

Island Wide Survey and Development of a Rapid Assessment Protocol of Invasive Macroalgae
on O‘ahu

Project Start Date 2/1/2024- Project End Date 4/31/2024

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Summary of activities:

In this project, survey work was conducted on O‘ahu to help to establish and develop a rapid assessment protocol for invasive marine macroalgae. These survey methods, if applied regularly in important and diversified habitats have the potential to better assess in novel introductions and incipient populations of invasive macroalgae. As the timing of the project was constrained more than expected, the project deliverables will reflect the development of survey methodology rather than the results of a complete survey and full picture of the distribution of invasive macroalgae on O‘ahu. Instead, the aim of this report is to provide the methodology for future research and management regarding how to best characterize the distribution of invasive macroalgae using affordable and time efficient manner.

Extensive surveys in three sites from the southeast portion of O‘ahu were used to help to establish survey protocols. The three sites that were selected had various rates of invasive macroalgal species cover. All three sites included surveys over the intertidal and reef flat areas which are known to harbor unwanted invasive species. The sites that were surveyed include the reefs at Kualoa, Kaiona, and Paikō. Species of interest and concern were found in this region included but not limited to *Acanthophora spicifera*, *Avrainvillea lacerata*, *Dictyospharea carvenosa*, *Eucheuma sp.*, *Gracilaria salicornia*, *Hypnea musciformis*, and *Kappaphycus alvarezii*.

Additionally in this project, field training was conducted with student volunteers and the O‘ahu Invasive Species Committee. It is with their assistance and through collaboration with the Division of Aquatic Resources that future invasive macroalgal species surveys will be able to be conducted. It is the goal of this project that surveys of this nature can be applied at a semi-regular basis to areas that provide significant ecological and cultural services to the community, and to better engage communities into understanding variable change in their natural resources over time. Although these survey methods might seem primitive to the advent of novel survey techniques using digital methods, the ability to ground truth survey data with observations and with voucher specimens cannot be understated.

Deliverables

Deliverable 1: # of sites surveyed for invasive algal abundance

Three sites were selected to compare survey results. These sites include the nearshore reef at Kualoa, Kaiona, and Paikō respectively. A belt-transect method was selected as an initial way to gather species abundance and diversity as we were unaware of the size constrictions and population structure of various macroalgae species that we wanted to characterize. The belt-transects were laid perpendicular to the shoreline across the intertidal bench into the reef flat. GPS locations at the beginning and end of each transect were collected. Approximately one meter from each transect line, survey teams conducted a belt-transect, and tallied each macroalgal species encountered within the belt transect as well as the approximate location along the transect line to within $\pm 0.1\text{m}$. The first specimen of each species encountered was collected for herbaria voucher specimens. Any species encountered that was unknown was denoted as such (i.e. Unknown #1) and was collected for further identification in the laboratory. After unknown species were identified, data was compiled and ran through species area curves to assess the appropriate of the survey methods at each site.

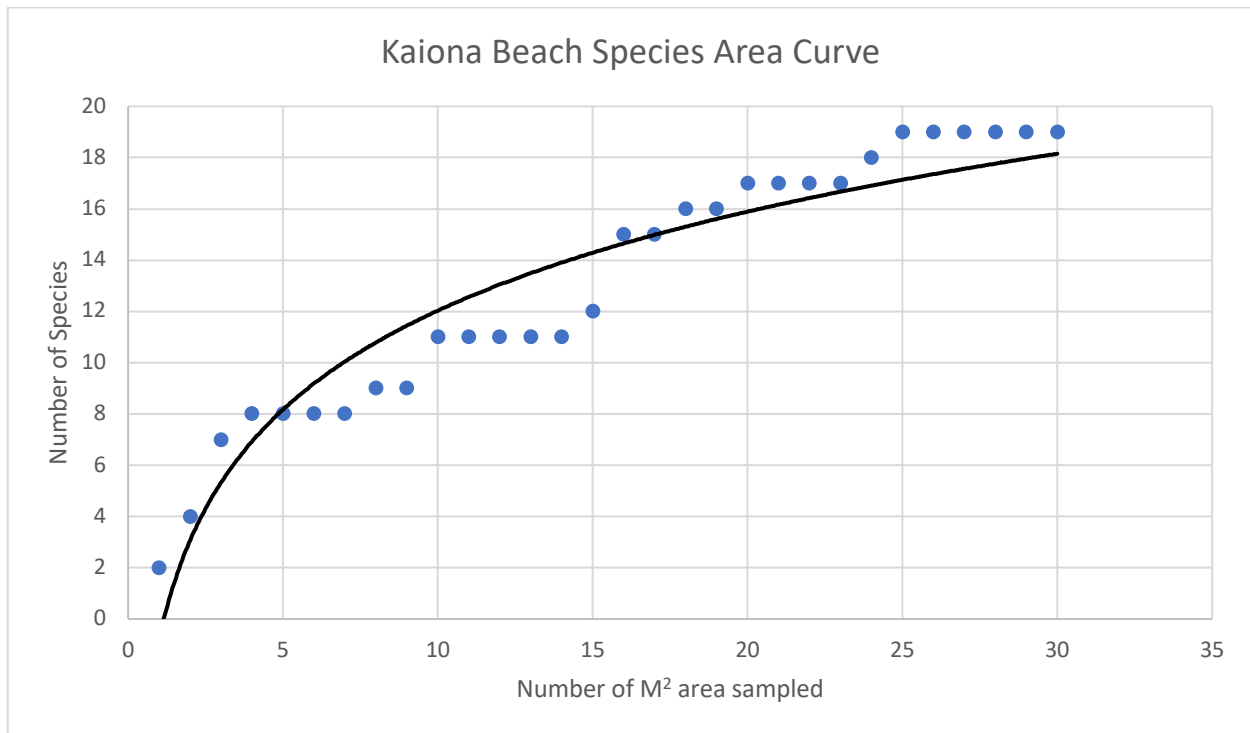


Figure 1. Species area curve attained from a 30-meter transect Kaiona Beach. The overall species diversity sampled was at 19 species which was greater than the other two sites sampled.

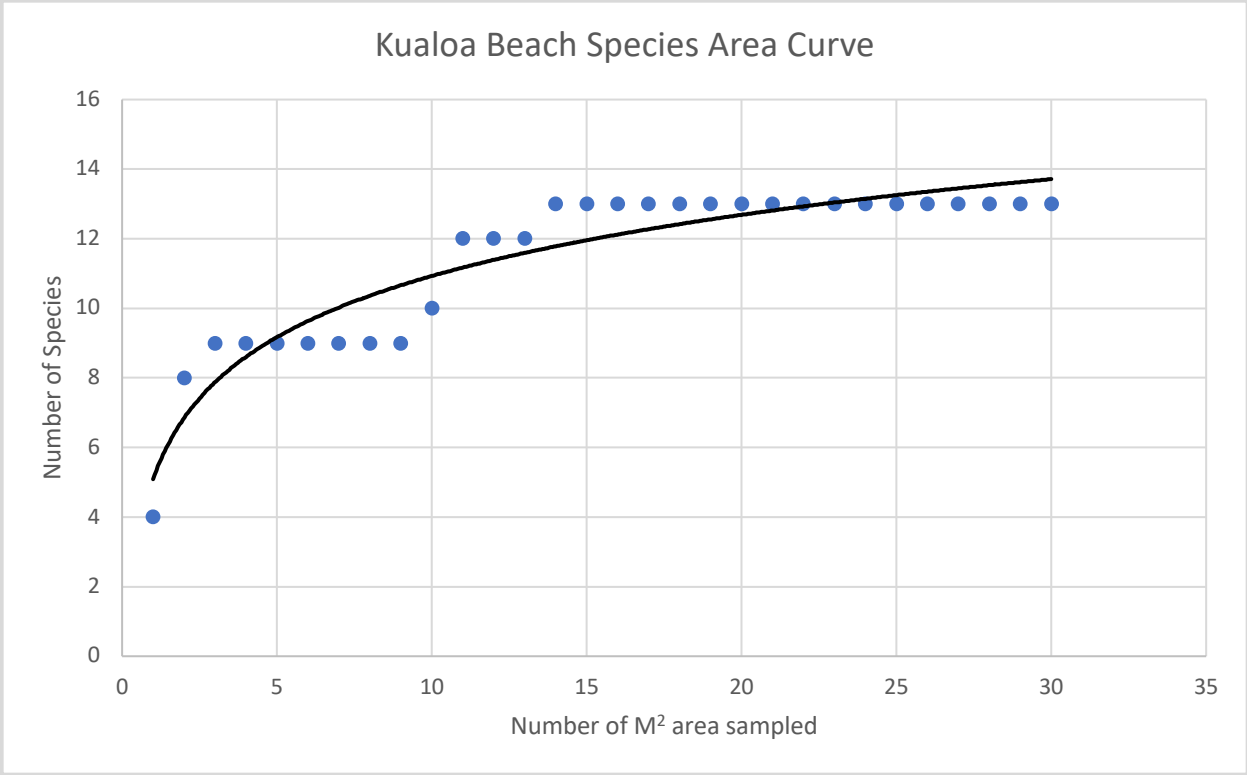


Figure 2. Species area curve attained from a 30-meter transect Kualoa Beach. The overall species diversity sampled ended at 13 species over the intertidal and reef flat area.

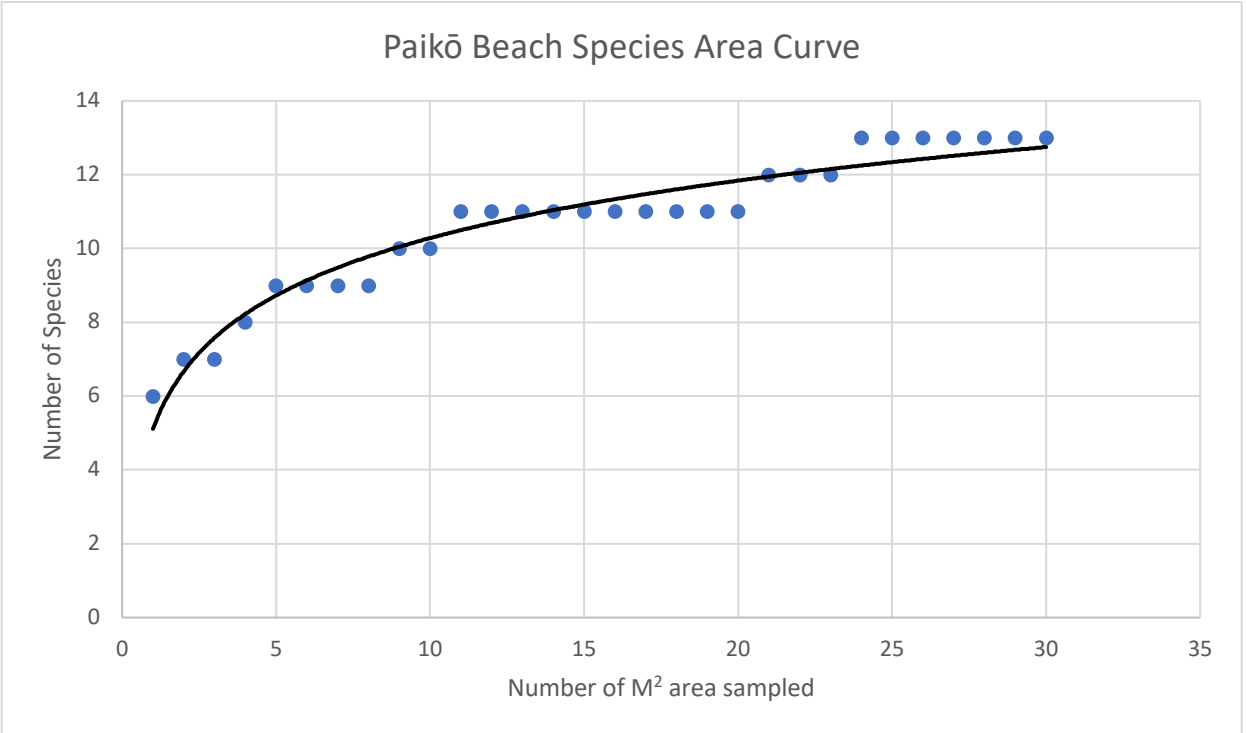


Figure 3. Species area curve attained from a 30-meter transect Paikō Beach. The overall species diversity sampled ended at 13 species over the intertidal and reef flat area.

Based on the shape of the curves attained from each site, it can be safe to say that the belt-transect method is an appropriate and quick survey method to ascertain quantitative information on invasive macroalgae species in varied and diversified sites on O‘ahu. In fact, based on the asymptote of each curve, the transect lengths can be reduced from 30 meters to approximately 10 meter transect lengths, as the return of information from increase sampling area quickly drops below a 1:1 sampling ratio. This means that in future surveys it will be beneficial to do additional 10-meter transects spread out over a site rather than 30-meter transects altogether. This will aid to better characterize sites over various habitats comparing intertidal areas, reef flats, and reef crests over greater areas with less sampling effort.

Deliverable 2: # of field trainings for field team

A field training was conducted with the O‘ahu Invasive Species Committee was held on August 15th, 2023 to compare and contrast invasive species and native flora look-alikes. This was done in conjunction with Mālama Maunalua who were gracious hosts and aided in the identification training. Close to 20 people were in attendance for the training and consisted mainly of surveying intertidal quadrats through pseudorandom haphazard sampling. Although survey methods in this training were not identical to the ones employed in the survey thus far, the ability to identify, compare, and contrast different invasive macroalgal species from native species was the focal point of the field training. A PowerPoint presentation was assembled prior to the training and was disseminated to participants to give visual cues in identifying different taxa. The success of this field training leaves much promise for future collaborations between invasive species management and community organizations moving forward.

Deliverable 3: # of workshops for students and volunteers

Student and volunteer training is ongoing, and a list of participants is being collected and curated over time. Workshops for students will be held once a critical capacity of student interest is met. There is also considerable interest from volunteers in various non-profit organizations that would be invited trainings as well. Once a critical capacity is met, outreach for volunteers will be made available for further community participation.

Deliverable 4: Heat map of invasive algal distribution and abundance on O‘ahu

At the time of this final report, there is insufficient information yet to provide a heat map distribution for O‘ahu currently. Future efforts to survey additional sites along the north, south, and west facing shore are underway and will be ascertained and reported in a heatmap to ongoing partners. Various non-profit community organizations such as Mālama Maunalua, Waimānalo Limu Hui, and Kua‘āina Ulu ‘Auamo will be consulted for their input on how to best approach outreach regarding this information once it is available.

Deliverable 5: Online infographic to disseminate heatmap to community partners

As this deliverable is dependent on the previous deliverable, it has yet to be provided to community partners. Plans to continue surveys are underway and results will be appropriately disseminated to community partners. Online reporting will be aimed at providing quick, effective, and transparent information of all sites surveyed throughout O‘ahu. This will help to maintain engagement with the community.

Deliverable 6: Peer-reviewed publication co-authored by project partners

Project partnership has been strongly supported by various organizations which will all be approached when further information from sites around O‘ahu is ascertained. A collective and peer-reviewed publication will be put forward as a baseline study to better understand distribution, abundance, and impact of invasive macroalgae on O‘ahu. The strength of this publication will lie in the diversified authorship and experiences throughout the community in O‘ahu.

There were many challenges in fulfilling the deliverables outlined by the end date. One of the most challenging aspects was to constrain the survey to the limited timeframe once funding became available. There was also a lack of available people to carry out the duties of the survey as proposed, again a function of the funding window. Thus, the scope of the survey and deliverables were constrained to a preliminary and exploratory survey in nature, rather than providing a complete picture of invasive species distribution on O‘ahu. In this way, the reduced survey can serve as an informative and preliminary steppingstone into how to approach a reliable quantitative survey across various sites and habitats around O‘ahu. Rather, it is suggested that this method of belt-transects be readily employed in the future to quickly and quantitatively characterize invasive macroalgal species distribution and abundance in semi-regular intervals.