

# Aquatic Invasive Species Program

## 2017 Accomplishment Report



# **Aquatic Invasive Species Program 2017 Annual Report**

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**Department of Land and Natural Resources,  
Division of Aquatic Resources**

**In Cooperation with**

**The Pacific Cooperative Studies Unit**

**And**

**The Hawai'i Coral Reef Initiative**



## Aquatic Invasive Species Program

### Aquatic Invasive Species Control

- Treated nine patch reefs in Kāneʻohe Bay covering ~1.5 acres
- 406,536 urchins outplanted since 2011
- *Salvinia molesta* removal pilot project Kilauea Stream, Kauaʻi



### AIS Monitoring and Planning

- Conducted AIS Surveys, around Oʻahu, Kauaʻi, Maui and Molokaʻi
- Heʻeia NERRS Watershed Restoration Monitoring



### Ballast Water & Hull Fouling Coordination

- Performed biofouling inspections on 6 vessels via ROV or Scuba
- Performed 8 ballast water compliance inspections with USCG
- Conducted Alien Aquatic Organism Task Force Meeting to acquire input on ballast water amendments



### Rapid Response and Marine Debris

- Responded to Japanese tsunami debris reports and sampled potential AIS for analysis
- Responded to grounding of F/V Pacific Paradise



### Outreach

- Featured on local Hawaiian broadcasts highlighting invasive species and marine debris
- Featured on National Geographic show Weird but True
- Participated in community events, science fairs, professional conferences, & workshops



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**Acronym List**

- AAOTF – Alien Aquatic Organism Task Force
- AIS – Aquatic Invasive Species
- ANS – Aquatic Nuisance Species
- CGAPS – Coordinating Group on Alien Pest Species
- CRCP – Coral Reef Conservation Program
- DAR – Division of Aquatic Resources
- DLNR – Department of Land and Natural Resources
- DJ funds – Dingell-Johnson/Wallop Breaux Act
- DOH – Department of Health
- DOT – Department of Transportation
- eDNA – Environmental DNA
- FWS – U.S. Fish and Wildlife Services
- HDOA – Hawai‘i Department of Agriculture
- HISC – Hawai‘i Invasive Species Council
- MLCD – Marine Life Conservation District
- MCTAB – Marine Corp Training Area Bellows
- NPS – National Park Service
- NOAA – National Oceanic and Atmospheric Administration
- OCCL – Office of Conservation and Coastal Lands
- ORMP – Ocean Resource Management Plan
- TNC – The Nature Conservancy
- USCG – U.S. Coast Guard



## Introduction

The Division of Aquatic Resources (DAR), Aquatic Invasive Species (AIS) Program is committed to managing AIS threats to Hawai'i with the goal to minimize the ecological, economic, and human health impacts of AIS through the prevention and management of AIS introduction, expansion, and dispersal into, within and from Hawai'i (State of Hawai'i Aquatic Invasive Species Plan 2003). The DAR, AIS program's focus areas include:

- Invasive algae management and control in Kāneʻohe Bay, Oʻahu
- Managing and operating the sea urchin hatchery
- Ballast water and hull fouling data gathering and policy development
- Prevention of AIS introduction and early detection
- Ecosystem monitoring
- Rapid response to AIS introductions, marine debris, disease outbreaks, coral bleaching, and other threats to Hawai'i's coral reefs
- AIS focused outreach, education, and community engagement
- AIS policy development
- Collaboration with fellow researchers, stakeholder, community groups and partners

This year (2017) has been very productive for the AIS Program, with a broad range of accomplishments including management and control work conducted in Kāneʻohe Bay, aquatic invasive species monitoring on Oʻahu, Molokaʻi, Maui, and Kauai, ballast water and hull fouling inspections, community engagement, and participation in state, national, and international conferences and workshops. This report summarizes the accomplishments of the AIS program in 2017 and lays out the program's direction for 2018.

## Invasive Algae Control, Monitoring, Rapid Response, Marine Debris, and Collaborative Partnerships

### Overview

Invasive algae control has been one of the primary management priorities of the DLNR-DAR Aquatic Invasive Species Program. The proliferation of introduced invasive algae throughout Kāneʻohe Bay poses a major threat to coral reef ecosystems. As a result, extensive invasive algae management has been conducted throughout the Bay over the past decade. Past efforts primarily included manual removal of algae by divers using the "Super Sucker" underwater vacuum system followed by a biocontrol technique of out-planting native sea urchins that were hatched and reared in the DAR Ānuenue Fisheries Research Center on Sand Island Oʻahu. Following the 2014 and 2015 warm water events, which lead to mass coral bleaching, the algae in Kāneʻohe Bay declined to levels too low for manual removal. Invasive algae still persist



throughout the Bay, but at levels effectively controlled by urchin grazers. Therefore, ongoing management efforts have shifted to urchin out-planting and herding.

The AIS team also carried out a wide range of ecosystem monitoring and response efforts throughout the state. Such as, a pilot project to detect the presence or absence of the invasive aquatic plant *Salvinia molesta* using eDNA (environmental DNA) was successfully implemented on multiple streams along the windward side of Kauaʻi. *S. molesta* removal techniques using the “Super Sucker” were tested on the Kilauea Stream, Kauaʻi in October of 2017.

Additionally, the AIS team served as the main rapid response dive team responding to unexpected events including invasive species reports (*Avrainvillea amadelpha* expansion in Kāneʻohe Bay and Ewa), marine debris, and ship groundings. The AIS team’s experience and ongoing efforts contributed to a wide range of steering committees, workshops, and trainings focusing on AIS and marine resource management.

## 2017 Key Accomplishments

- Out planted 16,136 hatchery raised juvenile sea urchins to reefs in Kāneʻohe Bay, totaling 406,536 urchins out planted since inception in 2011
- Treated invasive algae on nine patch reefs Kāneʻohe Bay, totaling approximately 1.5 acres
- Conducted AIS surveys and control methods in Kāneʻohe Bay, Maunalua Bay, Eastside Oʻahu , Kauaʻi, Molokaʻi, and Maui
- Coordinated, sampled, and cataloged Japanese Tsunami Debris landings
- Hosted conference field trips, outreach activities, and multiple presentations at the Hawaiʻi Conservation Conference

## 2017 Activity Highlights

### Hatchery Improvements and Advancements

- Upgraded and improved microalgae systems to address persistent larval mortalities
- Continued to supply urchin larvae and technical support to HPU Graduate Students investigating urchin larval diets
- Continued to supply early stage larvae and gametes to Chaminade University developmental biology course for DNA extraction
- Continued to supply larval stage subsamples to Chaminade University for future use in lipid profiling study
- Initiated study through The University of Hawaiʻi at Mānoa, *Seasonal and lunar patterns of gametogenesis and spawning in the collector urchin Tripneustes gratilla*. The study will run from August 2017 – July 2018

### Flattery Restoration Plan

- Completed stocking urchins on all previously prioritized reefs



- Annual monitoring of prioritized reefs and Marker 12
- Fringing and barrier reef AIS assessments for potential urchin out-plantings
- Pilot study of corals of opportunity reattachment in response to vessel groundings
- Feasibility proposal for Heʻeia watershed restoration

### **Kāneʻohe Bay Ecosystem Monitoring**

- Completed annual monitoring of permanently fixed study locations
- Assisted researchers in the 2017 Smithsonian Institute Marine Geo Hawaiʻi Census in Kāneʻohe Bay to identify and catalog as many species as possible
- Adopted and implemented a new technique developed by the Scripps Institute for monitoring coral coverage using photo-mosaics

### **Marine Debris and Rapid Response:**

- Responded to the vessel grounding F/V Pacific Paradise off Waikīkī
- Monk Seal pup habitat relocation assessment and marine debris removal
- Responded to Japanese Tsunami Debris and sampled AIS for analysis
- Responded to and removed a large fishing net from Reef 13 in Kāneʻohe Bay
- Responded to a community report of urchin removals in Kāneʻohe Bay

### **Other Projects**

- Conducted benthic habitat mapping in Waikīkī MLCD as a proposed mitigation site for the new Kapalama Fuel Terminal Expansion
- *Avrainvillea amadelpha*
  - Completed expansion mapping surveys on the east shore of Oʻahu from Chinamanʻs Hat to Punalu`u
  - Re-surveyed Maunalua Bay to monitor previous removal efforts and document current AIS distributions
  - Performed Dry and Wet weight analysis from Maunalua Bay to estimate current and historic biomass distributions
- *Salvinia molesta*
  - Partnering with the Oceanic Institute, an eDNA pilot project was conducted and proved successful for use as a rapid detection technique
  - Investigated control methods using the Super Sucker to remove *S. molesta* on the Kilauea River, Kauaʻi
- Participated in benthic and reef fish surveys on Kauaʻi and Maui
- Documented and relocated harbor corals with the coral nursery in Kāneʻohe and Waianae





- Completed final round of AIS surveys on Southern Molokaʻi in collaboration with the community and various agencies
- Conducted Hull fouling surveys of the traditional Hawaiian/Polynesian voyaging canoes on Kalaupapa Molokaʻi with the National Park Service
- Participated in estuary invasive fish species cast net surveys on Oʻahu
- Deployed temp loggers in Kāneʻohe Bay at coral reattachment sites
- Ran risk analysis on Nile tilapia

### Interagency Cooperation

- AIS advisory for the Kapalama Container terminal expansion project continued from 2016
- Participated in shipworm surveys in harbors on Oʻahu
- Conducted SCUBA site assessment surveys in collaboration with NOAA for placement of a coral nursery module following vessel groundings
- Conducted follow up surveys at the Cape Flattery Grounding site with NOAA and FWS
- Assisted USFWS with Marine Corp Base Training Area Bellows, Oʻahu with benthic ecological surveys
- Continued DAR and The Nature Conservancy (TNC) Kāneʻohe Bay Coordination Meetings
- Marine Corp Base Kāneʻohe *Gracilaria salicornia* removal from sea plane ramps with TNC
- Provided testimony for import of Nile tilapia to HDOA
- Lehua Island Monitoring advisory
- Hawaiʻi Institute of Marine Biology
  - Participated in Kāneʻohe Bay Coral Reef Assessment and Monitoring (CRAMP) surveys
  - Presented ship grounding presentation to UH Marine Biology Class, and facilitated a grounding survey and damaged coral stabilization project
- Partnered with NOAA to conduct Kāneʻohe Bay coral and AIS projects with visiting Hollings Scholars

### Reports and Publications

- Cape Flattery Settlement Restoration Project: Restoring Reefs in Kāneʻohe Bay” Bi-annual report
- Mitigation Bank Final Report
- Kapalama Mitigation Proposal
- Molokaʻi Mapping Report
- Heʻeia Watershed Restoration Proposal



- “Mapping coastal marine debris using aerial imagery and spatial analysis” Published in Marine Pollution Bulletin, 20 December 2017
- “Herbivore biocontrol and manual removal successfully reduce invasive macroalgae” (accepted in-review MEPS)

## Presentations

- Hawai‘i Conservation Conference – 5 different posters presented
- Western Regional Panel annual conference presentation
- Co-chair of sea urchin session at World Aquaculture 2017 conference in Cape Town, South Africa
  - Presented lecture on urchin hatchery methods and urchin biocontrol

## Steering, Committees, Workshops, and Trainings

- Participated in a NOAA sponsored ESRI ArcGIS Training
- Participated in Evidence Collection Training for vessel groundings
- Participated in NEBA (Net Environmental Benefit Analysis) Oil Spill Preparedness and Response Workshop
- Participated in a group Facilitation training workshop
- Microsoft Access Database training
- Participated in a NOAA sponsored Scripps Institute photo mosaic workshop
- Ballast Water Hull Fouling Steering Committee
- He`eia Science to Management Symposium
- Symposium on West Hawai‘i Marine Ecosystem
- Participated on steering committee for Western Regional Panel
- Participated on steering committee CGAPS
- Participated on steering committee for Hawai‘i 30 x 30 Ocean Management Initiative
- AAOTF Task Force Meeting
- HDOA subcommittee

## Staff

### AIS Team

- AIS Lead Aquatic Biologist IV promoted to DAR Program Manager
- Temporary assignment of AIS Aquatic Biologist III to Aquatic Biologist IV
- Completed the replacement hiring of two staff for the Kāne`ohe Bay Restoration Project funded through the Cape Flattery Settlement:
  - Replaced Kāne`ohe Bay Monitoring Coordinator
  - Replaced Kāne`ohe Bay Reef Habitat Monitoring Technician
- Converted one Fishery Technician IV position from temporary to permanent civil service
- Began groundwork for the AIS strategic Plan in 2018



## Hatchery Team

- Senior AIS Hatchery Technician resigned. New hire pending
- Hosted Kupu intern Justine Sheu (Oct 2016 – Aug 2017)
- Hosted Kupu intern Devon Aguiar (Oct 2016 – Aug 2017)
- Hosting Kupu intern Deanna Young (Oct 2017 – Aug 2018)

## Grants

- ANS Grant \$48,000
- OCCL Trust Funds (*Salvinia* Project)
- HISC Grant
- CRCP Grant

## 2018 Priorities

### Kāne`ohe Bay Restoration

- Continue invasive algae control on patch reefs and begin urchin control on fringing reefs
- Pilot *Avrainvillea amadelpa* removal project
- Continue coral reattachment projects
- Translocate coral deemed hazards to vessel safety within docks in He`eia Small Boat Harbor

### AIS Control and Management

- Continue running risk analysis for key species
- Collect eDNA samples of Kaua`i's perennial streams for *Salvinia molesta* detection
- Continue building on Hawai`i AIS Database
- Continue analysis of invasive algae in Maunalua Bay and complete report

### Staff

- Complete the hiring process for Aquatic Biologist IV position

### Program Development

- Develop the AIS strategic Plan



## Ballast Water and Hull Fouling Coordination

### Overview

The number of aquatic non-indigenous species (NIS) established in the State of Hawai'i is nearly equivalent to the Continental US States combined – 400 vs. 450 NIS, respectively. Up to 78% of the marine NIS of algae and invertebrates were unintentionally introduced through ballast water and vessel biofouling. NIS threaten Hawai'i's environmental and socioeconomic health for current and future generations; therefore, management of top vectors of NIS transfer into the State and among neighboring islands is imperative. Hawai'i State's Ballast Water and Hull Fouling Program is currently in development to achieve goals and objectives identified in the Hawai'i Interagency Biosecurity Plan and the Hawai'i Ocean Resources Management Plan. The program is heavily focused on preventative measures including developing or optimizing legislation for managing both sources of NIS transfer, conducting biosecurity risk assessments of commercial vessels, creating enforcement standard operating procedures, and monitoring current and newly established NIS.

### 2017 Key Accomplishments

- In coordination with Dr. Kim Peyton, developed an operable multi-purpose laboratory used for macro- and micro-organism investigations, equipped with epifluorescence microscopy capabilities
- Collaborated with Marisco representatives to minimize biosecurity risks associated with the arrival of their dry-dock and the heavy-lift ship which carried the dry-dock from Asia to Hawai'i
- Collaborated with Pacific Shipyards representatives to minimize biosecurity risks associated with the arrival of their dry-dock and heavy-lift vessel operations
- Completed verification study of the Ballast Check 2 against epifluorescence microscopy counts, a rapid assessment tool designed to measure ballast water compliance to be published on Turner Designs website
- Monitored water quality and plankton concentration in Honolulu Harbor, Kewalo Basin, and Rainbow Harbor on O'ahu in light of the pending amendment to Hawai'i Administrative Rules (HAR) §13-76-19 related to inter-island management of ballast water discharge
- Provided two introductory training sessions to USCG personnel on >50um Zooplankton and 10-50um Phytoplankton Enumeration

### 2017 Activity Highlights

#### Ballast Water (BW) Monitoring and Policy

- Performed 8 ballast water compliance inspections in coordination with the USCG



- Reviewed Washington’s 7-year Ballast Water Strategic Plan
- Conducted an Alien Aquatic Organism Task Force Meeting with stakeholders to acquire input on ballast water amendments
- Collaborated with the DAR Administrator, DLNR Chair, Hawai’i Attorney General’s Office, Congressional Delegates representing the State, and Pacific Regional State Partners to address the Commercial Vessel Incidental Discharge Act (a federal bill that preempts States’ rights to manage vectors of aquatic non-indigenous species transfer associated with ballast water and vessel biofouling)

### **Biofouling (BF) Monitoring and Policy**

- Performed biofouling inspections on 6 vessels via ROV or SCUBA
- Reviewed regulatory documents for New Zealand’s Ministry for Primary Industries
- Investigated regulatory and technical documents by countries and states that possess biofouling regulations in an effort to begin developing Hawai’i’s biofouling regulations; the government agencies that possess these documents include New Zealand’s Ministry for Primary Industries, Australia’s Department of Agriculture and Water Resources, California State Lands Commission, Western State Department of Fisheries
- Worked in coordination with the CGAPS Legal Fellow to develop an interim solution to the ban on in-water cleaning activities in commercial harbors

### **Regional Working Groups**

- Washington Ballast Water Working Group
- Western Regional Panel Coastal Committee
- Hawai’i Invasive Species Council
- Hawai’i Ocean Safety Team
- Hawai’i Harbor’s User Group
- Coordinating Group on Alien Pest Species
- California State Lands Commission

### **Community Activities**

- Created a Ballast Water and Biofouling outreach pamphlet for the general public
- Participated in the Smithsonian Marine Geo survey
- Provided a briefing to the Pacific Invasive Partnership on the development of Hawai’i’s Ballast Water and Biofouling Program
- Participated as a presentation judge for various Hawai’i Conservation Conference talks
- Contributed to the ORMP Dashboard
- Provided edits/comments to Hawai’i Interagency Biosecurity Plan Progress Report 2017



## Presentations

- Hawai'i Invasive Species Council Brown Bag (3/2/17) – Curbing Aquatic Alien Species Transfer to Hawaii by Regulating Ballast Water and Vessel Biofouling
- Pacific Ballast Water Group Meeting (4/12/17) – Regulating Vessel Biofouling and In-Water Cleaning in Hawai'i
- Pacific Ballast Water Group Meeting (4/12/17) – Hawai'i Ballast Water Rules, Standards, Current Analysis
- Australian Collaboration Workshop (6/13/17) – Managing Commercial Vessel Biofouling Biosecurity Risks in Hawai'i
- Australian Collaboration Workshop (6/13/17) – Hawai'i's Vessel Biofouling Survey
- Australian Collaboration Workshop (6/14/17) – Hawai'i's In-water Cleaning Survey
- Hawai'i Conservation Conference (7/6/17) - Emerging In-Water Hull Cleaning Technologies and Policies can Significantly Reduce the Biosecurity Risks Associated with In-Water Hull Husbandry
- Hawai'i Conservation Conference (7/17/17) – What Biosecurity Risk Assessment Tools are Being Considered for Aquatic Invasive Stowaways in Ballast Tanks and Attached to Ship Hulls?
- Alien Aquatic Organism Task Force Meeting (8/16/17) - Preventing AIS Introductions into Hawai'i through Collaboration
- ANZPAC Biofouling Management for Sustainable Shipping (9/13/17) – Domestic vessel biofouling management to minimize AIS transfer in the Hawaiian Archipelago
- Western Australia Department of Fisheries Meeting (9/18/17) – Addressing Vessel Biofouling in Hawai'i
- Hawai'i Ocean Resources Management Plan Meeting (11/9/17) – Proactive Management of Biosecurity Risks Related to Commercial Shipping
- USCG Meeting (11/14/17) – Proactive Management of Biosecurity Risks Related to Commercial Shipping

## Grants

- Hawai'i Invasive Species Council FY18 grant awarded
- U.S. Fish and Wildlife Service Aquatic Nuisance Species FY17 grant awarded

## Staff

- Completed the hiring of one Kupu intern
- Completed the hiring of one 89-day hire technician
- Collaborate with CGAPS Legal Fellow



## 2018 Priorities

### Ballast Water (BW)

- Analyze data reported on DLNR BW Reporting Forms 2017 to examine Hawai'i's shipping profile and evaluate level of compliance
- Develop biosecurity risk assessment matrix for overseas commercial vessels
- Develop standard operating procedure for conducting ballast water discharge compliance inspections
- Develop standard operating procedure for conducting proper sample collection and enforcement for ballast water discharge
- Amend Hawai'i State Ballast Water Rules (Ch. 13-76) to mandate interisland management of ballast water discharge for protecting neighbor islands
- Continue to conduct ballast water compliance inspections in coordination with the US Coast Guard on commercial ships capable of discharging large volumes of ballast water into State navigable waters

### Vessel Biofouling (BF)

- Develop measurable BF compliance standards for vessels arriving to Hawai'i
- Develop biosecurity risk assessment matrix for overseas commercial vessels
- Develop biosecurity risk assessment matrix for domestic vessels
- Develop permitting system with DOH, DOT, and other stakeholders to allow in-water management of vessel microfouling in commercial harbors
- Test vessel in-water cleaning technology to identify best available technology and best management practices for managing ship macrofouling
- Develop permitting system with DOH, DOT, and other stakeholders to allow in-water management of macrofouling in commercial harbors
- Develop standard operating procedures for conducting vessel biofouling inspections
- Develop standard operating procedure for conducting proper sample collection and enforcement for underwater BF inspections

### Other Projects

- Continue providing outreach and education on the subject of biosecurity concerns associated with BW and BF
- Continue developing BW and BF reporting form database
- Continue to develop the multi-purpose laboratory at AFRC
- Continue conducting stakeholder meetings with industry groups, federal agencies, state agency partners, scientists, and groups representing Hawaiian culture, to find workable solutions for managing these vectors



- Continue working with the DAR Administrator, DLNR Chair, Hawai'i Attorney General's Office, and Pacific Regional State Partners to address the Commercial Vessel Incidental Discharge Act

## Staff

- Add Fishery Technician IV civil service position to Ballast water and Hull fouling team

## Outreach and Community Engagement

### Overview

The AIS, Urchin Hatchery, and BW/BF teams participated in a variety of outreach and community engagement events in 2017. Events were aimed towards local community members, resource managers, researchers, students, and the general public. The teams also distributed outreach materials in order to better communicate AIS issues to Hawai'i's aquarium trade retail shops.

### Key Accomplishments

- Featured in multiple local Hawai'i news stories
- Participated in a variety of local outreach events and campaign

### 2017 Activity Highlights

- Featured on local Hawaiian news highlighting AIS and urchin hatchery
  - The Garden Isle News article
  - KHON News Report
  - Hawai'i Public Radio Interview
- Hosted field trips for international conference
- Featured on National Geographic show 'Weird But True'
- Waikalua Loko algae removal community work days
- Hunting and Fishing Day
- Waikiki Aquarium – "Circus Under the Sea"
- Build a Better World Conservation Mini-Fair and Summer Reading Finale – Hawai'i State Library
- World Oceans Day- Mohala I Ka Wai
- Moloka'i Earth Day
- Ocean Expo
- Hawai'i Invasive Species Awareness Week – Tamarind Park
- Fall in Love with Science – Bishop Museum





- Cooperated in the publication of the NOAA video, *How Tiny Sea Urchins are Saving Kāne`ohe Bay*
- Hosted urchin hatchery tours for HPU Marine Invertebrate Class, Hanauma Bay Volunteers, staff of the Hyperbaric Treatment Center and various NOAA staff
- Donated urchins to the Waikīkī Aquarium for display and tank maintenance

## **2018 Priorities**

- Continue to engage community members and groups, stakeholders, resource managers, rule makers, keiki and students regarding AIS issues
- Continue serving on steering committees and working groups for AIS and aquatic resource conservation initiatives in Hawai`i

