

Habitat Restoration in Kaneohe Bay, Hawaii
Division of Aquatic Resources
Report Period: April 01, 2013 – September 30, 2013

The Division of Aquatic Resources (DAR), Aquatic Invasive Species (AIS) team is working to restore 13 acres of coral reef habitat that is overgrown by a variety of alien invasive algae species. Upon initial removal of algae, the AIS team will transplant hatchery raised native collector sea urchins onto the patch reef to help control the re-growth of invasive algae. Monitoring of native/alien algae, fish abundance/diversity, and coral recovery/recruitment will be monitored throughout the initial restoration phase and continue 5 years thereafter. **All numbers given in this report are from preliminary analysis only and should not be used in any published or final material. This progress report covers the period from April 1, 2013 – September 30, 2013.**

Algal Removal/Field Team

During this reporting period, the AIS team conducted removal of invasive algae on Reef 29 with 29,497 pounds of invasive seaweed (*Euchema/Kappaphycus/Gracilaria*) removed from 9,000 m² over 15 working days.

Reef 29 1st Removal Summary

Date started: 8/22/12
Date completed: 01/03/2013
Days of removal: 39
Pounds Removed: 129,850 lbs
Area Cleared: ~29,000 sq. meters
Urchins outplanted: none

Reef 29 2nd Removal Summary

Date started: 8/15/13
Date completed: TBD
Days of removal: 15
Pounds Removed: 29,497 lbs
Area Cleared: 9,000 sq. meters
Urchins outplanted to date: 3,655

Reef 27 Summary

Date started: 3/21/12
Date completed: 08/22/12
Days of removal: 25
Pounds Removed: 15,630lbs
Area Cleared: ~12,000 sq. meters
Urchins outplanted to date: 51,119

Reef 26 Summary

Date started: 11/15/12
Date completed: 03/20/12
Days of removal: 23
Pounds Removed: 11,053 lbs
Area Cleared: ~12,000 sq. meters
Urchins outplanted to date: 43,063

Urchin Outplanting

April: 12,050 urchins released on Reef 27.
May: 2,550 released on Reef 27.
June: 0
July: 3,600 released on Reef 26

August: 4,000 released on Reef 26; 1500 on Reef 29
September: 3,655 released on Reef 29

Macroalgae & Phytoplankton Production

Cultures in the new phytoplankton room are performing well. Recent improvements have resulted in an increase in both culture density and overall volume, effectively doubling capacity. New lighting and improved climate control have resulted in a one third increase in phytoplankton culture density. New tanks have increased volume by 80%.

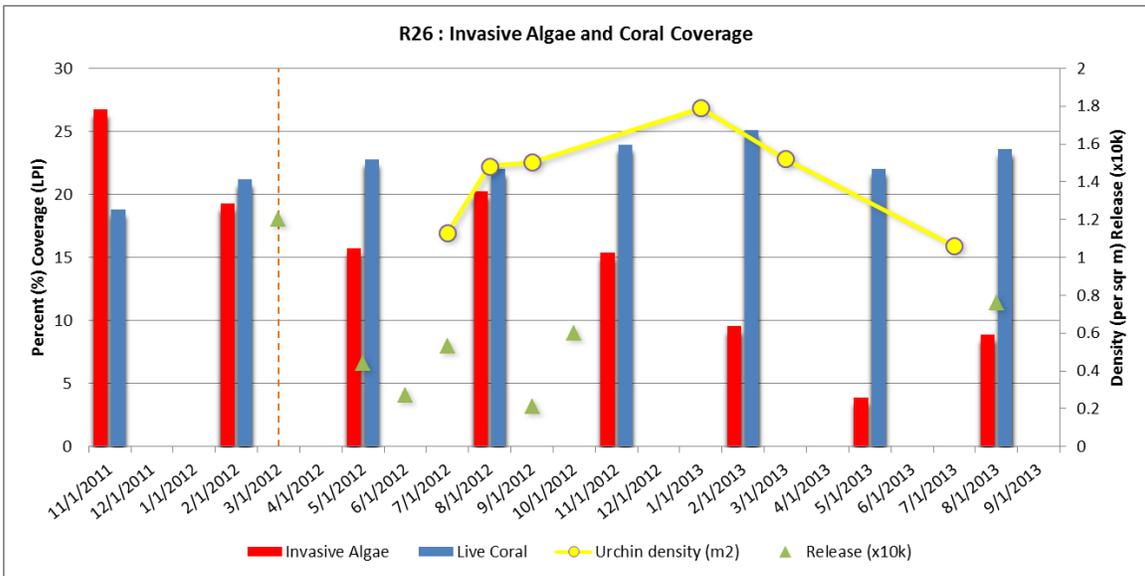
There appears to be an increase in protozoan activity in the cultures as well. It is not clear if this due to increased contamination or the change in growing conditions. It appears to have little or no impact on larval culture at this point. Larvae and phytoplankton are monitored daily and adjustments to technique will be made as needed. New moisture traps have been added to the air delivery system.

Monitoring

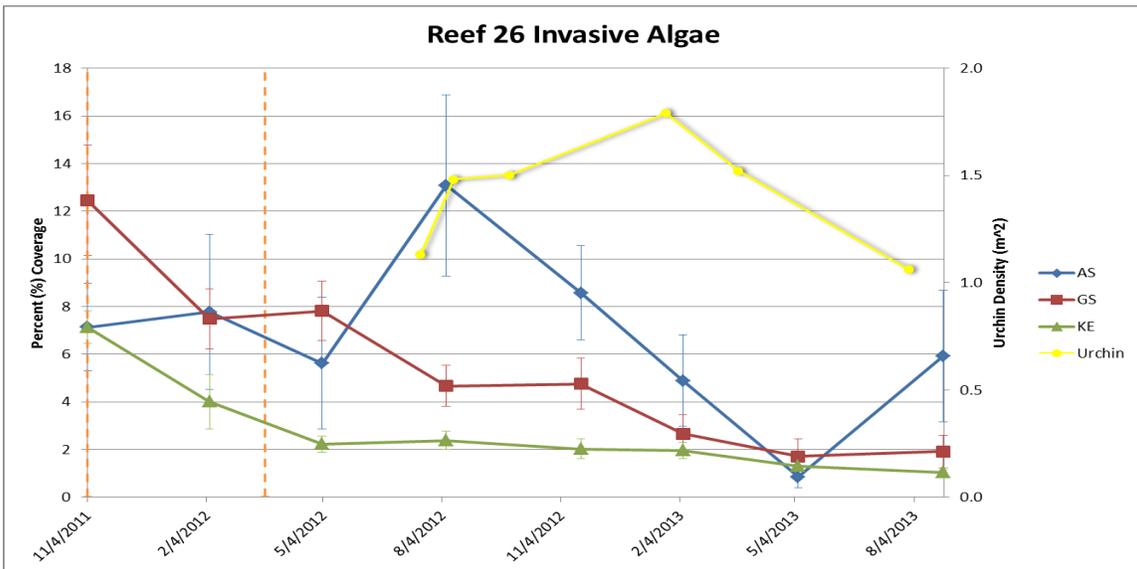
Accomplishments:

- Fixed Permanent Sites (fish, benthic, echinoderm):
 - Reef 16: June, September 2013
 - Reef 26: May, August 2013
 - Reef 27: May, August 2013
 - Reef 28: June, September 2013
 - Reef 29: April, July 2013
- Random Benthic Quads:
 - Reef 16:
 - Reef 26: August 2013
 - Reef 27: August 2013
 - Reef 28:
 - Reef 29: July 2013
- Urchin Population Assessment:
 - Reef 26: August 2013
 - Reef 27: August 2013

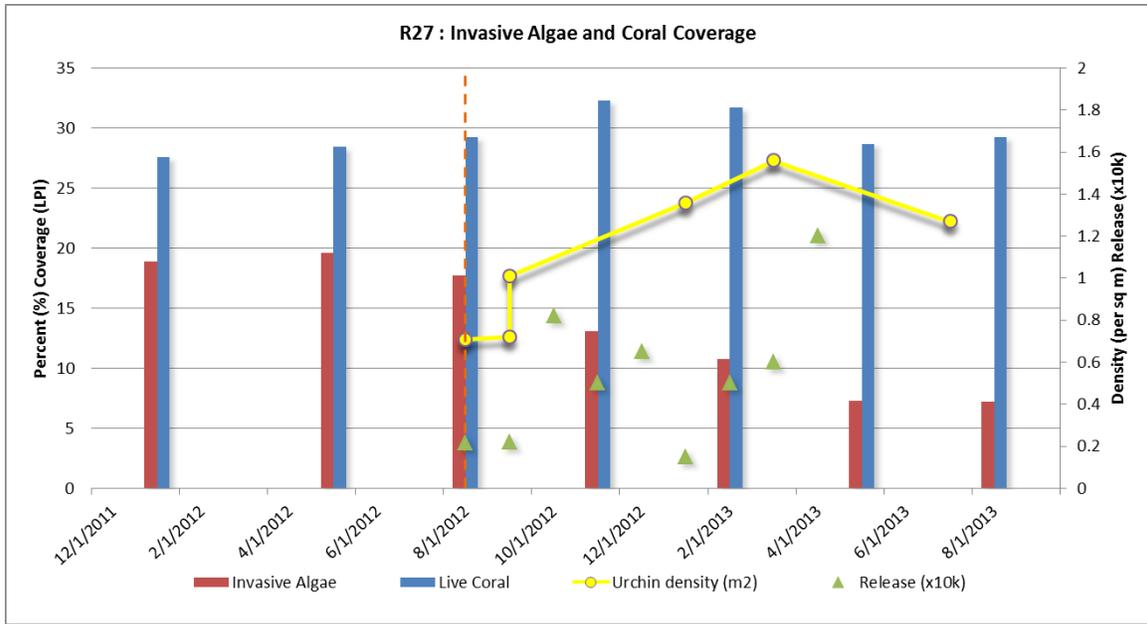
Monitoring Preliminary Analysis



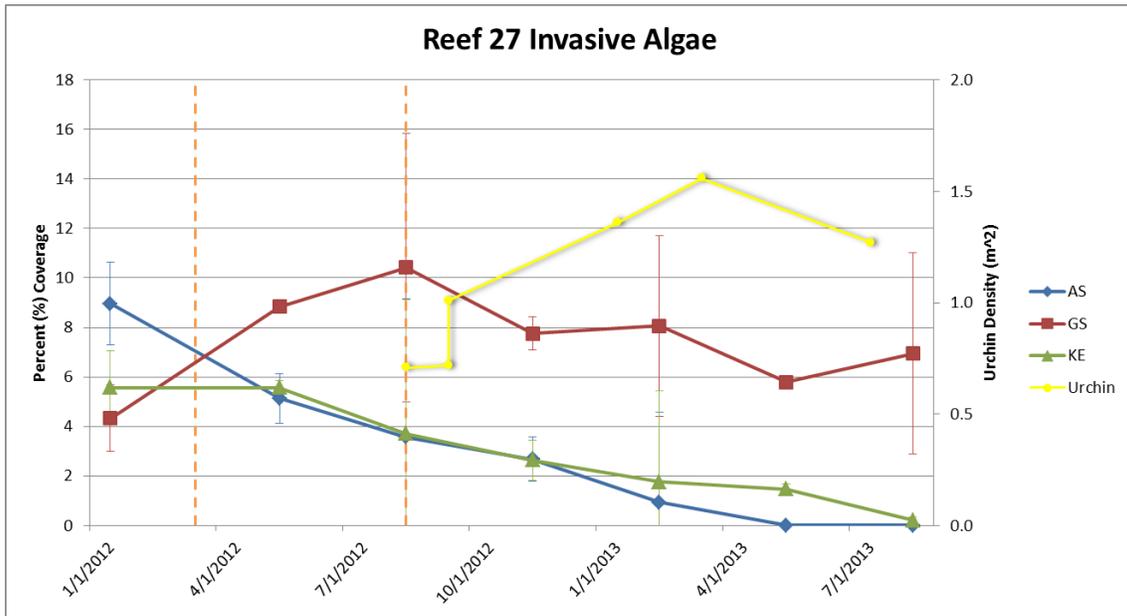
Reef 26. Invasive Algae and Live Coral coverage calculated using database of Line Point Intercept (LPI) over 14-25m transects. Urchin density calculated using reef wide non-randomized sampling. Urchin Release numbers relate to actual counts from nursery to site (as indicated on right y axis 1=10,000 urchins). Dashed vertical line represents date of final mechanical removal event. This reef has been stocked with urchins for the longest period.



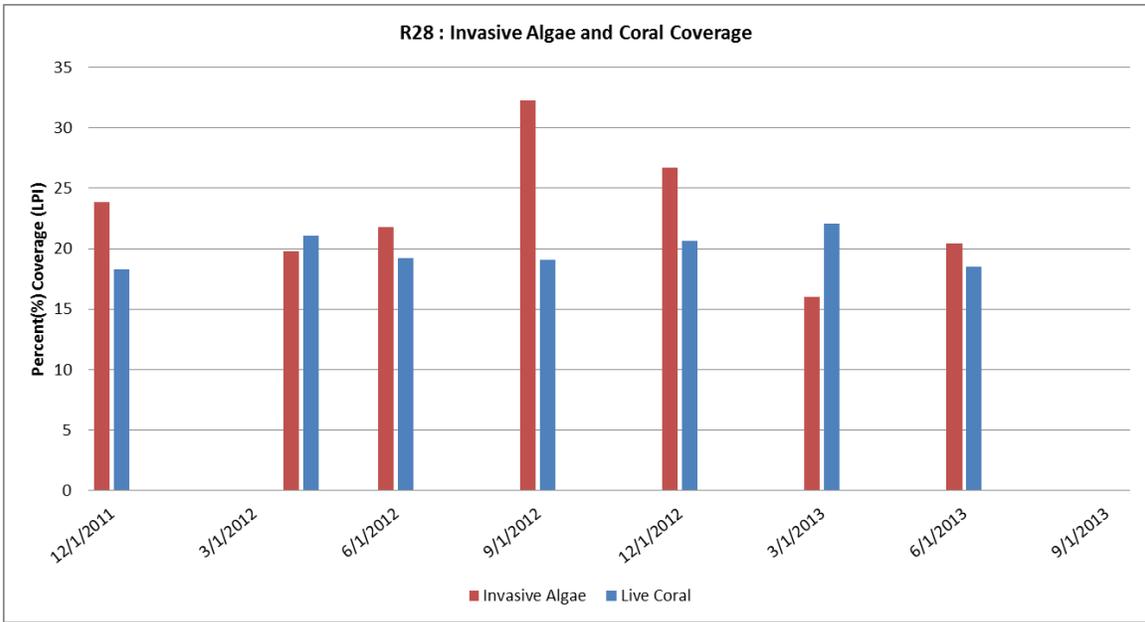
Reef 26 data showing individual alien invasive species (AS- *Acanthophora specifera*, GS- *Gracilaria salicornia*, KE- *Kappaphycus/Eucheuma spp.*); time of mechanical removal (dashed lines); and urchin density numbers per square meter. Spike in AS believed to be due to seasonal growth. Super Sucker mainly targets KE, because GS and AS are too labor intensive to remove. However, these species are reduced through addition of urchins.



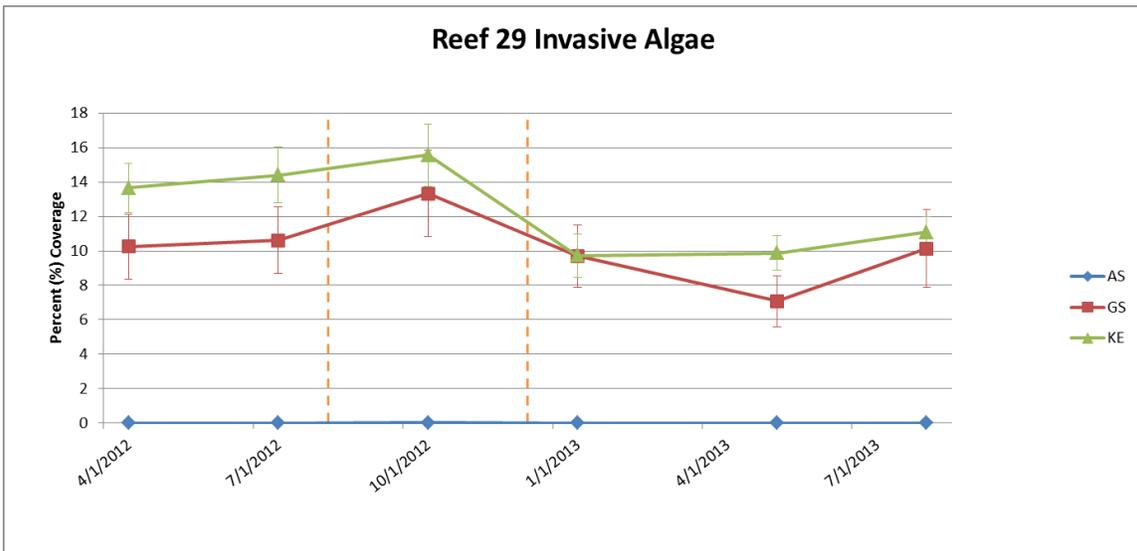
Reef 27. Invasive Algae and Live Coral coverage calculated using database of Line Point Intercept (LPI) over 13-25m transects. Urchin density calculated using reef wide non-randomized sampling. Urchin Release numbers relate to actual counts from nursery to site (as indicated on right y axis 1=10,000 urchins). Dashed vertical line represents date of final mechanical removal event.



Reef 27 data showing individual alien invasive species (AS- *Acanthophora specifera*, GS- *Gracilaria salicornia*, KE- *Kappaphycus/Eucheuma spp.*); time of mechanical removal (dashed lines); and urchin density numbers per square meter. Super Sucker mainly targets KE, because GS and AS are too labor intensive to remove. However, these species are reduced through addition of urchins.



Reef 28. Invasive Algae and Live Coral coverage calculated using database of Line Point Intercept (LPI) over 18-25m transects. Reef 28 set as control, no manipulation has occurred. The most recent data (September 2013) is not available for analysis at this time.



Reef 29 data showing individual alien invasive species (AS- *Acanthophora specifera*, GS- *Gracilaria salicornia*, KE- *Kappaphycus/Eucheuma spp.*); time of mechanical removal (dashed lines). Notice the increase of KE/GS without the addition of urchins upon completion of removal. A second removal effort is in process and urchins will be outplanted to this reef as they become available.

Outreach

AIS team participated in Ben Parker Elementary School's Science Night. The booth had an interactive invasive algae display and urchins for the visitors to see and touch. The focus was on invasive algae and the impacts on the coral reefs in Kaneohe Bay. Also, there were brochures on reef health, invasive algae, and fishing regulations for the parents to take with.

The AIS team participated at the Ocean Expo. This public event targeted ocean and fishing enthusiasts. The booth had an information display, invasive algae samples, juvenile urchins, a Super Sucker video, brochures, and an interactive activity for kids.

The Urchin Hatchery Manager brought hatchery urchins to the Waikiki Aquarium's Ocean's Day. This family-friendly event had hands on educational displays and showcased more than 20 city, state, and federal agencies that are aimed to preserving and protecting Hawaii's environment. There was an emphasis on the Island's unique water resources from mauka to makai.

The AIS team co-hosted a field day for 8th grade science classes from Punahou Schools with Kako'o 'Oiwi. First, the students helped remove invasive algae from the fringing reef flats. Then, the removed algae and the students went to Kako'o 'Oiwi wetland where the students had an opportunity to see how the removed algae is incorporated throughout the wetland and in the loi patches. The students had an opportunity to restore the cultural connection between the land and the community and help develop local, sustainable projects.

The AIS team participated in a family friendly Earth Day event at the Windward Mall coordinated by The Nature Conservancy. The booth had an information display, invasive algae samples, juvenile urchins, a Super Sucker video, brochures, and an interactive activity for kids. AIS intern also participated in an Earth Day event held on Pearl Harbor Naval Base. The event was open to the public. An informational display was brought to showcase the Super Sucker project and invasive algae impacts in Kaneohe Bay.

Obstacles and/or Delays

The Field team was terminated from early May through the middle of July, and the Monitoring team for the first half of July due to funding issues, so no removal or monitoring took place at that time. Because changes in hires were made to both teams upon return, there has been a delay in returning to normal operations prior to termination due to necessary training and information gathering.

The layoff of the Field Team also had significant detrimental effects on the hatchery. The hatchery staff had to limit broodstock collection to inshore areas where broodstock appear to be of lower quality. The mid-cycle crash that occurred in the hatchery may have been due to several factors. Renovations in the algae room may have caused changes in the quality of the phytoplankton. Those changes may cause rapid tank fouling or the introduction harmful microorganisms. Broodstock quality may have affected larval performance. Lack of filter maintenance seems a likely culprit. All of these factors, and their causes, have since been remedied or addressed for the time being.

Adaptive Management

While the first full scale removal of algae was completed on Reef 29 in January, no urchins were added to this reef until August because urchins were needed on Reefs 26 & 27. It was necessary to fully stock Reefs 26 & 27 to the target density of $\sim 2/m^2$ and due to some natural mortality, this required supplemental urchins to maintain the density near the $2/m^2$ target.

Along with oversight from the Nature Conservancy, cage trials continue by a graduate student from Hawaii Pacific University to answer questions about the optimal stocking density, outplant size differences, and coral recruitment. The cage trials will continue through December of this year and analysis of the results will help to properly stock this reef with the correct density of urchins.