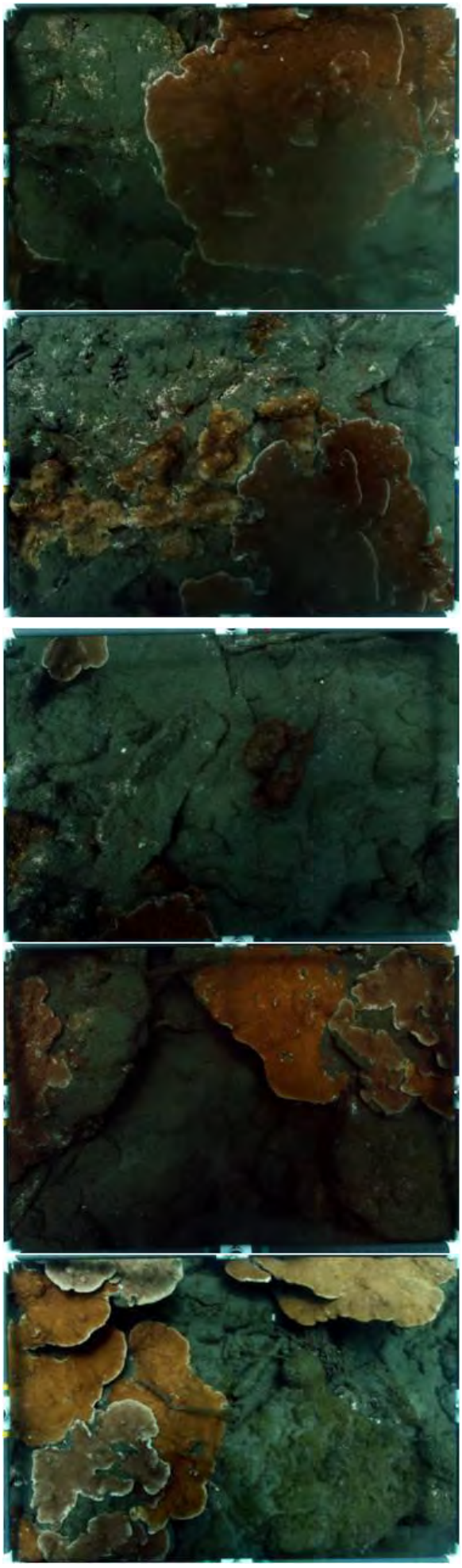

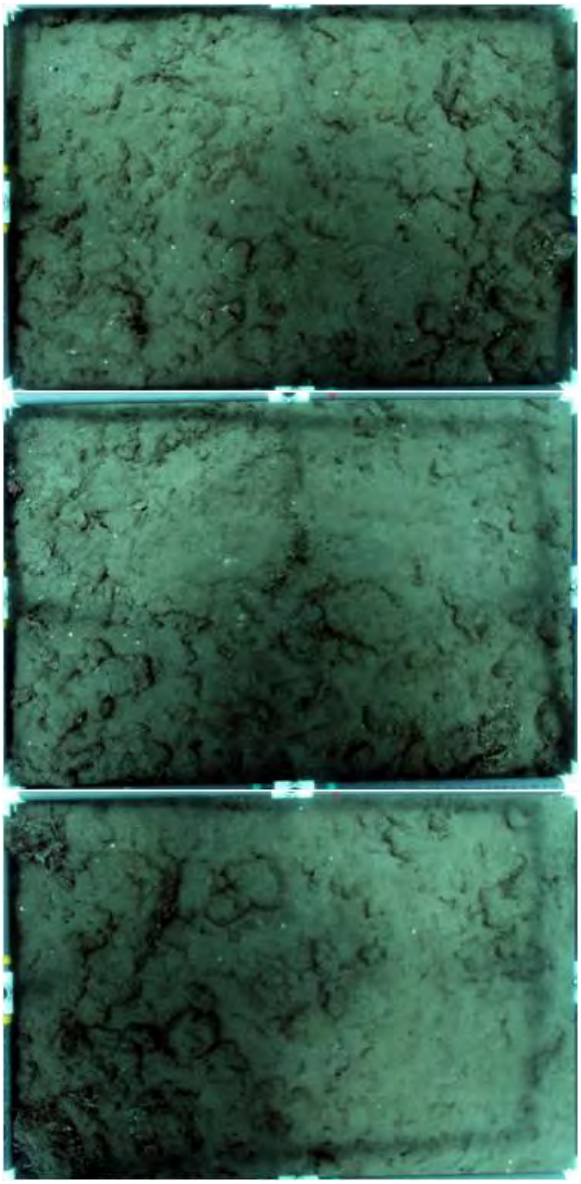

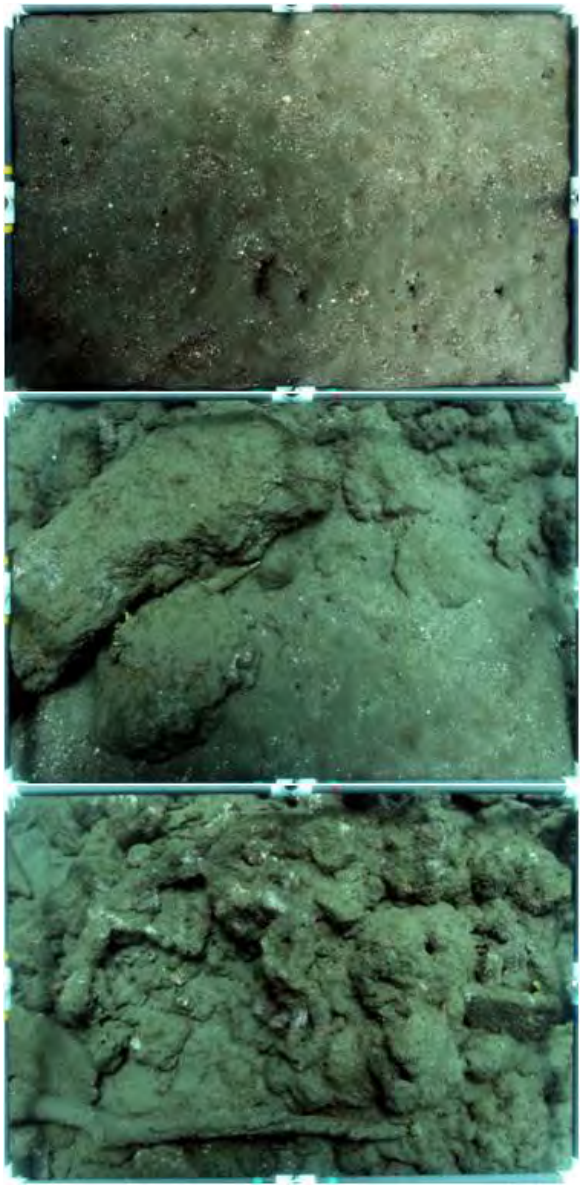

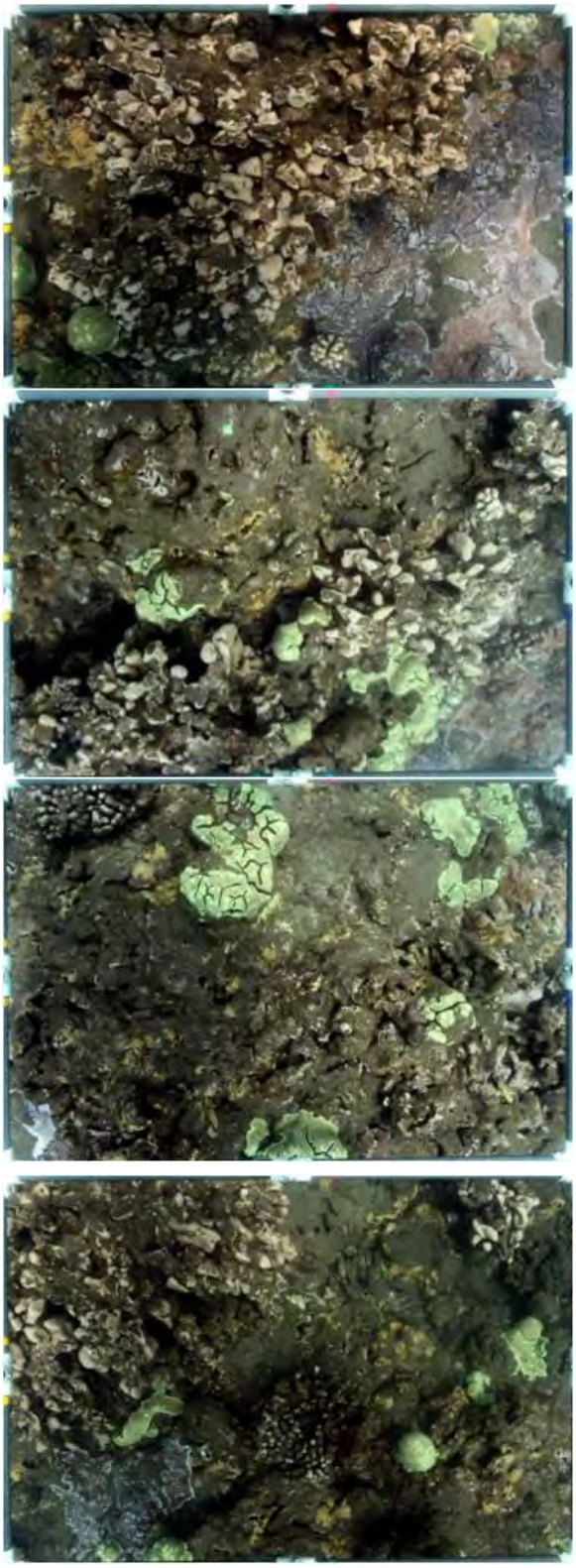

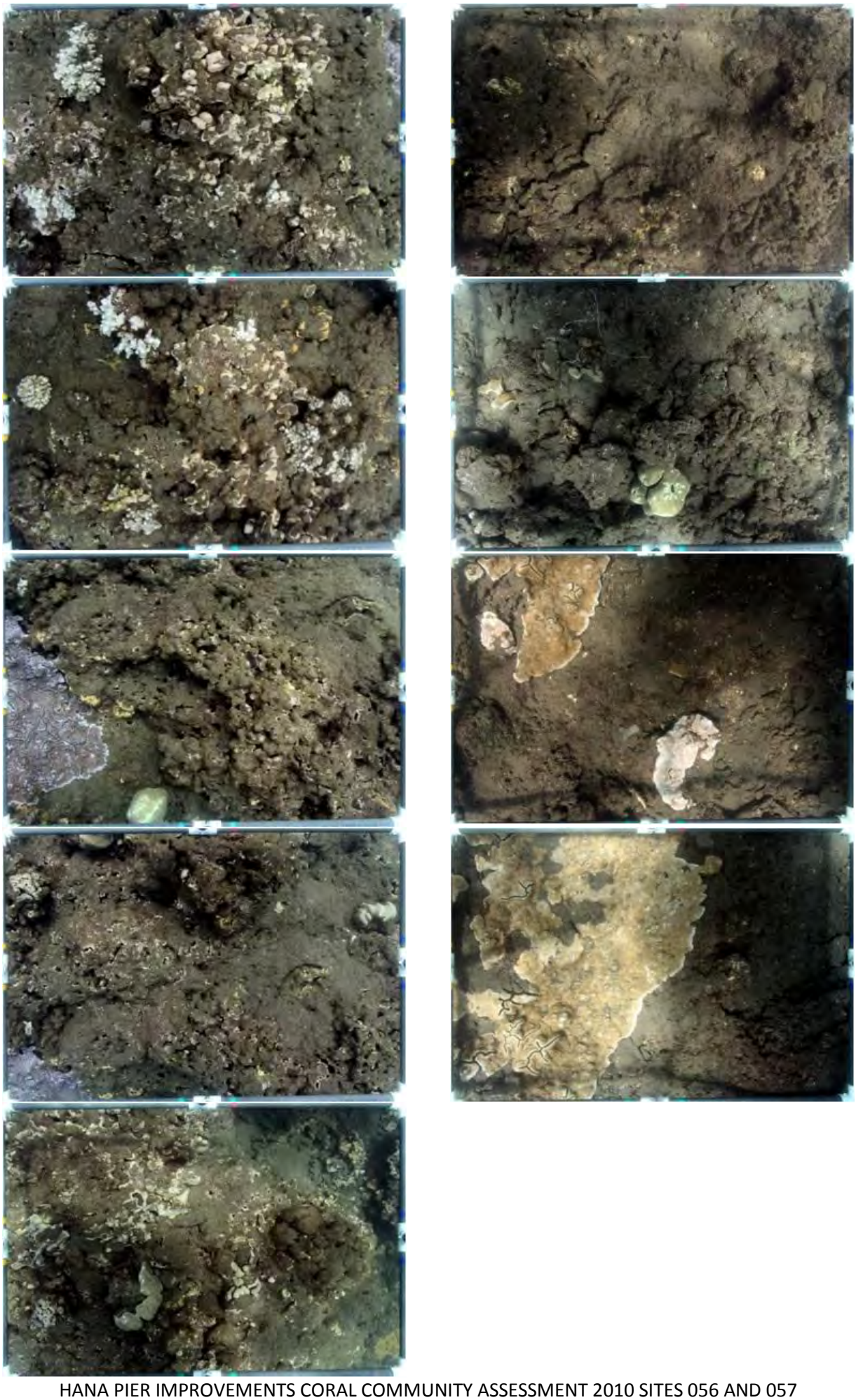

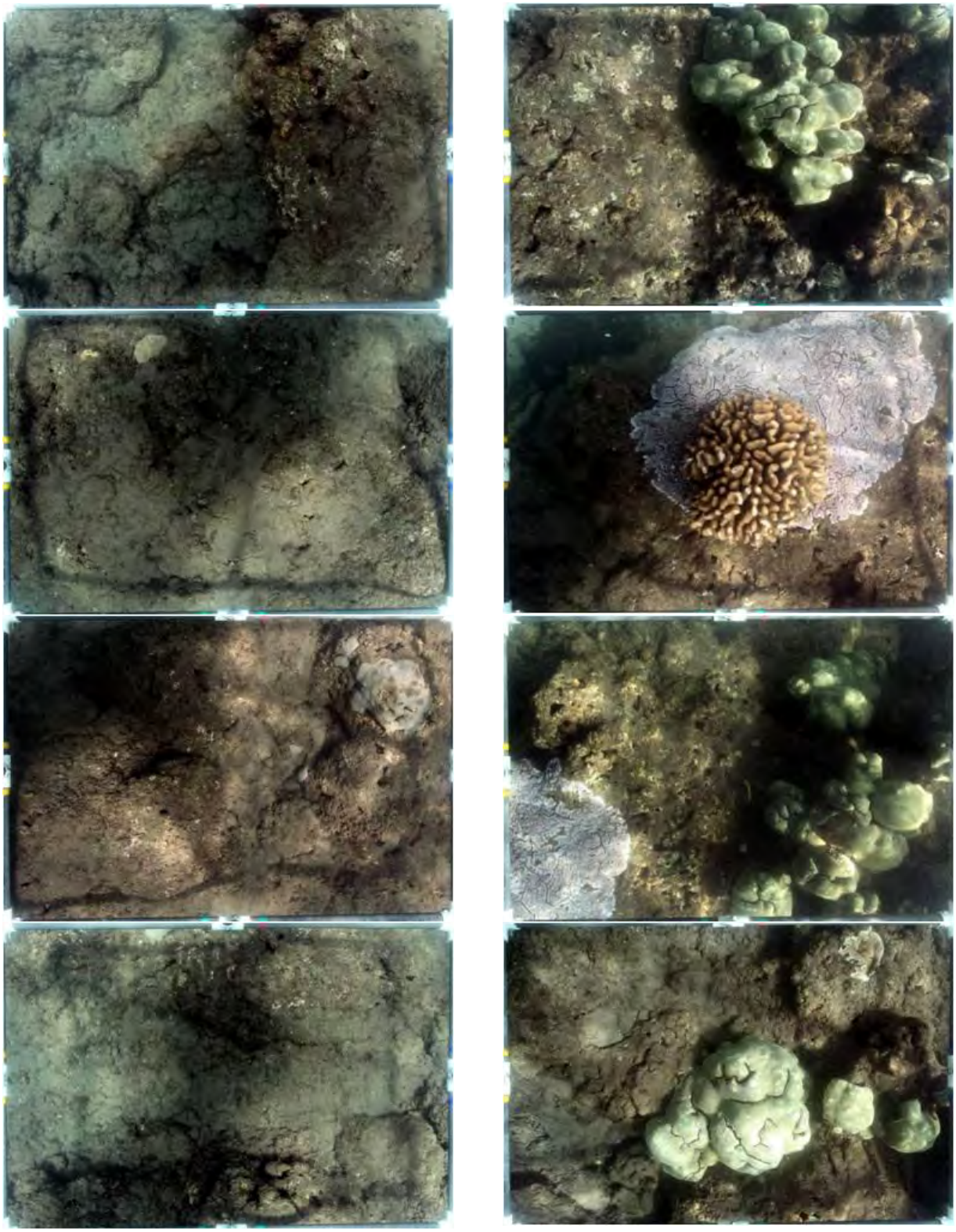




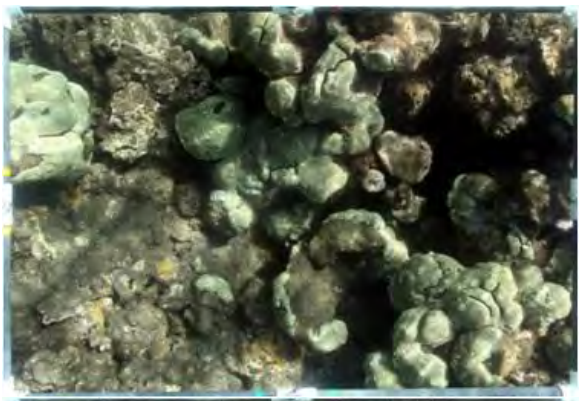
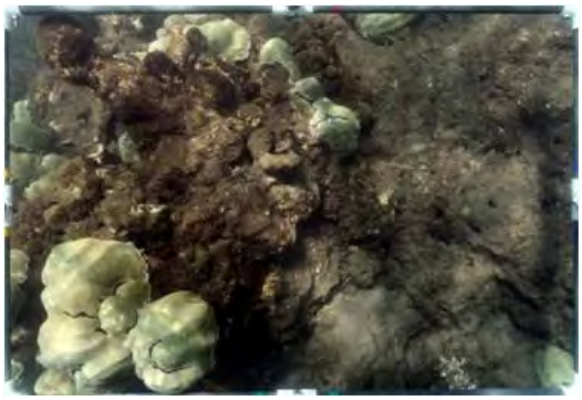

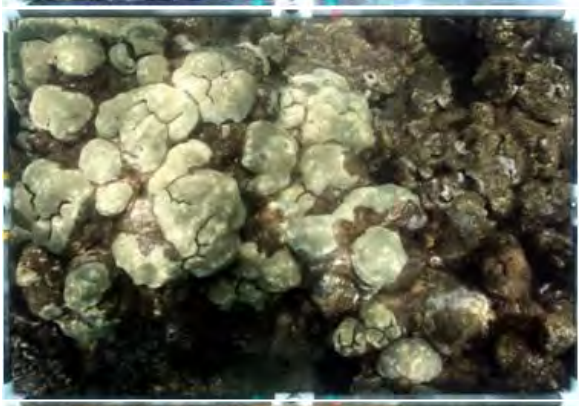
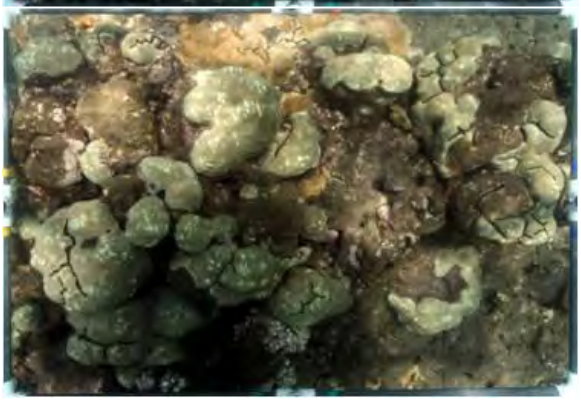

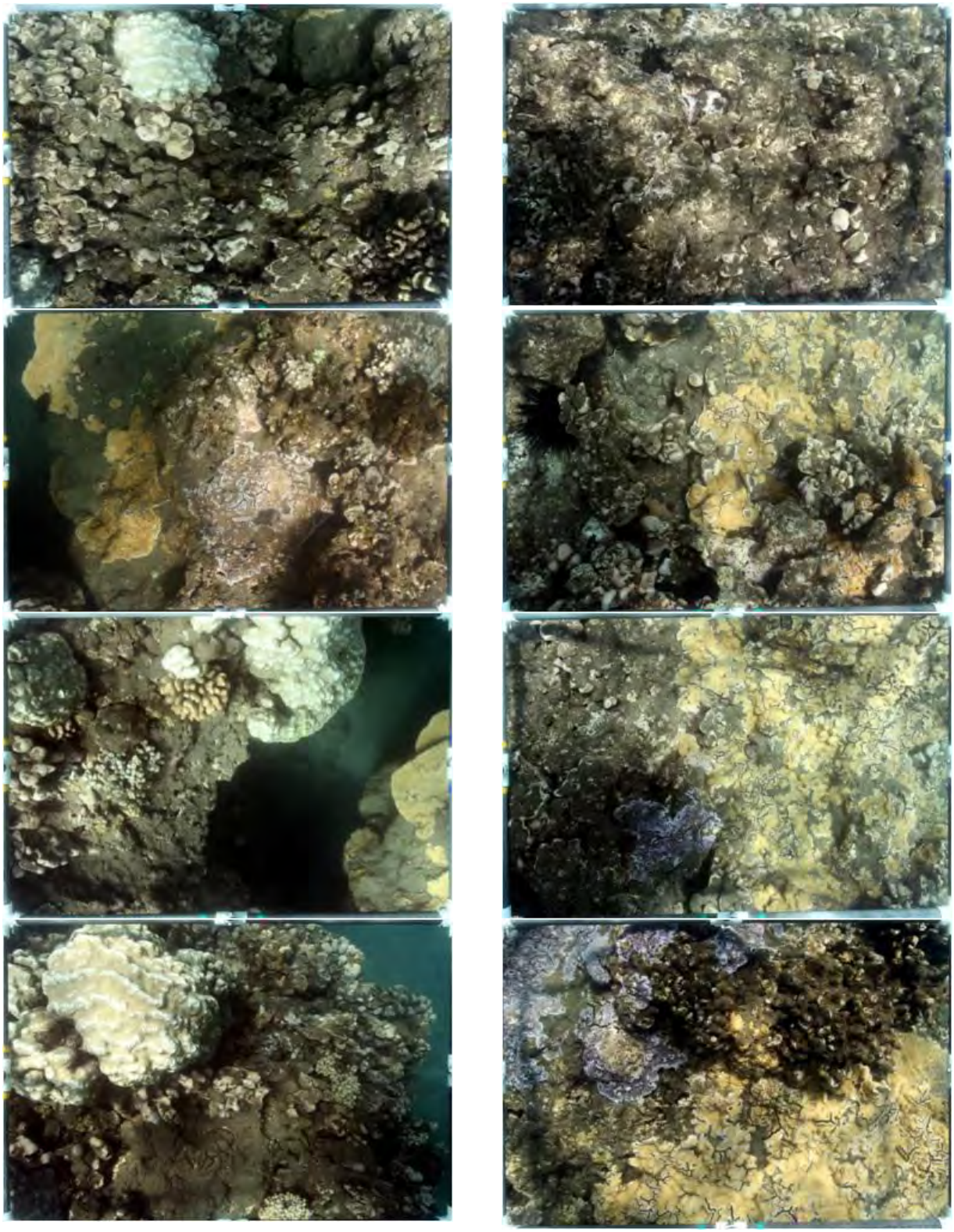

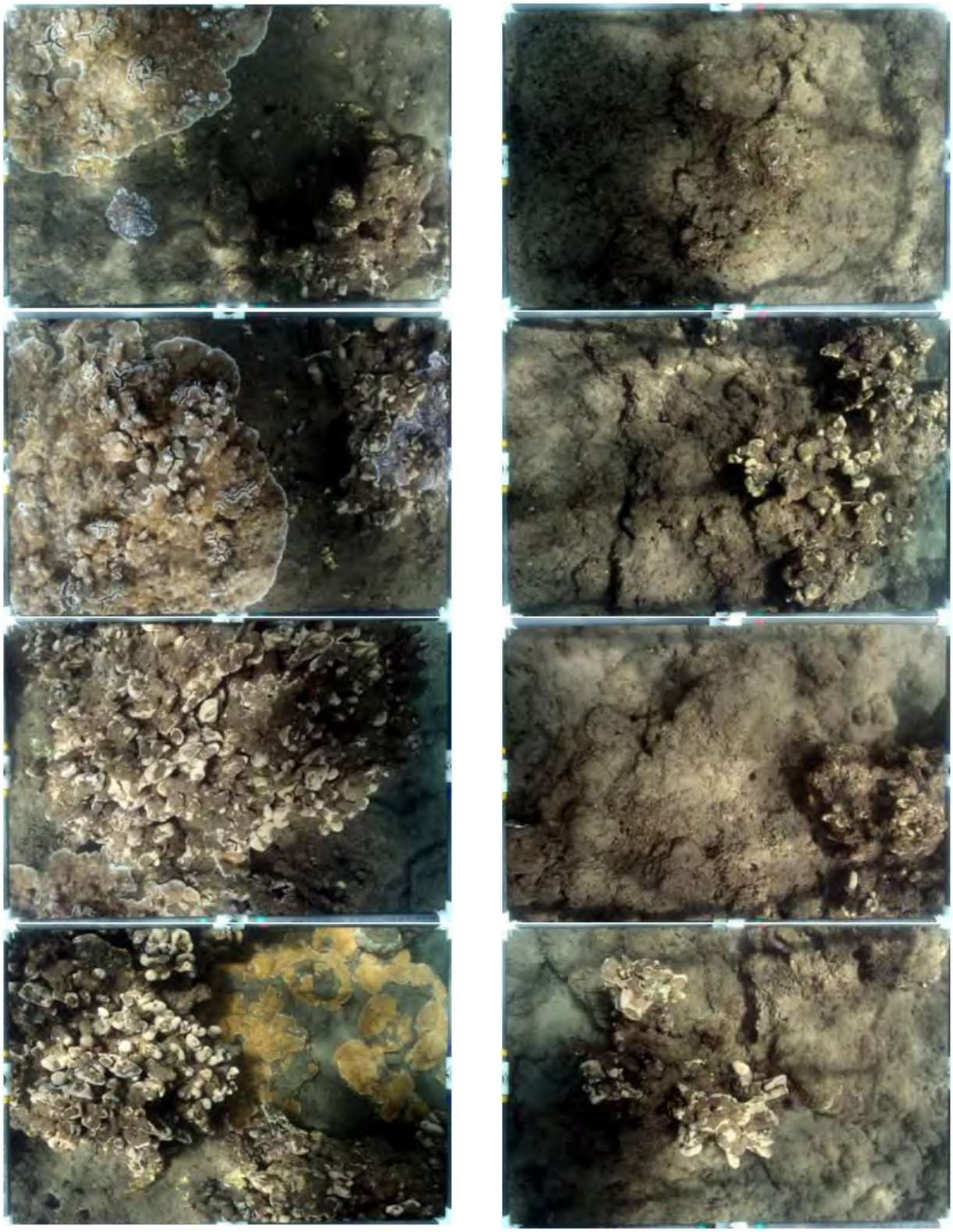

APPENDIX B. Percent cover of bottom composition for individual photo-quadrats, Hana Wharf Reef Coral Assessment, May 29, 2010.

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
007	7978	0	5	0	0	0	25	0	0	0	30	0	55	5	0	0	0	10	0	0	0	100
	7979	0	10	0	0	3	15	0	0	0	28	0	57	0	0	0	0	15	0	0	0	100
	7980	0	25	0	0	0	15	0	0	3	43	0	47	0	0	0	0	10	0	0	0	100
	7981	0	5	0	0	0	10	0	0	0	15	0	40	0	0	0	0	10	35	0	0	100
	7982	0	5	0	0	0	25	0	0	0	30	0	25	0	0	0	0	15	30	0	0	100
	MEAN	0	10	0	0	0.6	18	0	0	0.6	29.2	0	44.8	1	0	0	0	12	13	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
008	7987	0	5	0	0	0	40	0	0	0	45	0	50	5	0	0	0	0	0	0	0	100
	7988	0	5	0	0	0	15	5	0	0	25	0	45	5	0	0	0	10	15	0	0	100
	7989	0	5	0	0	2	10	3	0	0	20	0	55	5	0	0	0	15	5	0	0	100
	7990	0	0	0	0	0	10	0	0	0	10	0	55	5	0	0	0	5	25	0	0	100
	7991	0	3	0	0	0	5	7	0	0	15	0	50	5	0	0	0	20	10	0	0	100
	MEAN	0	3.6	0	0	0.4	16	3	0	0	23	0	51	5	0	0	0	10	11	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
009	7996	0	0	0	0	0	10	0	0	0	10	0	0	5	0	0	0	0	82	0	3	100
	7997	0	0	0	0	0	10	0	0	0	10	0	0	0	0	0	0	5	85	0	0	100
	7998	0	0	0	0	0	15	0	0	0	15	0	0	0	0	0	0	5	80	0	0	100
	7999	0	7	0	0	0	20	0	0	0	27	0	0	0	0	0	0	5	68	0	0	100
	8000	0	10	0	0	0	25	0	0	0	35	0	0	0	0	0	0	5	60	0	0	100
	MEAN	0	3.4	0	0	0	16	0	0	0	19.4	0	0	1	0	0	0	4	75	0	0.6	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
010	8005	0	0	0	0	0	5	0	0	0	5	0	50	0	0	0	0	45	0	0	0	100
	8007	0	0	0	10	0	0	0	0	0	10	0	85	0	0	0	0	5	0	0	0	100
	8008	0	0	0	3	0	0	0	0	0	3	0	52	0	0	0	0	15	30	0	0	100
	8009	0	20	0	5	0	0	0	0	0	25	0	25	0	0	0	0	10	40	0	0	100
	MEAN	0	5	0	4.5	0	1.25	0	0	0	10.8	0	53	0	0	0	0	18.75	17.5	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
011	8011	0	0	0	2	0	10	0	0	0	12	0	68	0	0	0	0	20	0	0	0	100
	8012	0	0	0	2	0	2	3	0	0	7	0	73	0	0	0	0	20	0	0	0	100
	8013	0	0	0	0	0	5	0	0	0	5	0	80	0	0	0	0	15	0	0	0	100
	8014	0	5	0	2	0	15	0	0	0	22	0	0	0	0	0	0	5	73	0	0	100
	8015	0	2	0	3	0	20	0	0	0	25	0	0	0	0	0	0	5	70	0	0	100
	MEAN	0	1.4	0	1.8	0	10.4	0.6	0	0	14.2	0	44.2	0	0	0	0	13	28.6	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
012	**8020**	0	0	0	3	0	2	0	0	0	5	0	75	0	0	0	0	20	0	0	0	100
	8021	0	0	0	0	1	5	0	0	0	6	5	69	0	0	0	0	20	0	0	0	100
	8022	0	7	0	0	0	3	0	0	0	10	0	60	0	0	0	0	30	0	0	0	100
	8023	0	2	0	0	0	15	0	0	0	17	0	60	5	0	0	0	18	0	0	0	100
	MEAN	0	2.25	0	0.75	0.25	6.25	0	0	0	9.5	1.25	66	1.25	0	0	0	22	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
013	**8029**	2	0	0	0	0	0	0	3	0	5	0	0	5	0	70	0	20	0	0	0	100
	8030	3	0	0	0	0	7	0	0	0	10	0	0	5	0	60	0	25	0	0	0	100
	8031	3	0	0	0	0	7	0	0	0	10	0	0	10	0	75	0	5	0	0	0	100
	8032	0	10	0	0	0	5	0	0	0	15	0	0	0	0	75	0	10	0	0	0	100
	MEAN	2	2.5	0	0	0	4.75	0	0.75	0	10	0	0	5	0	70	0	15	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
014	**8038**	10	0	0	0	0	0	0	0	0	10	0	0	0	90	0	0	0	0	0	0	100
	8039	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	8040	20	3	0	0	0	0	0	0	0	23	0	0	0	77	0	0	0	0	0	0	100
	8041	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	MEAN	7.5	0.75	0	0	0	0	0	0	0	8.25	0	0	0	91.75	0	0	0	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
015	**8059**	60	0	0	0	0	2	3	0	0	65	0	0	0	0	0	15	0	0	20	0	100
	8060	45	0	0	0	0	5	0	0	0	50	0	0	0	0	0	5	0	0	45	0	100
	8061	45	0	0	0	0	10	0	0	0	55	0	0	0	5	0	5	0	0	35	0	100
	8062	0	0	0	0	0	40	0	0	0	40	0	0	0	0	60	0	0	0	0	0	100
	8063	0	10	0	0	0	65	0	0	0	75	0	0	0	0	25	0	0	0	0	0	100
	MEAN	30	2	0	0	0	24.4	0.6	0	0	57	0	0	0	1	17	5	0	0	20	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
016	**8071**	0	40	0	0	0	15	0	0	0	55	0	0	0	0	20	0	0	0	25	0	100
	8072	10	40	0	0	0	0	0	0	0	50	0	0	0	0	20	0	0	0	30	0	100
	8074	40	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	5	0	55	0	100
	MEAN	16.67	26.67	0	0	0	5	0	0	0	48.3	0	0	0	0	13.33	0	1.67	0	36.67	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
017	**8086**	0	0	7	0	0	3	0	5	0	15	0	0	0	15	45	0	0	0	25	0	100
	8087	0	0	7	0	0	10	0	10	0	27	0	0	0	5	43	0	25	0	0	0	100
	8088	0	0	6	0	0	7	0	0	0	13	0	0	0	0	22	0	30	20	15	0	100
	8089	1	0	7	0	0	7	0	0	0	15	0	0	0	5	20	0	25	0	35	0	100
	MEAN	0.25	0	6.75	0	0	6.75	0	3.75	0	17.5	0	0	0	6.25	32.5	0	20	5	18.75	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
018	**8091**	0	0	0	0	0	10	1	0	0	11	0	0	0	0	54	0	35	0	0	0	100
	8092	0	0	0	0	0	15	0	0	0	15	0	0	0	0	55	0	30	0	0	0	100
	8093	0	0	20	0	0	5	0	0	0	25	0	0	0	0	55	0	20	0	0	0	100
	8094	0	0	35	0	0	5	1	0	0	41	0	0	0	0	59	0	0	0	0	0	100
	8095	0	0	20	0	0	5	0	0	0	25	0	0	0	0	70	0	5	0	0	0	100
	MEAN	0	0	15	0	0	8	0.4	0	0	23.4	0	0	0	0	58.6	0	18	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
019	**8097**	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	8098	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	8099	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	MEAN	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
020	**8103**	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	8104	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	8105	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	8106	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	MEAN	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
021	**8108**	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	8109	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	8110	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	8112	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100
	MEAN	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
022	**8117**	20	10	20	0	0	0	0	0	0	50	0	0	0	20	0	0	0	0	30	0	100
	8118	5	0	30	0	0	3	0	0	0	38	0	0	0	5	22	0	0	35	0	0	100
	8119	0	0	0	0	0	5	7	0	0	12	0	0	0	10	53	0	0	0	25	0	100
	8120	0	0	0	0	0	0	0	1	0	1	0	0	0	20	25	3	0	0	51	0	100
	MEAN	6.25	2.5	12.5	0	0	2	1.75	0.25	0	25.3	0	0	0	13.75	25	0.75	0	8.75	26.5	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
023	**8124**	0	0	0	5	0	15	0	1	0	21	4	75	0	0	0	0	0	0	0	0	100
	8126	0	0	0	2	0	15	0	0	0	17	15	68	0	0	0	0	0	0	0	0	100
	8127	0	0	0	0	0	10	0	0	0	10	10	77	3	0	0	0	0	0	0	0	100
	8128	0	0	0	0	0	10	0	0	0	10	7	80	3	0	0	0	0	0	0	0	100
	MEAN	0	0	0	1.75	0	12.5	0	0.25	0	14.5	9	75	1.5	0	0	0	0	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
024	**8131**	0	0	0	20	0	5	0	0	0	25	10	62	3	0	0	0	0	0	0	0	100
	8132	0	0	0	13	0	15	2	0	0	30	0	67	3	0	0	0	0	0	0	0	100
	8133	0	0	0	20	0	5	0	0	0	25	5	67	3	0	0	0	0	0	0	0	100
	8134	0	0	0	13	0	7	0	2	0	22	3	70	5	0	0	0	0	0	0	0	100
	MEAN	0	0	0	16.5	0	8	0.5	0.5	0	25.5	4.5	66.5	3.5	0	0	0	0	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
025	**8142**	3	0	0	3	0	3	0	0	0	9	5	71	5	0	0	0	10	0	0	0	100
	8143	0	0	0	2	0	15	0	1	0	18	5	62	5	0	0	0	10	0	0	0	100
	8144	0	0	0	2	0	20	0	0	0	22	5	58	5	0	0	0	10	0	0	0	100
	8145	0	0	0	2	0	10	0	0	0	12	5	63	5	0	0	0	15	0	0	0	100
	8146	0	0	0	2	0	10	0	0	0	12	5	63	5	0	0	0	15	0	0	0	100
	MEAN	0.6	0	0	2.2	0	11.6	0	0.2	0	14.6	5	63.4	5	0	0	0	12	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
026	**8155**	10	0	0	5	0	0	0	0	0	15	0	0	2	0	0	0	0	0	83	0	100
	8156	10	0	0	2	1	2	0	1	0	16	0	0	2	0	0	0	0	0	82	0	100
	8157	5	1	0	2	1	1	0	0	0	10	0	0	2	0	0	0	0	0	88	0	100
	8158	5	20	0	0	0	7	0	0	0	32	0	0	0	0	0	0	0	0	68	0	100
	8159	0	30	0	2	8	3	0	0	0	43	0	0	0	0	0	0	0	0	57	0	100
	MEAN	6	10.2	0	2.2	2	2.6	0	0.2	0	23.2	0	0	1.2	0	0	0	0	0	75.6	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
027	**8166**	0	0	20	0	0	15	0	0	0	35	0	0	0	20	0	0	0	25	20	0	100
	8167	0	0	20	0	0	20	0	0	0	40	0	0	0	25	0	0	0	0	35	0	100
	8168	0	15	40	0	0	15	0	0	0	70	0	0	0	0	0	0	0	0	30	0	100
	8169	25	25	5	0	0	20	0	0	0	75	0	0	0	5	0	0	0	0	20	0	100
	8170	30	0	10	0	0	0	0	0	0	40	0	0	0	15	0	0	0	15	30	0	100
	MEAN	11	8	19	0	0	14	0	0	0	52	0	0	0	13	0	0	0	8	27	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
028	**8175**	25	0	0	0	0	2	0	0	0	27	0	0	0	40	0	0	0	0	33	0	100
	8176	0	10	0	0	0	0	0	0	0	10	0	0	0	25	0	0	0	0	65	0	100
	8177	8	5	0	2	0	5	0	0	0	20	0	0	0	25	0	0	0	0	55	0	100
	8178	0	0	15	0	0	0	0	0	0	15	0	0	0	25	0	0	0	0	60	0	100
	8179	0	0	15	0	0	0	0	0	0	15	0	0	0	5	0	5	0	0	75	0	100
	MEAN	6.6	3	6	0.4	0	1.4	0	0	0	17.4	0	0	0	24	0	1	0	0	57.6	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
029	**8183**	0	0	60	0	0	10	0	0	0	70	0	0	0	0	0	0	0	0	30	0	100
	8184	0	0	5	0	0	65	0	0	0	70	0	0	0	0	0	0	0	0	30	0	100
	8185	0	0	0	2	0	62	0	3	0	67	3	0	0	0	0	0	0	0	30	0	100
	8186	0	5	25	0	0	30	0	0	0	60	10	0	0	0	0	0	0	0	30	0	100
	8187	0	0	5	5	0	55	0	0	0	65	5	0	0	0	0	0	0	0	30	0	100
	MEAN	0	1	19	1.4	0	44.4	0	0.6	0	66.4	3.6	0	0	0	0	0	0	0	30	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
030	**8191**	10	13	20	0	0	2	0	0	0	45	5	45	5	0	0	0	0	0	0	0	100
	8192	10	30	0	0	0	15	0	0	0	55	0	45	0	0	0	0	0	0	0	0	100
	8193	20	10	20	0	0	10	0	0	0	60	0	40	0	0	0	0	0	0	0	0	100
	8194	10	10	10	0	0	15	0	0	0	45	0	50	0	0	0	5	0	0	0	0	100
	8195	3	15	2	5	0	30	0	0	0	55	0	40	0	0	0	5	0	0	0	0	100
	MEAN	10.6	15.6	10.4	1	0	14.4	0	0	0	52	1	44	1	0	0	2	0	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
031	**8198**	10	16	20	0	1	3	0	0	0	50	0	0	0	0	0	0	0	0	50	0	100
	8199	0	10	35	0	0	0	0	0	0	45	0	0	0	0	0	0	0	0	55	0	100
	MEAN	5	13	27.5	0	0.5	1.5	0	0	0	47.5	0	0	0	0	0	0	0	0	52.5	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
032	**8202**	13	8	15	0	0	12	2	3	0	43	0	27	0	0	0	0	20	0	0	0	100
	8203	0	3	0	0	0	20	7	0	0	30	0	40	5	0	0	0	25	0	0	0	100
	8204	0	2	0	0	0	25	7	0	1	35	0	25	10	0	0	0	30	0	0	0	100
	8205	0	3	0	0	0	15	5	0	5	28	0	42	5	0	0	0	25	0	0	0	100
	8206	5	25	0	0	0	5	5	0	2	42	0	33	10	0	0	0	15	0	0	0	100
	MEAN	3.6	8.2	3	0	0	15.4	5.2	0.6	1.6	35.6	0	33.4	6	0	0	0	23	0	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
033	**8211**	15	0	0	0	0	8	1	0	6	30	0	60	0	0	0	0	10	0	0	0	100
	8212	0	0	0	0	0	8	17	0	25	50	0	40	5	0	0	0	5	0	0	0	100
	8213	0	13	0	0	1	25	1	0	15	55	0	40	0	0	0	0	5	0	0	0	100
	8214	0	15	0	0	0	14	1	0	15	45	0	35	5	0	0	0	15	0	0	0	100
	8215	0	25	0	0	0	10	0	0	10	45	0	25	10	0	0	0	20	0	0	0	100
	MEAN	3	10.6	0	0	0.2	13	4	0	14.2	45	0	40	4	0	0	0	11	0	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
034	**8217**	5	2	0	0	0	7	0	6	5	25	0	55	5	0	0	0	15	0	0	0	100
	8218	0	15	0	0	0	5	0	0	0	20	0	55	5	0	0	0	20	0	0	0	100
	8219	0	15	0	0	0	2	0	3	0	20	0	35	5	0	0	0	40	0	0	0	100
	8220	0	15	0	0	1	20	0	4	0	40	0	30	0	0	0	0	20	10	0	0	100
	8221	0	15	0	0	0	40	0	0	0	55	0	25	0	0	0	0	20	0	0	0	100
	MEAN	1	12.4	0	0	0.2	14.8	0	2.6	1	32	0	40	3	0	0	0	23	2	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
035	**8229**	5	0	0	0	0	3	0	0	0	8	0	57	5	0	0	0	30	0	0	0	100
	8230	0	30	0	0	0	10	0	2	0	42	0	43	5	0	0	0	10	0	0	0	100
	8231	0	0	1	0	0	22	1	1	0	25	0	55	5	0	0	0	15	0	0	0	100
	8232	3	6	0	0	0	4	1	1	0	15	0	65	5	0	0	0	15	0	0	0	100
	MEAN	2	9	0.25	0	0	9.75	0.5	1	0	22.5	0	55	5	0	0	0	17.5	0	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
036	**8234**	0	2	0	0	0	13	0	0	0	15	0	57	3	0	0	0	25	0	0	0	100
	8235	0	0	0	0	0	15	0	0	0	15	0	55	5	0	0	0	25	0	0	0	100
	8236	1	0	1	0	0	23	0	0	0	25	0	57	3	0	0	0	15	0	0	0	100
	8237	1	0	1	0	0	23	0	0	0	25	0	62	3	0	0	0	10	0	0	0	100
	8238	0	2	1	0	0	7	0	0	0	10	0	77	3	0	0	0	10	0	0	0	100
	MEAN	0.4	0.8	0.6	0	0	16.2	0	0	0	18	0	61.6	3.4	0	0	0	17	0	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
037	**8241**	4	0	1	0	0	2	3	0	0	10	0	63	2	0	0	0	25	0	0	0	100
	8242	2	0	0	0	0	1	1	0	0	4	0	34	2	0	0	0	60	0	0	0	100
	8243	0	0	0	0	0	10	0	0	0	10	0	28	2	0	0	0	60	0	0	0	100
	8244	0	0	0	0	0	5	0	0	0	5	0	73	2	0	0	0	20	0	0	0	100
	8245	0	0	0	0	0	1	0	0	0	1	0	37	2	0	0	0	60	0	0	0	100
	MEAN	1.2	0	0.2	0	0	3.8	0.8	0	0	6	0	47	2	0	0	0	45	0	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
038	**8247**	0	0	0	0	0	3	0	0	0	3	0	70	2	0	0	0	25	0	0	0	100
	8248	0	0	0	0	0	4	0	1	0	5	0	88	2	0	0	0	5	0	0	0	100
	8249	0	0	0	0	0	2	0	0	0	2	0	60	3	0	0	0	15	20	0	0	100
	8250	0	0	0	0	0	10	0	1	0	11	0	85	0	0	0	0	4	0	0	0	100
	8251	0	0	0	0	0	1	0	1	0	2	0	83	3	0	0	0	5	5	0	2	100
	MEAN	0	0	0	0	0	4	0	0.6	0	4.6	0	77.2	2	0	0	0	10.8	5	0	0.4	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
039	**8253**	0	4	3	0	0	3	0	0	0	10	0	80	0	0	0	0	10	0	0	0	100
	8254	0	10	2	0	0	1	3	0	0	16	0	74	0	0	0	0	10	0	0	0	100
	8255	0	5	18	0	1	1	0	0	0	25	0	70	0	0	0	0	5	0	0	0	100
	8256	0	2	12	1	0	5	0	0	0	20	0	65	0	0	0	0	15	0	0	0	100
	MEAN	0	5.25	8.75	5	0.25	2.5	0.75	0	0	17.8	0	72.25	0	0	0	0	10	0	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
040	**8258**	0	0	1	1	0	0	0	0	0	2	0	98	0	0	0	0	0	0	0	0	100
	8259	0	0	9	1	0	0	0	0	0	10	0	90	0	0	0	0	0	0	0	0	100
	8260	0	0	0	50	0	0	0	0	0	50	0	50	0	0	0	0	0	0	0	0	100
	8261	0	0	5	25	0	0	0	0	0	30	0	70	0	0	0	0	0	0	0	0	100
	MEAN	0	0	3.75	19.25	0	0	0	0	0	23	0	77	0	0	0	0	0	0	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
041	**8266**	80	0	0	0	0	0	0	1	0	81	0	0	0	0	0	0	0	0	19	0	100
	8267	25	0	8	0	0	0	0	2	0	35	0	0	0	0	0	0	0	0	65	0	100
	8268	50	0	8	0	0	0	0	2	0	60	0	0	0	0	0	0	0	0	40	0	100
	8269	75	0	0	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0	25	0	100
	MEAN	57.5	0	4	0	0	0	0	1.25	0	62.8	0	0	0	0	0	0	0	0	37.25	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
042	**8277**	0		0	2	0	0	0	0	0	2	0	98	0	0	0	0	0	0	0	0	100
	8278	0		1	2	0	0	0	0	0	3	0	97	0	0	0	0	0	0	0	0	100
	8279	2		1	7	0	10	0	0	0	20	0	80	0	0	0	0	0	0	0	0	100
	8280	2		23	20	0	0	0	0	0	45	0	55	0	0	0	0	0	0	0	0	100
	MEAN	1		6.25	7.75	0	2.5	0	0	0	17.5	0	82.5	0	0	0	0	0	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
043	**8282**	3	0	5	2	0	15	0	10	0	35	0	60	0	0	0	0	5	0	0	0	100
	8283	0	0	5	3	0	4	1	10	0	20	0	72	0	0	0	0	5	0	0	0	100
	8284	2	15	0	1	0	8	0	10	0	36	0	59	0	0	0	0	5	0	0	0	100
	8286	0	20	3	5	0	5	0	10	0	43	0	47	0	0	0	0	10	0	0	0	100
	MEAN	1.25	8.75	3.25	2.75	0	8	0.25	10	0	33.5	0	59.5	0	0	0	0	6.25	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
044	**8291**	50	0	3	0	0	4	0	3	0	60	0	40	0	0	0	0	0	0	0	0	100
	8293	40	25	0	0	0	2	0	3	0	70	0	30	0	0	0	0	0	0	0	0	100
	8294	15	0	2	0	0	5	0	10	0	32	0	68	0	0	0	0	0	0	0	0	100
	8295	50	0	0	0	0	4	0	0	0	54	0	46	0	0	0	0	0	0	0	0	100
	MEAN	38.75	6.25	1.25	0	0	3.75	0	4	0	54	0	46	0	0	0	0	0	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
045	**8299**	0	0	2	0	0	1	0	0	0	3	9	67	0	0	0	0	20	0	0	1	100
	8300	0	10	0	0	0	0	0	0	0	10	0	60	0	0	20	0	10	0	0	0	100
	8301	0	20	0	0	1	1	1	0	0	23	0	67	0	0	5	0	5	0	0	0	100
	8302	0	0	20	1	1	0	0	0	0	22	0	73	0	0	5	0	0	0	0	0	100
	8303	0	2	4	1	2	1	0	0	0	10	10	75	0	0	0	0	5	0	0	0	100
	MEAN	0	6.4	5.2	0.4	0.8	0.6	0.2	0	0	13.6	3.8	68.4	0	0	6	0	8	0	0	0.2	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
046	**8305**	0	0	5	5	0	5	0	0	0	15	0	65	0	0	15	0	5	0	0	0	100
	8306	0	0	0	0	1	2	0	0	0	3	0	77	0	0	0	0	20	0	0	0	100
	8307	0	2	0	3	0	10	0	0	0	15	0	80	0	0	0	0	5	0	0	0	100
	8308	0	0	0	2	0	10	0	0	0	12	0	78	0	0	0	0	10	0	0	0	100
	MEAN	0	0.5	1.25	2.5	0.25	6.75	0	0	0	11.3	0	75	0	0	3.75	0	10	0	0	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
047		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100
	MEAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
048	8338	30	0	0	0	1	0	0	0	0	31	0	0	0	0	0	0	0	0	69	0	100
	8339	0	0	0	0	0	0	0	10	0	10	0	0	0	0	0	0	0	0	90	0	100
	8340	0	0	0	0	0	0	0	5	0	5	0	0	0	0	0	0	0	0	95	0	100
	8341	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	98	0	100
	8344	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100
	MEAN	6	0	0	0	0.2	0	0	3.4	0	9.6	0	0	0	0	0	0	0	0	90.4	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
050	8348	10	0	55	0	0	0	0	0	0	65	0	14	0	0	0	0	20	0	0	1	100
	8349	3	0	7	0	0	0	0	0	0	10	0	50	0	0	0	0	40	0	0	0	100
	8350	0	0	2	0	0	0	0	8	0	10	0	0	0	0	0	0	10	0	80	0	100
	8351	1	0	20	0	0	0	0	0	0	21	0	0	0	0	0	0	10	0	69	0	100
	MEAN	3.5	0	21	0	0	0	0	2	0	26.5	0	16	0	0	0	0	20	0	37.25	0.25	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
051		0	0	0	0	0	20	0	0	0	20	0	0	0	0	0	0	0	0	80	0	100
	MEAN	0	0	0	0	0	20	0	0	0	20	0	0	0	0	0	0	0	0	80	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
052	8355	60	0	0	0	0	0	0	0	0	60	0	0	0	0	0	0	5	0	35	0	100
	8356	25	0	0	0	0	0	0	20	0	45	0	0	0	0	0	0	5	0	50	0	100
	8357	5	0	0	0	0	0	0	10	0	15	0	0	0	0	0	0	0	0	85	0	100
	8358	15	0	15	0	0	0	0	1	0	31	0	0	0	0	0	0	0	0	69	0	100
	8359	20	0	35	0	0	0	0	0	0	55	0	0	0	0	0	0	0	0	45	0	100
	MEAN	25	0	10	0	0	0	0	6.2	0	41.2	0	0	0	0	0	0	2	0	56.8	0	100

SITE	PHOTO	Mc	Mf	Mp	Pc	Pd	Pl	Pm	Pv	ZO	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
053	8364	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100
	8365	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	99	0	100
	8366	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	98	0	100
	MEAN	0	0	0	0	0	0	0	0	0	0	0.33	0	0.67	0	0	0	0	0	99	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
054	**8369**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100
	8370	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100
	8371	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100
	MEAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
055	**8448**	0	25	0	0	1	35	0	5	0	61	0	34	0	0	0	0	0	0	0	0	100
	8449	0	7	0	0	1	25	0	5	0	38	0	60	0	0	0	0	2	0	0	0	100
	8450	0	2	0	0	0	10	0	3	0	15	0	73	0	0	0	2	10	0	0	0	100
	8451	0	5	0	0	0	20	0	10	0	35	0	60	0	0	0	5	0	0	0	0	100
	MEAN	0	9.75	0	0	0.5	22.5	0	5.75	0	37.3	0	56.75	0	0	0	1.75	3	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
056	**8453**	0	1	0	5	0	14	0	0	0	20	0	75	0	0	0	0	5	0	0	0	100
	8454	0	0	0	6	1	10	0	3	0	20	0	75	0	0	0	0	5	0	0	0	100
	8455	0	13	0	0	0	1	0	1	0	15	0	80	0	0	0	0	5	0	0	0	100
	8456	0	5	0	0	0	1	0	0	0	6	0	84	0	0	0	0	10	0	0	0	100
	8457	0	0	1	0	0	14	0	0	0	15	0	75	0	0	0	0	10	0	0	0	100
	MEAN	0	3.8	0.2	2.2	0.2	8	0	0.8	0	15.2	0	77.8	0	0	0	0	7	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
057	**8461**	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	97	0	100
	8462	1	0	0	0	0	2	0	0	0	3	0	0	0	0	0	0	2	0	95	0	100
	8463	15	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	85	0	100
	8464	40	0	0	0	0	0	0	0	0	40	0	0	0	0	0	0	0	0	60	0	100
	MEAN	14	0	0	0	0	0.5	0	0.25	0	14.8	0	0	0	0	0	0	1	0	84.25	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
058	**8467**	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	10	0	88	0	100
	8468	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	99	0	100
	8469	0	0	0	0	0	0	0	0	5	5	0	0	0	0	0	0	0	0	95	0	100
	8470	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100
	MEAN	0	0	0	0	0	0	0	0.5	1.5	2	0	0	0	0	0	0	2.5	0	95.5	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
059	**8472**	0	0	0	0	0	20	0	0	0	20	0	80	0	0	0	0	0	0	0	0	100
	8473	0	30	0	0	0	0	15	0	0	45	0	50	0	0	0	0	5	0	0	0	100
	8474	0	10	0	0	0	25	0	0	0	35	0	60	0	0	0	0	5	0	0	0	100
	8475	1	0	0	0	0	15	0	0	0	16	0	25	0	0	0	0	5	0	54	0	100
	MEAN	0.25	10	0	0	0	15	3.75	0	0	29	0	53.75	0	0	0	0	3.75	0	13.5	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
060	**8479**	2	0	3	0	0	3	0	0	0	8	0	0	0	0	0	0	0	0	92	0	100
	8480	1	0	3	1	0	20	0	0	0	25	0	0	0	0	0	0	0	0	75	0	100
	8481	0	0	0	1	0	20	0	0	0	21	0	0	0	0	0	0	5	0	74	0	100
	MEAN	1	0	2	0.67	0	14.33	0	0	0	18	0	0	0	0	0	0	1.67	0	80.33	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
061	**8483**	0	0	0	1	0	1	0	2	1	5	0	90	0	0	0	0	5	0	0	0	100
	8484	0	0	0	0	0	40	0	3	0	43	0	47	0	0	0	0	10	0	0	0	100
	8486	0	0	0	0	1	10	0	1	3	15	0	55	0	0	0	0	30	0	0	0	100
	8487	0	0	0	0	0	40	0	1	0	41	0	44	0	0	0	0	15	0	0	0	100
	8488	7	0	0	3	0	40	0	0	0	50	0	30	0	0	0	0	20	0	0	0	100
	MEAN	1.4	0	0	0.8	0.2	26.2	0	1.4	0.8	30.8	0	53.2	0	0	0	0	16	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
062	**8491**	1	0	0	0	0	40	3	2	0	45	0	54	0	0	0	0	0	0	0	0	100
	8492	10	0	15	5	0	5	0	0	0	35	0	45	0	10	0	0	10	0	0	0	100
	8493	0	0	10	3	2	30	0	0	0	45	0	25	0	30	0	0	0	0	0	0	100
	8494	0	0	0	5	0	40	0	0	0	45	0	40	0	10	0	0	5	0	0	0	100
	MEAN	2.75	0	6.25	3.25	0.5	28.75	0.75	0.5	0	42.5	0	41	0	12.5	0	0	3.75	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
063	**8497**	0	0	0	0	0	5	0	0	0	5	0	95	0	0	0	0	0	0	0	0	100
	8498	0	0	30	0	0	10	0	0	0	40	0	48	0	0	0	0	10	0	0	2	100
	8499	0	3	40	0	0	5	0	0	0	48	0	47	0	0	0	0	5	0	0	0	100
	8500	0	20	30	0	0	0	0	5	0	55	0	45	0	0	0	0	0	0	0	0	100
	MEAN	0	5.75	25	0	0	5	0	1.25	0	37	0	58.75	0	0	0	0	3.75	0	0	0.5	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
064	**8505**	25	2	0	0	0	3	0	0	0	30	0	70	0	0	0	0	0	0	0	0	100
	8506	55	7	0	0	0	3	0	0	0	65	0	35	0	0	0	0	0	0	0	0	100
	8507	10	0	0	0	0	30	0	0	0	40	0	60	0	0	0	0	0	0	0	0	100
	8508	0	0	20	0	0	25	0	1	0	46	0	49	0	0	0	0	5	0	0	0	100
	MEAN	22.5	2.25	5	0	0	15.25	0	0.25	0	45.3	0	53.5	0	0	0	0	1.25	0	0	0	100

SITE	PHOTO	*Mc*	*Mf*	*Mp*	*Pc*	*Pd*	*Pl*	*Pm*	*Pv*	*ZO*	TC	A	TUR	SP	SA	LS	DC	CCA	RU	TBS	INV	TOTAL
065	**8512**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0	100
	8513	0	0	0	0	0	10	0	0	0	10	0	0	0	0	0	0	0	0	90	0	100
	8514	0	0	0	0	0	5	0	0	0	5	0	0	0	0	0	0	0	0	95	0	100
	8515	0	0	0	0	0	10	0	0	0	10	0	0	0	0	0	0	0	0	90	0	100
	MEAN	0	0	0	0	0	6.25	0	0	0	6.25	0	0	0	0	0	0	0	0	93.75	0	100

"Mc" = "Montipora capitata"
"Mf" = Montipora flabellata
"Mp" = Montipora patula
"Pc" = "Porites compressa"
"Pd" = "Pocillopora damicornis"
"Pl" = "Porites lobata"
"Pm" = Pocillopora meandrina
"Pv" = "Pavona varians"
"ZO" = "Zoanthus"
"TC" = "Total Coral Cover"
"A" = "Algae"
"TUR" = "Turf"
"SP" = "Sponge"
"SA" = "Sand"
"LS" = "Limestone"
"DC" = "Dead Coral"
"CCA" = Crustose Corraline A"
"RU" = "Rubble"
"TBS" = Mud/Turf-Bound-Sediment
"INV" = "Invertebrate"

APPENDIX B

2010/2011 Cost Estimates for Pier Repair

Hana Harbor Development Plan
Cost Estimate
August 2010

BASE

Description: Demolish existing pier, including concrete deck, beams and girders. Cutoff piles at mudline elevation and remove. Dispose of all construction debris.

Item Description	Quantity	Unit	Unit Cost	Total
Demolition and Removal of Existing Concrete Pier (18,100 sf Deck Area)	18,100	SF	$ 84	$ 1,520,400
Removal of Existing Concrete Piles. Cut off Piles at Mudline.	146	EA	$ 2,035	$ 297,110
		Sub-Total		$ 1,817,510
		50% increase for remote work location		$ 908,755
		Sub-Total		$ 2,726,265
		10% Contingency		$ 272,627
		Total		$ 2,998,892
		SAY		**$ 3,000,000**
				($165/sf)

OPTION NO. 1

Description: Repair the underside of the **18,000 sf** pier, including the existing deck slab, beams, girders, pile caps, and piles. The repair consists of removal of all loose, unsound concrete, removal and replacement of all rebar that is corroded beyond a given point, and repairing with a marine grade concrete. The new pier deck will have the capacity to support vehicles to load and offload barges. Additional piles are added to reinforce the pier for barge mooring and berthing loads. Mooring appurtenances (bollards, cleats) are added, as well as curbing and handrails around the perimeter of the pier.

Item Description	Quantity	Unit	Unit Cost	Total
Repair Concrete Deck Slab	18,100	SF	$ 300	$ 5,430,000
Repair Concrete Beams	21,000	SF	$ 425	$ 8,925,000
Repair Concrete Girders	3,000	SF	$ 425	$ 1,275,000
Repair Concrete Piles	146	EA	$ 7,500	$ 1,095,000
Curbing	9	CY	$ 3,000	$ 27,000
21 added piles	21	EA	$ 40,000	$ 840,000
Pile Load Test	2	EA	$ 75,000	$ 150,000
Fenders along ro/ro pier face	10	EA	$ 40,000	$ 400,000
Mooring bollards	6	EA	$ 30,000	$ 180,000
Mooring cleats	8	EA	$ 12,000	$ 96,000
Handrail	900	LF	$ 75	$ 67,500
Turbidity Testing Stations for Harbor WQ Control	5	EA	$ 3,000	$ 15,000
Bulkhead repairs at beginning of pier	1	LS	$ 50,000	$ 50,000
Removal/Disposal of Asbestos/Lead Mat'l	1	LS	$ 50,000	$ 50,000
Environmental Controls	1	LS	$ 50,000	$ 50,000
Project Sign	1	EA	$ 2,000	$ 2,000
Mobilization & Demobilization	1	LS	LS	$ 1,865,250
		Sub-Total		$ 20,517,750
		50% increase for remote work location		$ 10,258,875
		Sub-Total		$ 30,776,625
		10% Contingency		$ 3,077,663
		Total		$ 33,854,288
		SAY		**$ 34,000,000**
				($1,889/sf)

Hana Harbor Development Plan
Cost Estimate
August 2010

OPTION NO. 2

Description: Remove the entire existing concrete deck, including girders, beams and pilecaps. Construct a new **18,000 sf** deck that will be designed to have the load capacity to support vehicles and equipment for loading/offloading barges, for rollon/rolloff capability, and to be designed for barge mooring and berthing forces. The new pier will have new fenders attached to the ocean side of the pier for barge docking. No mooring dolphin will be necessary. Bollards and cleats will be installed at various locations on the pier for barge mooring. A handrail will be mounted to the perimeter of the new pier and access pier.

Item Description	Quantity	Unit	Unit Cost	Total
Demolition of Existing Deck, Beams, and Girders	18,100	SF	$ 84	$ 1,520,400
Repair Existing Concrete Piles	87	EA	$ 7,500	$ 652,500
Rollon/Rolloff Pier:				
Construct New Concrete Deck, Beams and Girders	18,000	SF	$ 250	$ 4,500,000
Curbing	9	CY	$ 3,000	$ 27,000
21 added piles	21	EA	$ 40,000	$ 840,000
Pile Load Test	2	EA	$ 75,000	$ 150,000
Fenders along ro/ro pier face	10	EA	$ 40,000	$ 400,000
Mooring bollards	6	EA	$ 30,000	$ 180,000
Mooring cleats	8	EA	$ 12,000	$ 96,000
Handrail	900	LF	$ 75	$ 67,500
Turbidity Testing Stations for Harbor WQ Control	5	EA	$ 3,000	$ 15,000
Bulkhead repairs at beginning of pier	1	LS	$ 50,000	$ 50,000
Removal/Disposal of Asbestos/Lead Mat'l	1	LS	$ 50,000	$ 50,000
Environmental Controls	1	LS	$ 50,000	$ 50,000
Project Sign	1	EA	$ 2,000	$ 2,000
Mobilization & Demobilization	1	LS	LS	$ 860,040
		Subtotal		**$ 9,460,440**
		50% increase for remote work location		$ 4,730,220
		Sub-Total		$ 14,190,660
		10% Contingency		$ 1,419,066
		Total		$ 15,609,726
		SAY		**$ 15,500,000**
				($861/sf)

OPTION NO. 3

Description: Demolish the entire exising concrete deck, girders and beams. Construct a new, smaller deck that will be **8,400 s.f. Repair the existing concrete piles.**

Item Description	Quantity	Unit	Unit Cost	Total
Demolition of Existing Deck	18,100	S.F.	$ 84	$ 1,520,400
Construct New Concrete Deck, Beams and Girders	8,100	S.F.	$ 250	$ 2,025,000
Repair Existing Concrete Piles	87	EA	$ 7,500	$ 652,500
Cutoff unused existing concrete piles at mudline and dispose of debris.	59	EA	$ 2,035	$ 120,065
		Sub-Total		$ 4,317,965
		50% increase for remote work location		$ 2,158,983
		Sub-Total		$ 6,476,948
		10% Contingency		$ 647,695
		Total		$ 7,124,642
		SAY		**$ 7,200,000**
				($889/sf)

Hana Harbor Development Plan
Cost Estimate
August 2010

OPTION NO. 7

Description: Remove the entire existing concrete deck, including girders, beams and pilecaps. Construct a new deck that will serve as a rollon/rolloff platform for barges during an emergency event. The rollon/rolloff pier will be approximately **9,000 sf**, and will have new fenders attached to the ocean side of the pier for barge docking. One 7-pile mooring dolphin will be installed at each end of the pier for assisting in the mooring of the supply barges. An additional **8,250 sf** pier will be constructed for pedestrian loads only and will be connected to the rollon/rolloff pier through an expansion joint. A handrail will be mounted to the perimeter of the new pier and access pier, except at the rollon/rolloff face of the pier.

Item Description	Quantity	Unit	Unit Cost	Total
Demolition of Existing Deck, Beams, and Girders	18,100	SF	$ 84	$ 1,520,400
Repair Existing Concrete Piles	87	EA	$ 7,500	$ 652,500
Rollon/Rolloff Pier:				
Construct New Concrete Deck, Beams and Girders	9,000	SF	$ 250	$ 2,250,000
Curbing	6	CY	$ 3,000	$ 18,000
5 added piles	5	EA	$ 40,000	$ 200,000
Pile Load Test	1	EA	$ 75,000	$ 75,000
Fenders along ro/ro pier face	10	EA	$ 40,000	$ 400,000
Mooring dolphins	2	EA	$ 65,000	$ 130,000
Reduced Capacity Pier:				
Construct New Concrete Deck, Beams and Girders	8,250	SF	$ 200	$ 1,650,000
Handrail	780	LF	$ 75	$ 58,500
Turbidity Testing Stations for Harbor WQ Control	5	EA	$ 3,000	$ 15,000
Bulkhead repairs at beginning of pier	1	LS	$ 50,000	$ 50,000
Removal/Disposal of Asbestos/Lead Mat'l	1	LS	$ 50,000	$ 50,000
Environmental Controls	1	LS	$ 50,000	$ 50,000
Project Sign	1	EA	$ 2,000	$ 2,000
Mobilization & Demobilization	1	LS	LS	$ 712,140
		Subtotal		**$ 7,833,540**
		50% increase for remote work location		$ 3,916,770
		Sub-Total		$ 11,750,310
		10% Contingency		$ 1,175,031
		Total		$ 12,925,341
		SAY		**$ 13,000,000**
				($753/sf)

Hana Harbor Development Plan
Cost Estimate
August 2010

OPTION NO. 8

Description: Remove the entire existing concrete deck, including girders, beams and pilecaps. Construct a new **18,100 sf** deck that will be designed to have the load capacity to support vehicles and equipment for loading/offloading barges, for rollon/rolloff capability, and to be designed for barge mooring and berthing forces. The new pier will have new fenders attached to the ocean side of the pier for barge docking. No mooring dolphin will be necessary. Bollards and cleats will be installed at various locations on the pier for barge mooring. A handrail will be mounted to the perimeter of the new pier and access pier.

Item Description	Quantity	Unit	Unit Cost	Total
Demolition of Existing Deck, Beams, and Girders	18,100	SF	$ 84	$ 1,520,400
Repair Existing Concrete Piles	87	EA	$ 7,500	$ 652,500
Rollon/Rolloff Pier:				
Construct New Concrete Deck, Beams and Girders	18,100	SF	$ 250	$ 4,525,000
Curbing	6	CY	$ 3,000	$ 18,000
14 added piles	14	EA	$ 40,000	$ 560,000
Pile Load Test	2	EA	$ 75,000	$ 150,000
Fenders along ro/ro pier face	10	EA	$ 40,000	$ 400,000
Mooring bollards	6	EA	$ 30,000	$ 180,000
Mooring cleats	8	EA	$ 12,000	$ 96,000
Handrail	780	LF	$ 75	$ 58,500
Turbidity Testing Stations for Harbor WQ Control	5	EA	$ 3,000	$ 15,000
Bulkhead repairs at beginning of pier	1	LS	$ 50,000	$ 50,000
Removal/Disposal of Asbestos/Lead Mat'l	1	LS	$ 50,000	$ 50,000
Environmental Controls	1	LS	$ 50,000	$ 50,000
Project Sign	1	EA	$ 2,000	$ 2,000
Mobilization & Demobilization	1	LS	LS	$ 832,740
Subtotal				**$ 9,160,140**
50% increase for remote work location				$ 4,580,070
Sub-Total				$ 13,740,210
10% Contingency				$ 1,374,021
Total				$ 15,114,231
SAY				**$ 15,200,000**
				($840/sf)

Hana Harbor Development Plan
Cost Estimate
May 2011

OPTION NO. 7A

Description: Remove the entire existing concrete deck, including girders, beams and pilecaps. Construct a new **17,250 sf** reinforced concrete deck that will be designed to support vehicles and equipment for loading/offloading barges, for rollon/rolloff capability, and to be designed for barge mooring and berthing forces. The new pier will have new fenders attached to the ocean side of the pier for barge docking. One 7-pile mooring dolphin will be installed at each end of the pier for assisting in the mooring of the supply barges. A handrail will be mounted to the perimeter of the new pier and access pier.

Item Description	Quantity	Unit	Unit Cost	Total
Demolition of Existing Deck, Beams, and Girders	18,100	SF	$ 84	$ 1,520,400
Repair Existing Concrete Piles	87	EA	$ 7,500	$ 652,500
Rollon/Rolloff Pier:				
Construct New Concrete Deck, Beams and Girders	17,250	SF	$ 250	$ 4,312,500
Curbing	6	CY	$ 3,000	$ 18,000
10 added piles	10	EA	$ 40,000	$ 400,000
Pile Load Test	2	EA	$ 75,000	$ 150,000
Fenders along ro/ro pier face	10	EA	$ 40,000	$ 400,000
Mooring bollards	6	EA	$ 30,000	$ 180,000
Mooring cleats	8	EA	$ 12,000	$ 96,000
Mooring dolphins	2	EA	$ 65,000	$ 130,000
Handrail	780	LF	$ 75	$ 58,500
Turbidity Testing Stations for Harbor WQ Control	5	EA	$ 3,000	$ 15,000
Bulkhead repairs at beginning of pier	1	LS	$ 50,000	$ 50,000
Removal/Disposal of Asbestos/Lead Mat'l	1	LS	$ 50,000	$ 50,000
Environmental Controls	1	LS	$ 50,000	$ 50,000
Project Sign	1	EA	$ 2,000	$ 2,000
Mobilization & Demobilization	1	LS	LS	$ 808,490
		Subtotal		**$ 8,893,390**
		50% increase for remote work location		$ 4,446,695
		Sub-Total		$ 13,340,085
		10% Contingency		$ 1,334,009
		Total		$ 14,674,094
		SAY		**$ 14,700,000**
				($852/sf)

APPENDIX C

General Community Meetings Minutes

MEMORANDUM

Group 70 International, Inc. • Architecture • Planning • Interior Design • Environmental Services • Assets Management
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GROUP 70
INTERNATIONAL

TO:	MEMORANDUM FOR RECORD		
FROM:	George I. Atta, Principal		
DATE:	June 1, 2010		
PROJECT:	Hana Harbor Improvements	**PROJECT NO:**	29024-011
SUBJECT:	Hana Harbor Community Meeting Helene Hall, Hana, Maui Monday, May 17, 2010		

Background

The purpose of this general community meeting was to present to the community various alternatives for pier design, based on their input, as well as on the input of other stakeholders. Twenty-six people signed in as attending this meeting, including Maui Councilman Bill Medeiros.

Questions and comments from the meeting

Cost estimates will be available for Options 5 and 6 only after a recommendation is finalized.
(In Kahului Harbor, the dolphin is 200+ feet from center and cost $1M in 2003)

The catwalk presented under the new alternative is not required, but having one would allow current pier uses to continue.

- The catwalk is narrowed primarily for cost factor
- A catwalk utilizing the same footprint as the existing pier could be Option 7; same width but different materials.

Environmental Impacts – some in the community want to know how invasive would a new pier be to the coral?

- A marine consultant should be here at this meeting.
    - One was hired to conduct a coral study and we were hoping he'd present his findings at this meeting as well, but rough marine conditions prohibited him from doing his study.
- Recovery period for coral.
- We need to make sure we get back how things were before construction of new pier starts.

Is there a temporary situation so that we can use the pier now in a limited capacity? There's a new gate, but who is monitoring it? It will take a long time before a permanent solution is in place.

- The State could make folks sign a waiver like what Hāna Ranch does.

- Put a steel plate over hole.
    - However, a solid steel plate won't last during a strong surge.
- Canoe regatta – adult judges only were allowed onto the pier.
- DLNR doesn't have money to fix light at the pier.
-

Inoperative lights and cargo boom removal.

- The inoperative boon is under DLNR's jurisdiction, but DOT-Harbors Division is trying to help in getting it either fixed or removed.
- **Status:** No action taken. Awaiting results of discussions between DLNR and DOT Harbors (Honolulu) to determine which department will take for action.

There is a **third hole** in the pier deck - Makai end of the cross "T" - which has not been covered.

- Unless otherwise directed, Maui District maintenance section will obtain, erect, and anchor "crowd control barriers" around the hole on next maintenance trip. **Status:** Crowd control barriers are in process of being ordered / trip plans being developed. ETC 30 July 2010 unless RUSH action deemed appropriate.
- Other two identified holes have been covered.

Will Option 5 help with surge?

- Option 5 presented today is not specifically designed, but we could probably have piles designed to withstand the powerful surges.
- Something to consider is that a different pier design could affect current circulation of water in the harbor, thereby possibly affecting fishing and surfing.

Will there be any utilities added to pier for lighting and\or safety?

- Will a Cathodic system be incorporated into the design?
    - Whatever option is chosen it will be built to today's engineering standards.

What are the boundaries of the HHDP?

- Boundaries include the Pier itself, but we'll look at all peripheral issues.

A barge delivers goods and services to Kalaupapa once/year.

Make the Okubo Study for public.

An EA/EIS will be required for any pier improvements.

This project is not utilizing Federal money right now.

Can demolished materials be used as artificial reefs?

- Probably yes, but another study would probably need to be done that would indicate the best location to build a new reef so as not to affect water circulation in the harbor.

For Option 6, the shortened "I" will take heavy impact from storms and surges. The height of the pier will need to be high enough to sustain these surges.

LSV/LST options presented today will have an impact on the reefs.

Fishing Koʻa: substantial fishing grounds just off-shore.

Storms could take out aluminum catwalks.

During the team's next visit, a site tour at the pier should be conducted.

Hāna doesn't have a breakwater to offset powerful surges.

How will pilings be built today? Thinner, fatter, etc.?
- Only engineers can answer those questions after an actual design is selected.
- Will minimize impact to coral during construction.

A more detailed design will be done once a concept is selected.

The community worked on a previous plan with DLNR which included steps, single vehicle access, moorings on land side, and catwalks on ocean side. Everything was acceptable so we're wondering what happened to that plan?
- We'll try to locate that plan

A catwalk is not built as strong as the part of the pier that will absorb the most impact from a barge. The surface is also not as strong because no vehicles will be allowed there. But, the pilings the pier will be built on will be built to standard to support surge and impacts.
- The catwalk in Kahului is built to handle a forklift. Option 5 catwalk is intended for pedestrian, fishing, protocol, etc.
- A steel surface would be too slippery.

Moorings on the beach side are better:
- There are two moorings so that a barge can be secured to both ends.

Are there other creative ideas for pier use?
- There's not too much outside of what the current uses are.

Now that the gate to the pier has been is locked by DOT-Harbors, how can the Kupuna go and fish?
- The pier is condemned because it is not safe.

Is there an appropriate procedure for setting policy regarding access to pier?
- There is currently no policy in place.
- Will be difficult to get authorization.

Once it is condemned, keep it condemned. The problem started when access was granted to some, for limited use, and not to others.
- Talk with your senator because they deal with DOT.

Maintenance of the pier will be an issue
- Maintenance will be addressed in the final report.
- Other harbors have maintenance money generated by harbor fees. But there's not a whole of fees generated in Hāna Harbor.

The "bridge" part of the current pier is where everyone learned to swim. Incorporate recreational functions into pier design.

Next steps:

- Team will be back several more times to conduct general community meetings, especially to report on the coral study that will be conducted by the end of this month.
- Today's PowerPoint will be made available to everyone here.
- Harbors Division - Maui District will budget for two **maintenance trips** for FY 2012 and FY 2013.

P:\2009\29024-01 Hana Harbor Improvements\Community Consultation\May 17 General Community Meeting\HHDP_MeetingNotes_051710.doc

MEMORANDUM

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GROUP 70
INTERNATIONAL

TO:	MEMORANDUM FOR RECORD		
FROM:	George I. Atta, Principal		
DATE:	July 8, 2010		
PROJECT:	Hāna Harbor Improvements	**PROJECT NO:**	29024-011
SUBJECT:	Hāna Harbor Community Meeting Helene Hall, Hāna, Maui Thursday, July 8, 2010		

Background

The purpose of this 2nd general community meeting was to present a follow-up from the 1st general community meeting on May 17, 2010. Some meeting participants expressed an interest in hearing about possible environmental impacts to coral habitats that may be present around the pier area. Option 7, based on input from the 1st meeting, was also presented at this 2nd meeting.

Members of the planning team present at this meeting were George Atta and Gladys Quinto of Group 70; Steve Dollar, marine biology consultant from MRC, Hawaii; and Mike Hunneman, structural engineering consultant from Kai Hawaii.

The meeting began with a site visit at 5:00pm at the gate to the pier. Mike Hunneman and George Atta went to the pier to talk to residents while Gladys and Steve Dollar completed the room set up for the meeting. Local children were diving into the water between the piles and off the edge of the dock at two to three locations on the pier. The gate was still locked but two boys were playing and jumping up and down on top of the plastic screen over the big puka by the entrance gate. The wood frame was intact but a section of the thick plastic grating covering the hole was already partially torn. It looks like there will be a hole through the plastic screen shortly.

We met the group of community residents at the pier. There were a handful of people in front of the locked gate. The first questions were about access on to the pier. Several expressed and interest in seeing the holes up close. George said we did not have the keys to open the gate expressed his regret that the policy restricting access was still in place due to safety and liability concerns.

The second concern was about the light at the gate that has still not been fixed.

The third concern was about the dangerous boom over the boat deck. Concern was raised that kids continued to jump off the high top bean and one of these days someone will get seriously hurt. George

mentioned that the boat ramp was a DLNR responsibility but we would certainly put it in our reports. The people there already knew the boat ramp and deck were DLNR responsibilities.

There was a review of the discussion of this issue from the last community meeting and an understanding that even the Maui Harbor Master was not authorized to let people on to the pier. It was clarified that the issue was at the director and State Legislator level. Several people mentioned that if they were younger they would also probably climb around the gate and go on to the pier deck like kids who were currently jumping over the side. Another residence asked if some kind of better temporary solution could be found for the holes and access allowed. For instance what about using more solid steel plates that are anchored to the concrete? It was pointed out that the problem was not just covering the existing holes but the condemnation and safety of the overall structure. They understood the dilemma the State is in and did not push the question further.

People asked about the agenda for the meeting and we mentioned the presentations by the structural engineer on the costs for the new options and the results of the coral study by the marine biologist. They seemed eager to hear the reports. One person went home because he said he had dinner guests he needed to meet.

The group then moved to Helene Hall for the second part of the meeting, which started at 6:00pm. At least eleven people signed in as attending this meeting, including a representative from Maui Councilman Bill Medeiros's office. *(Sign-in sheet attached.)* A few people came in and listened for a while and left without signing in.

The meeting started with a pule and introduction of the planning team. George Atta immediately launched into the PowerPoint presentation starting with a brief background of the project and overview of the process; overview of the 1st community meeting; and pier design alternatives, including cost estimates. The planning team narrowed the original six pier design options presented at the 1st community meeting down to three options: 1) Complete Repair and Retrofit; 2) Remove/Replace Deck and Piles; and 3) Narrowed "T", Twin Moorings, and Catwalk Access, full footprint of existing pier. At this point, Mike Hunneman took over the presentation and discussed each option and corresponding cost estimate:

Option 1: Complete repair and no demolition; chip away any loose concrete and replace rebars. Most expensive option, but will retain same look and ambiance of existing pier. This option is closest to historic preservation of the existing pier.

Option 2: The existing piles are in good condition below the water line, so this option would cut off piles above the water and build above it. This design accommodates barge traffic by adding additional piles. Additional bollards and mooring devices would be included. The price range will be between $11 and $13 million, but somewhat speculative at this point. There is a wide range because there is no in-depth analysis of the existing pier and there are no as-built drawings, so we are unsure of the actual condition and composition of the pier.

Option 3 (formerly Option 7): This option would reutilize existing piles. There are two designs for the deck: 1) a reinforced T to accommodate barge traffic; and 2) a thinner deck for the outer pedestrian area, which will not allow any barge traffic or roll-on/roll-off activity. This option will also add bollards for barge operations. Estimated cost is about $13 million. (This estimate similar to Option 2 because most of the cost is from labor and there is little difference in the labor cost of installing a 12" deck verses an 18" deck. The 6" material cost difference would be relatively minor.)

Steve Dollar then did his presentation of his findings from his coral study, which was conducted in mid-June. His presentation showed a map of where coral was found, and pictures of the type of coral that was found. Coral is growing on the pilings below the water line, but only on the side that is exposed to the sun. The pilings that are not exposed to sunlight are clean and, according to Steve, "looks like they were built yesterday."

People present at the meeting asked questions during the slide presentation and are summarized below.

Questions and comments from the meeting

Would new pier be at water level if pilings are cut off just above the water line and built on top of existing pilings?

- No, pier will be at the same level as the existing pier.
- The elevation is needed for barge operations and protection from wave and storm surge forces.

The existing pier length is 337'. Will a barge be that big?

- No. The pier will be designed to accommodate the smallest barge, which today is at 256'. Most commercial barges have been getting bigger over the years.

Would the pier be built by land machinery or barged in by water?

- Not quite sure at this point.
- This is going to be a contractor issue, but will likely require approval by DOT in advance, before the contract is put out to bid.

Primary reason for this pier project is to be able to get out of Hāna in an emergency. Why not just fix the bridges on the Hāna Highway?

- This is not an either/or questions. Both may be desirable.
- Emergency is only one issue. There are also issues relating to recreational activities such as fishing, swimming, and sentimental, historical, and cultural value.
- There are also other ways to get cut off besides damaged bridges, such as a tsunami or hurricanes, which may cause landslides and fallen trees that obstruct access.

No commercial option is being considered.

This will trigger either an EA/EIS, and all these options will need to be examined. Is that the process?

- After this community process, a recommendation will go to DOT to see which option to pursue.
- Complete project program and design.
- Before construction, an EA or EIS will be required, but that will depend on the design of the pier and anticipated impact.
- Obtain bond financing for construction.
- The project will also need a CDUP, SMP, and Corp of Engineers Sec 10 permit

What about other alternatives other than barges to get goods in?

- Other options may be viable, but not sure how many vehicles will be needed to bring things in via the Hāna Highway.
- Other options were reviewed such as LSTs, air transport via Hāna Airport, and helicopters, but most have limited capacity or excessive costs.

You should redo Option 2 by designing better for earthquake and surge. Any load over ten tons should be required to being brought in by barge.

- We will consider recommendation
- Before the beach nourishment question the question of surge was discussed. Any surge barrier is likely to raise questions of erosion, water circulation and quality, and coral mitigation.

Why build weaker ends (pedestrian catwalk)?

- The excessive loads are weakening the bridges on the Hāna Highway.
- We thought it might be cheaper and the design lessened the likelihood of other commercial vehicles tying up.

Concern about replenishment of beach was discussed. Any predictions on replenishment?

- No, but the advantage of maintaining the same footprint for the pier is that nothing changes with regards to circulation.
- This also reduces potential environmental impact and may make the difference between an EA or EIS requirement.

Will there be any dredging?

- Probably not because the area around the pier is deep enough (based on bathymetry) for a barge.

Are there any plans for some type of a storage structure on the pier?

- We have no plans for a storage structure, but we can consider it if there is a desire in the community.
- We received no such comment from the community suggesting such a structure on the pier in prior meetings.

Why are we considering Option 1 if it's so expensive?

- Early in the process, some folks expressed that the pier, in its current state, has sentimental and historical value and was interested in retaining as much of the original pier as possible.
- It was also one of the original options in the Okubo Study that we used as a baseline for evaluation.

The three preferred alternatives will have essentially the exact same footprint as the existing pier.

Next Steps

Return with recommendations in August/September; Final Report in September/October.

MEMORANDUM

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GROUP 70
INTERNATIONAL

TO:	MEMORANDUM FOR RECORD		
FROM:	George I. Atta, Principal		
DATE:	March 30, 2011		
PROJECT:	Hāna Harbor Improvements	**PROJECT NO:**	29024-011
SUBJECT:	Hāna Harbor Community Meeting Helene Hall, Hāna, Maui Tuesday, March 29, 2011		

Background

The purpose of this final general community meeting was to present the selected pier design option.

Members of the planning team present at this meeting were George Atta and Barbara Natale of Group 70; and Shari Ikeda, Department of Transportation, Harbors Division.

The meeting began at 6:00pm. Twenty-eight people signed in as attending this meeting, including a representative from Maui Councilman Bob Carroll's office. *(Sign-in sheet attached.)*

The meeting started with a pule and introduction of the planning team. George Atta started with a clarification that the construction currently going on at the pier is part of the DLNR DOBOR (Division of Boating and Outdoor Recreation) boat ramp repair. A flyer with DLNR contact information was made available. George then launched into the PowerPoint presentation starting with a brief background of the project and overview of the process; findings during this study; overview of the 1st and 2nd community meetings; and pier design alternatives. The selected Alternative #7, Narrowed Reinforced "T" Option/Twin Mooring Support, and Pedestrian Access (Same Footprint as Existing Pier) was presented. Examples were given of what barge pier operations may look like, as well as what the next steps will be after this development plan is completed.

People present at the meeting asked questions at the end of the slide presentation and are summarized below.

Questions and comments from the meeting

I didn't see a ladder in the plans, or a lower section for use by smaller boats. How will the kids get onto the pier? And will there be a fenceline along the section going out? Will the wall be restored for people to use the pier for different activities?

- The differential level of the platform was not investigated. We didn't go into design details, but we can direct these ideas to the selected contractor. A fence or wall can be considered. A ladder for the swimmers will not affect the overall design of the pier, and these suggestions will be considered in the final designs.

When the tug boats come in, how are they going to tie off / come up to the pier?

- No questions as to how this would be done arose when we had conversations with barge operators. They used to do it in the 1950's and didn't say that they needed anything else more than the moorings. The bathymetry is deep enough that tug boat operators could maneuver well enough. We could go back to them and ask them if there is anything else they need.

I have a concern with the reflection and heat from stainless steel vs. concrete. Also, stainless steel is not supposed to rust, but I'm not sure that is the best option. Is this a realistic option for users who will be out there all day?

- We didn't discuss this. There may be the possibilities of putting a coating over the stainless steel. But you are right, stainless steel does give a different feel than concrete. This is the main difference between Options #7 and #8. We will review these issues before finalizing our report.

What is the cost savings for having stainless steel and aluminum?

- These were chosen for their long-term operational maintenance. I do not have specific numbers on the cost savings but will bring this question back to the project decision makers at SDOT.

Will we have the opportunity to comment in the future?

- Yes, even if this recommendation is selected, the community can raise their concerns again during the EA and CDUA processes.

The stainless steel option is still bothering me a little bit just from living here; homes that were supposedly built with marine grade steel have deteriorated, and this is further inland, not on the water. It would be a good idea for the contractors to take a look at these structures in the Hana environment. DOT should also inspect similar piers seriously before making a final decision.

There is a safety concern for the keiki running across – the metal can be slippery, especially when wet. The heat of the metal could get up to 120 degrees; this is really hot for keiki feet.

- It is possible to put a resin on top, but this will be an additional maintenance cost to be kept up. We will ask our specifiers to look at these issues.

Why do they think steel is more efficient to maintain then concrete?

- I don't know the specific rationale, but based on the materials used at other piers / harbors, this is the recommendation that emerged. We will re-asses what is more durable.

What is the timeframe for an EA/EIS? Has the budget and preliminary design been set?

- The money is available; it is in the entitlement phase. There is no timeframe yet – the development plan will be completed within the next few months, and then the EA process will begin.
- The Corps permit and CDUA can be done concurrently. It takes about 6 months for the EA schedule and 6 months for the CDUA. However, this could double in time if any major problems come up.

Will the funds lapse?

- There is a bill in the legislature to extend the funds; we currently still have a few years left.

Who will be the accepting authority?

- The State DLNR or Governor, since a CDUA will be necessary.

What will be the quality of the stainless steel? 304 or 316?

- We won't know until the design phase.
- We will ask the questions that have been brought up today between options #7 and #8, and if the final decision is to use concrete, this question will be moot.

The Pier was not originally 336' – it was extended in the 1950's. My grandfather was an original diver who put in the piles. You can see the pilings are not all vertical – some are horizontal. You could use this information when determining the strength of the pilings. They used to bring in oil barges to the pier.

- Thank you, the engineers will need to come in and take measurements, and figure in the horizontal pilings in calculating the necessary strengths for the piles.

They may have decided to use stainless steel because it can be raised easily for different sized barges.

Roll-on / Roll-off – is that onto the pier or onto the ship?

- It should be both ways.

Do you need an EIS before you start a project?

- No, you do the EIS once you have a project proposal. There are some questions about this and the law is fuzzy - the trigger point has never been clearly defined. The plus side about starting early is that you look at everything. The downside of looking too early is that you don't have a clear design in which to assess impacts. The impact is based on what you are proposing. It is a judgment call as to when to start it.

Who are the people doing the EIS?

- Harbors hasn't selected anyone to do it yet. If you know anyone, then send their name to Harbors, and they can tell you whether they are on the selected registered consultant list or not.

Are the concerns of the pier for the children or for the corporations bringing boats into the harbor? We all know it is for the corporations.

- I'd have to disagree that it is for the corporations. Senator English wanted it not for the corporations, but for the community. The conditions for use which will ensure this will need to be established. SDOT Harbors' position is that this issue will be determined and managed through the CDUA and permit processes.

Will we be informed in the future of what is going on?

- The EA/EIS process and the CDUA process are both public processes and the community will have the opportunity to comment during these stages.
- Shari is with DOT Harbors and will be able to continue to inform the community about the permitting process.

Does the design get done before the EA process?

- It can be done concurrently. Design issues, such as deck height and slickness of the surface will come up in the EA and CDUA phases. These conditions will be identified in the permit process. After that, Harbors will then need to design the pier to address and meet these conditions.

We would like to request that a meeting be held in Hana at each step in the process – EA/EIS, permit stage, etc.

- We will put this request in our report, but the EA does not require that a public meeting be held, and a community meeting will be held for the CDUA permit process, but not necessarily in Hana. We will put this in the report that the community requests this, and we suggest contacting Senator English regarding this desire.

Is this going to be a commercial pier?

- Hana Harbor pier is already classified as a commercial pier, since it is under the jurisdiction of SDOT Harbors, who manage all commercial piers statewide. If you want to change this designation to a recreational pier, it would have to be under the jurisdiction of the DLNR DOBOR. This suggestion was made to DLNR but they did not want to take jurisdiction; this may change but we don't see DOBOR taking it over very soon.

The tsunami is a big reason why this was brought up in the first place.

Can a helicopter land on the pier?

- We can check to see what it would take to land a Chinook or similar emergency helicopter. However, helicopters are pretty flexible and can land pretty much anywhere; it doesn't have to be directly on the pier. Still, we will check.

In an earlier meeting we discussed sending an electrical charge through the rebar of the concrete to reduce spalling. If the stainless steel option is chosen, running an electric charge through it may help reduce rusting.

- We will look into that option.

Next Steps

Final Report in April.