Rapid Response to Octocoral Spread at Kualoa Beach in Kāneʻohe Bay

Hawai'i Division of Aquatic Resources

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Field Report

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Executive Summary

On June 17, 2024, the Division of Aquatic Resources (DAR) Aquatic Invasive Species Team (AIS) received correspondence from partners at the Hawai‘i Institute of Marine Biology (HIMB) with reports of a potentially non-native invasive octocoral growing near Kualoa Beach and Mokoli‘i Island in Kāne‘ohe Bay. The report was concerning as the octocoral was observed growing in large patches near native stony coral colonies and did not resemble any known octocorals native to Hawaiian waters. The DAR AIS Team rapidly responded to the report. After an initial sample collection on June 21, 2024, HIMB and Bishop Museum colleagues conducted morphological and genetic identification on the octocoral while DAR AIS conducted delimiting surveys. Rob Toonen genetically identified the octocoral as *Sarcothelia edmondsoni*, a native octocoral. The morphological identification process was complex, as the morphology of *S. edmondsoni* does not resemble typical colonies. The initial inspection highlighted differences between this morphology and other *S. edmondsoni* populations. Genetic testing was repeated, confirming the identification of *S. edmondsoni*. Cathy McFadden clarified the observed morphological differences (V. Wishingrad, personal communication, July 31, 2024). During the identification process, the AIS Team surveyed approximately 300 acres of benthic habitat near Kualoa Beach Park. Polygons located approximately 800m offshore and around Mokoli‘i Island exhibited the highest concentration of *S. edmondsoni* growing near native stony coral. *Sarcothelia edmondsoni* was observed overgrowing coral skeletons. Delimiting surveys concluded following genetic identification; however, there are still questions on the conclusiveness of the results, as soft corals can be highly polymorphic and the genetic taxonomy is complex. Due to this uncertainty, HIMB and Bishop Museum have been working to process vouchered samples of taxonomically related cnidarians to confirm the reliability of the genetic markers utilized (R. Toonen, personal communication, November 23, 2024).

Background

On June 17, 2024, members of the Division of Aquatic Resources Aquatic Invasive Species Team received a notification from partners at HIMB of a potentially non-native octocoral growing near Kualoa Beach and Mokoliʻi Island in Kāneʻohe Bay. Concerns arose from this report as the octocoral was observed growing in large patches near native stony coral colonies and did not resemble any known octocorals native to Hawaiian waters (Fig.1). Due to concerns expressed by our partners that this is likely a non-native species, DAR AIS and partners rapidly responded to the report.

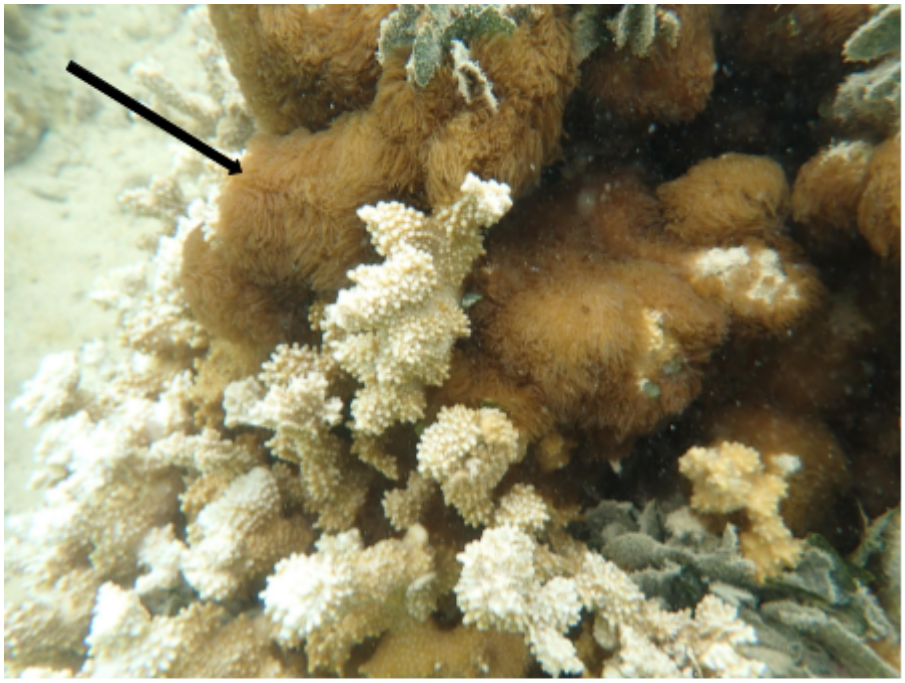


Fig. 1: Photograph of octocoral ***Sarcothelia edmondsoni*** (arrow) growing in close proximity to ***Montipora capitata*** colonies.

Sample Collection

Photographs of this octocoral, taken during a previous field survey by HIMB members, depicted it growing in large colonies on top of native coral substrate. Partners noted that the octocoral was widespread and not difficult to find in the area, highlighting the need for sample collection and identification. On June 21, 2024, AIS Biologists, HIMB, and Bishop Museum members snorkeled approximately 400m offshore from Kualoa Beach Park to collect a sample. Photographs, GPS points, and tissue samples of the octocoral were collected. Samples were preserved for genetic testing. Following the sample collection, members from both HIMB and Bishop Museum worked to identify the octocoral species. The AIS Team then utilized the GPS points as references to design and implement a rapid response survey.

Identification

Staff from Bishop Museum and the Hawaiʻi Institute of Marine Biology (HIMB) worked on identifying the octocoral using the sample collected on June 21, 2024. Initial morphological inspection tentatively identified the octocoral as a Xenid species or potentially *Clavularia sp.* due to the size of the polyps and growth form. Additional morphological examination revealed that this sample lacked reflective sclerites, a characteristic of the native octocoral *Sarcothelia edmondsoni*. Cross-referencing these morphological findings with documented octocorals around Oʻahu revealed that *Clavularia sp.* also lacks reflective sclerites. As a result, biologists believed this octocoral was from the genus *Clavularia*, *Cervera*, or potentially an exotic species found in the aquarium trade. Genetic sequencing later called this identification into question with a 97% match to *Sarcothelia edmondsoni*, a native octocoral. However, the sampled colony of unknown octocoral was found growing next to a known colony of *S. edmondsoni*, leaving members at HIMB concerned that there was genetic contamination. Therefore, samples were then recollected, and genetic sequencing was rerun, with the addition of a known sample of *S. edmondsoni* to verify the previous results. These sequences returned results most closely resembling *S. edmondsoni*, often at 100% identity (V. Wishingrad, personal communication, July 31, 2024). Additionally, communication with Cathy McFadden, an octocoral specialist, verified that *S. edmondsoni's* morphology can vary greatly and that various morphologies of *S. edmondsoni* thought to be differing species were later sequenced and discovered to be genetically identical (V. Wishingrad, personal communication, July 31, 2024). The following morphologies have been recorded around the island and are all genetically identical, highlighting the difficulty of initial identification of unknown octocorals: from Pūpūkea, large matted colonies of vibrant blue all over; from Halʻiewa, small colonies of dark brown with a light blue center; from Kaʻaʻawa Tube, colonies not heavily matted together, lighter brown with blue centers; from Waikīkī, small colonies, brown with light blue center; from Lāʻie, colonies not heavily matted together, light brown with light blue centers; from Lanikai, brown morph; and from Pūpūkea Beach Park, Kapoʻo (Shark's Cove), blue morphology (V. Wishingrad, personal communication, July 31, 2024).

Delimiting Survey

Parallel to the ongoing species identification, the AIS Team conducted delimiting surveys to determine the extent of growth. On July 3, 2024, the AIS Team surveyed nearshore areas around Kualoa Beach and Mokoliʻi Island in Kāneʻohe Bay. The survey methodology was designed utilizing a similar resource survey methodology used by the U.S. Fish and Wildlife (USFW). Polygons, extending an area of approximately 2.2km by 2.5km, were outlined on handheld GPS units (Fig. 2A). Team members used watches and GPS units that recorded time-stamped tracks, and swam in a parallel search pattern within a designated polygon.

Surveys were conducted in a lawn mower pattern, with teams of two starting on each side of the polygon swimming inwards. DAR AIS staff noted any presence of the unidentified octocoral by recording the time and presence. Time-specific data points were coordinated to the tracks taken in the field. The observed change in benthic cover of the unidentified octocoral was recorded (e.g., swimming over a patch of octocoral would be recorded as a detection with a

corresponding time, then when the octocoral is no longer detected, it would be re-recorded with a corresponding time). Divers binned the percent coverage on a scale of 0 to 3 for efficiency while surveying hundreds of acres: 0 for absence, 1 for low coverage (<10%), 2 for medium-high coverage (10-50%), and 3 for high coverage (>50%) (Fig. 3). Live stony coral was also recorded if there was a detection within 0.5m of the octocoral. Additional species of concern were surveyed for, specifically *Eukema denticulatum*, *Kappaphycus spp.*, *Cassiopea sp.*, *Unomia stolonifera*, and a non-native zoanthid *Terrazoanthus sp*. None of these species were detected within the polygons.

After an initial week of surveying inshore polygons, the management response protocol was adapted to include sub-polygons in greater depths, requiring surveys to be conducted via

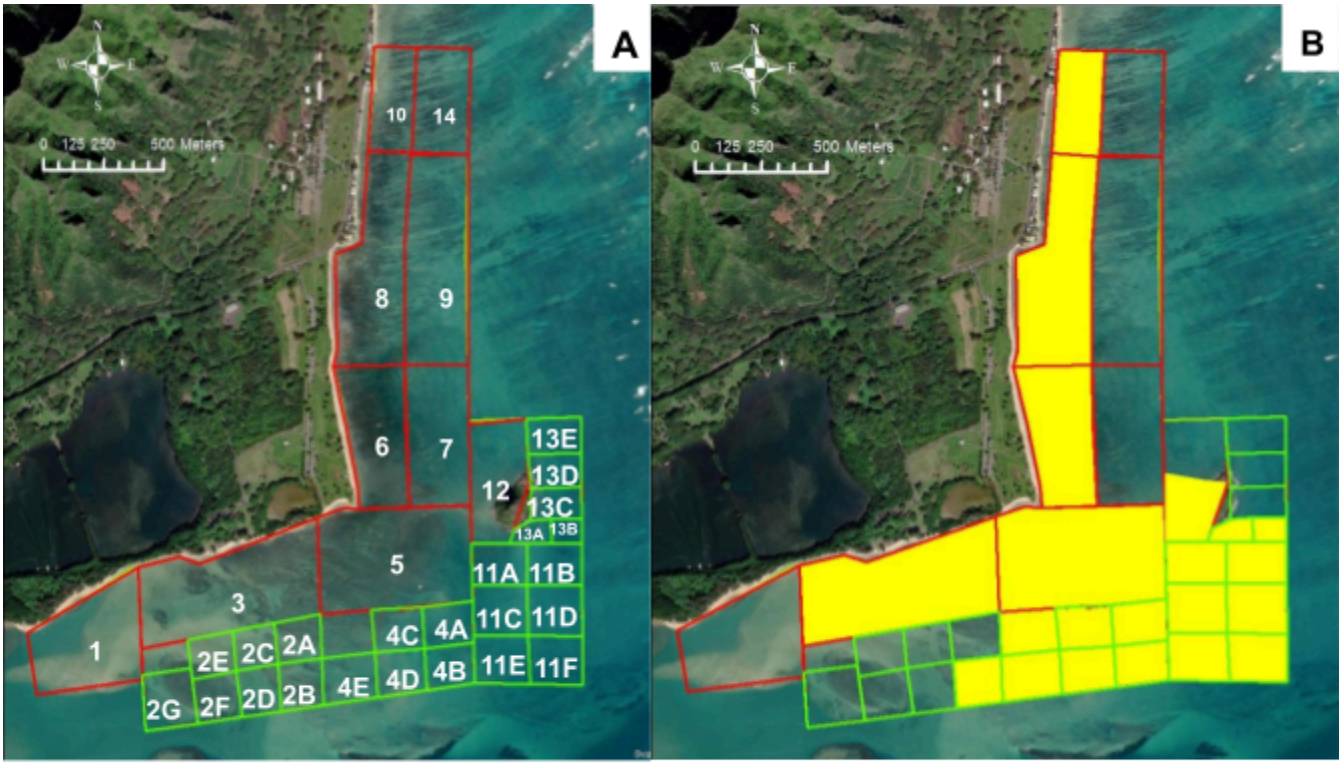


Fig. 2: Polygon map designed for systematic delimiting surveys near Kualoa Beach Park. **A)** Red polygons were surveyed via snorkeling. Green polygons were surveyed via SCUBA diving from boat. **B)** Polygon map after completion of surveys for the month of July and August prior to the confirmed genetic identification of the octocoral ***Sarcothelia edmondsoni***. Yellow polygons represent areas where surveys were completed.

SCUBA. Polygons 2, 4, 11, and 13 were surveyed via SCUBA. The depths of these polygons ranged from 2m to 4m, with substrate mostly consisting of pavement, rubble, and occasional stony native coral. The DAR AIS Team surveyed approximately 300 acres of benthic habitat (Fig. 2B). Surveys concluded following the tentative identification of *S. edmondsoni* as a native Hawaiian octocoral.

Detections of *S. edmondsoni* were recorded in all of the polygons surveyed. Polygons 4, 5, and 11 have the highest percentage of *S. edmondsoni* (Fig. 4). In these polygons, depth

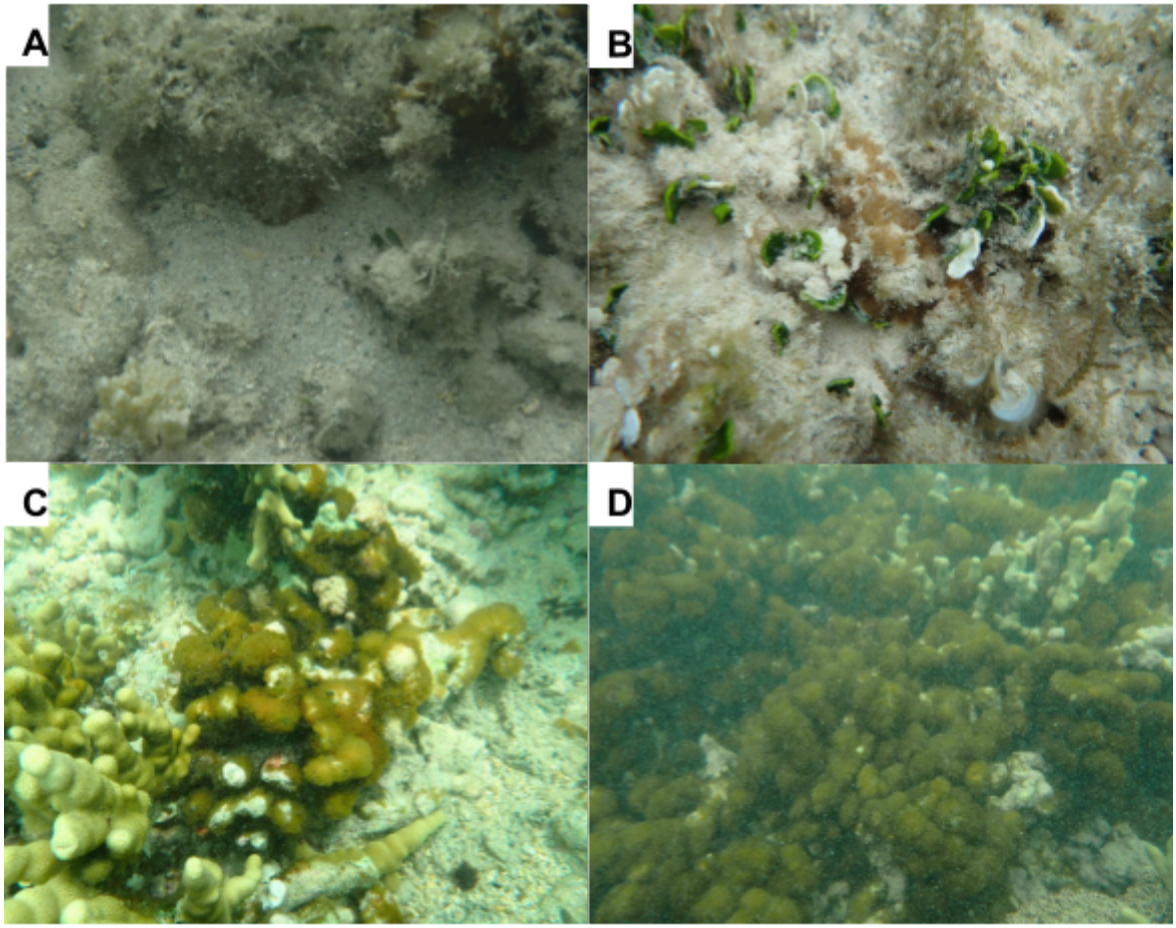


Fig. 3: Photographs of ***Sarcothelia edmondsoni*** growing on hard benthic substrate including hard coral skeleton and pavement. Photographs depict varying levels of growth coverage from a scale of 0-3. **A)** Photograph of benthos without ***S. edmonsoni*** (rated a 0 for 0% coverage). **B)** Photograph of ***S. edmondsoni*** that is a growth coverage category 1 (<10% coverage). **C)** Photograph of ***S. edmondsoni*** that is a growth coverage category 2 (10%-50% coverage). **D)** Photograph of ***S. edmondsoni*** that is a growth coverage category 3 (>50% coverage).

ranges from 1.5m to 4m. The octocoral was commonly documented reaching medium-high and high level coverage, especially where benthic cover consisted of live rock and coral skeleton (Fig. 5). In polygons 6, 8, and 10, *S. edmondsoni* was present growing in low coverage, sporadic patches along the benthos (<10%) (Fig.4). Out of the 300 acres surveyed, *S. edmondsoni* was present within ~120 acres (Fig.4).

Fig. 4: ***Sarcothelia edmondsoni*** survey map depicting varying levels of coverage. Light blue represents areas with no ***S. edmondsoni*** presence (0%), yellow represents areas with low coverage (<10%), orange represents areas with medium to high coverage (10-50%), and red represents high coverage (>50%).

Conclusion

Delimiting surveys concluded following genetic identification*Sarcothelia edmondsoni* was identified as a native octocoral but continues to overgrow stony coral (Fig. 5). Overgrowth onto stony coral colonies is a concern as octocorals are known for prolific growth, often at the expense of other organisms and the environment. Determining if this interaction is invasive or opportune requires further study.

Given these soft corals' highly polymorphic qualities, questions and concerns still surround the genetic identification of this species. Specifically, observations of *S. edmondsoni* overgrowing the stony coral substrate, which is not typical behavior for this species, questioned the reliability of the taxonomic resolution for the genetic markers used to identify the Kualoa morphology (R. Toonen, personal communication, November 23, 2024). Because of this, partners at HIMB and Bishop Museum are working to obtain vouchered samples of closely related cnidarian species to confirm the reliability of the genetic markers (R. Toonen, personal communication, November 23, 2024).

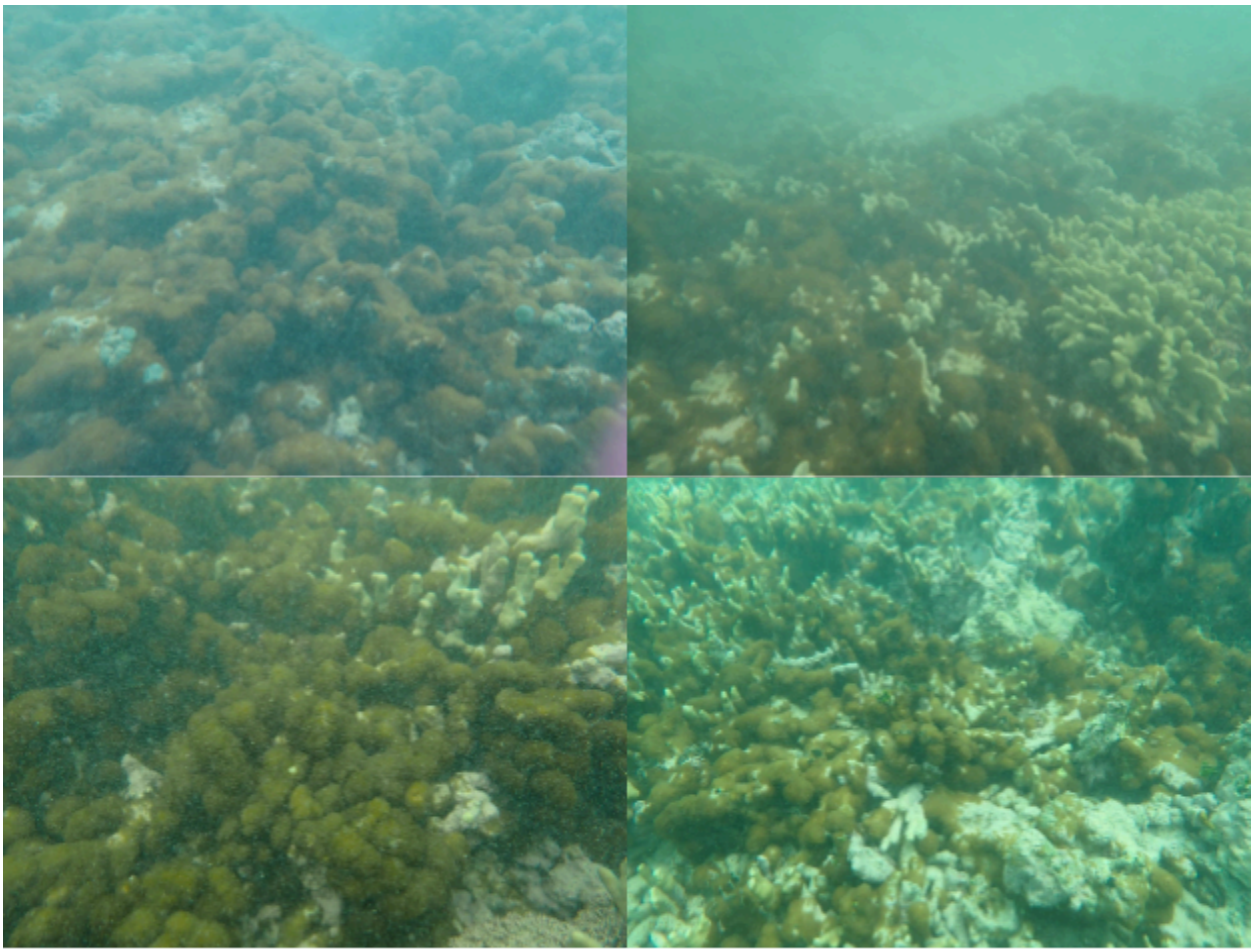


Fig. 5: Photographs of ***Sarcothelia edmondsoni*** growing in dense patches (>50% coverage) on various substrates (hard coral skeletons, rubble, pavement) and in close proximity to living native hard coral.

Sarcothelia edmondsoni is an endemic Hawaiian octocoral, but it has not been previously observed growing in large colonies around Kualoa Beach Park. However, *S. edmondsoni* has been documented in abundance at other locations and can go through rapid population increases in areas with high influxes of anthropogenic inputs (Tsang 2021). Leather mudweed, *Avrainvillea lacerata*, was observed growing in thick mats over hard substrate, including rubble, live rock, stony coral, and coral skeleton. In some cases, *A. lacerata* was observed overgrowing and smothering native coral colonies. This invasive species was the primary macroalgae observed, composing the majority of the benthic cover in the surveyed polygons. The relationship between anthropogenic nitrogen influx and *A. lacerata* in this area has been studied, with cesspools, agricultural runoff, surface discharge, and septic restrooms all being potential factors influencing nitrogen levels in the waters near Kualoa Beach Park (Huynh-Nguyen 2021). The observed population growth of *S.edmondsoni* located off of Kualoa Beach could be related to high levels of nitrogen inputs from anthropogenic influences and heavy rainfall. Given the opportune environment and unusual overgrowth, further investigation of the ecological characteristics of this morphology should be considered.

References

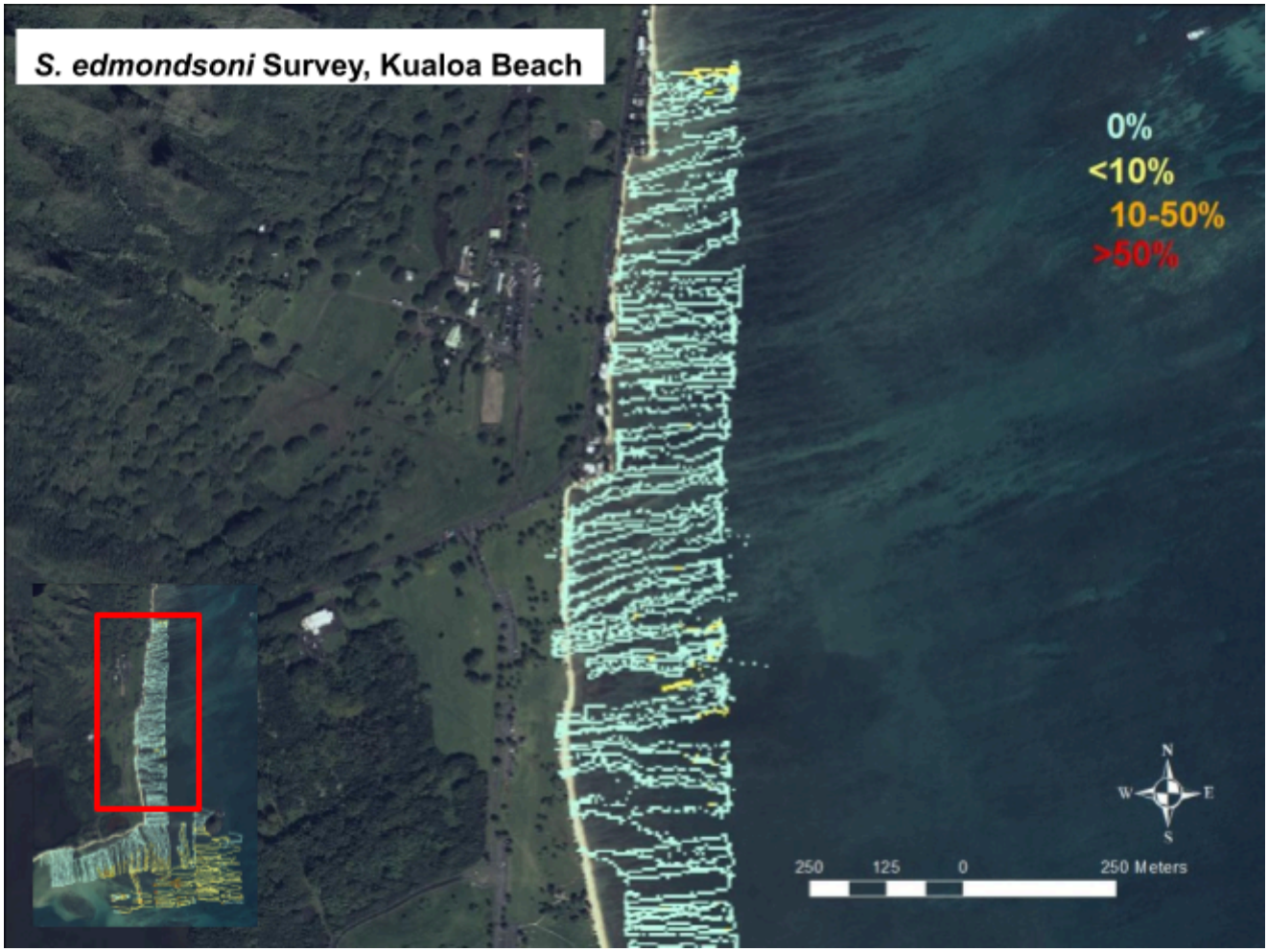
Huynh-Nguyen, T. (2021). Characterizing Nitrogen and δ15N Values in the Tissues of a Windward Population of Avrainvillea lacerata, an Invasive Green Alga (Doctoral dissertation).

Lasker, H. R., Bramanti, L., Tsounis, G., & Edmunds, P. J. (2020). The rise of octocoral forests on Caribbean reefs. Population Dynamics of the Reef Crisis, 87, 361-410.

Tsang, A. O. (2021). Evaluating the potential of an endemic Hawaiian octocoral, Sarcothelia edmondsoni, as a bioindicator of anthropogenic influence (Master's thesis, University of Hawai'i at Manoa).

Map Appendix

Magnified views of survey map.




S. edmondsoni Survey, Kualoa Beach
0%
<10%
10-50%
>50%
N
W
E
S
250
125
0
250 Meters

Photo Appendix

Additional photos of *Sarcothelia edmondsoni* found off of Kualoa Beach Park in Kāneʻohe Bay.