

An underwater photograph showing the dark hull of a ship on the left. Two divers in full scuba gear are visible; one is in the foreground, slightly to the right, and another is further back. The water is a clear, deep blue. In the upper right, there are some mechanical components, possibly part of a pump or propeller system, with propellers visible.

# Hawaii Ballast Water and Biofouling Program

August 26<sup>th</sup>, 2019

Hawaii Invasive Species  
Council Brown Bag Series

Jules Kuo, M.Sc.

Ballast Water and Hull Fouling  
Coordinator





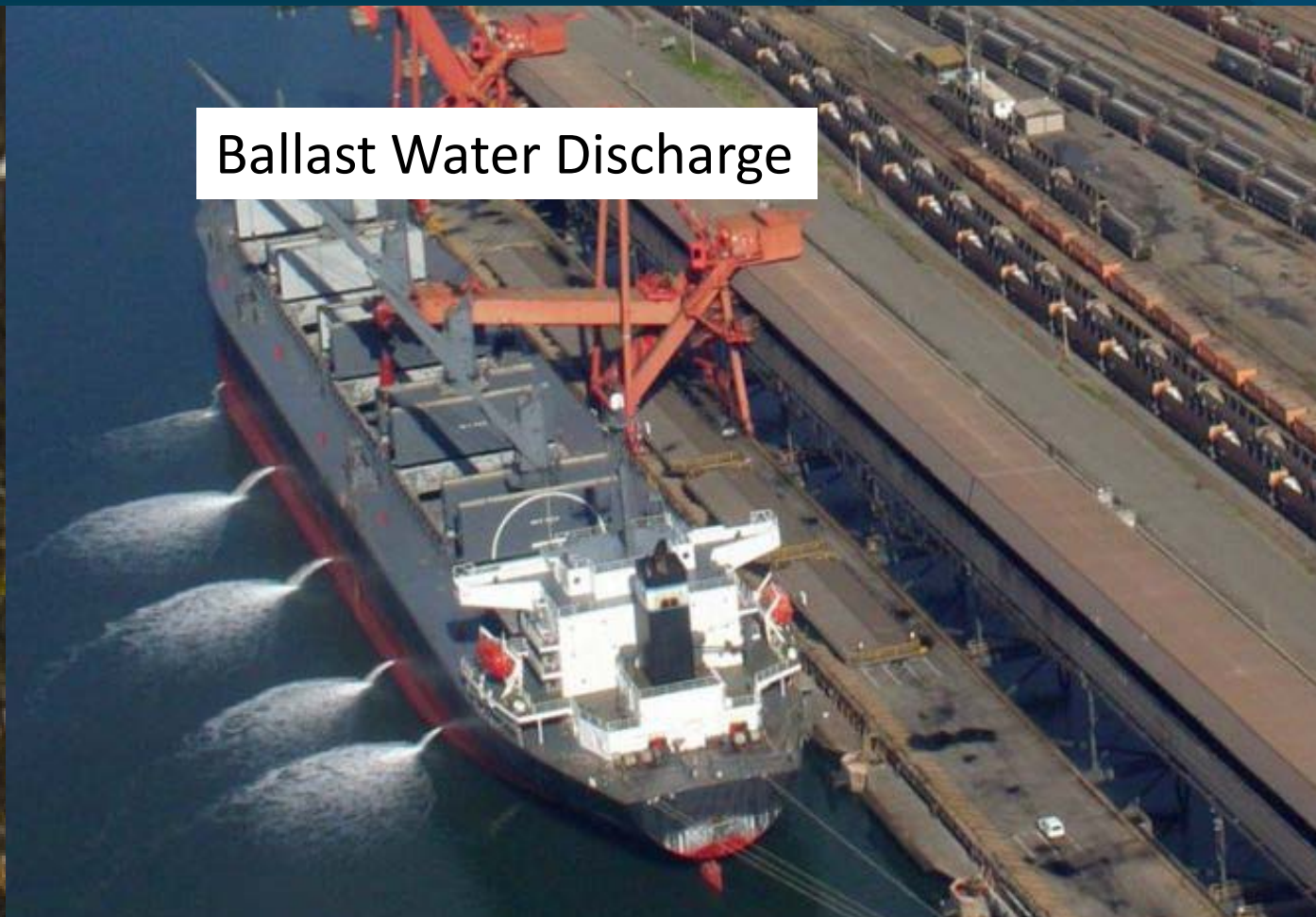
# Division of Aquatic Resources

## Department of Land & Natural Resources

Vessel Biofouling



Ballast Water Discharge



**Ballast water and vessel biofouling is associated with 78% of marine invertebrate and algae alien species established Hawai'i (Eldredge and Carlton 2009, Davidson et al., 2014)**



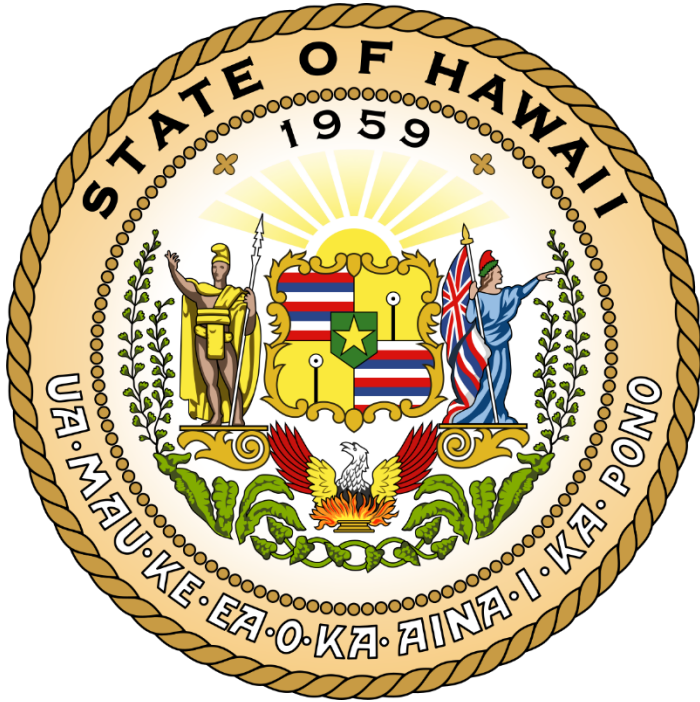
# Fishing Vessels and Small Boats Also Responsible for Marine Alien Introductions and Intra/Inter Island Transport





# Division of Aquatic Resources

## Department of Land & Natural Resources



## Hawaii Revised Statutes

### TITLE 12. CONSERVATION AND RESOURCES

#### 187A. Aquatic Resources

**187A-32 Alien aquatic organisms; lead agency; rules.**

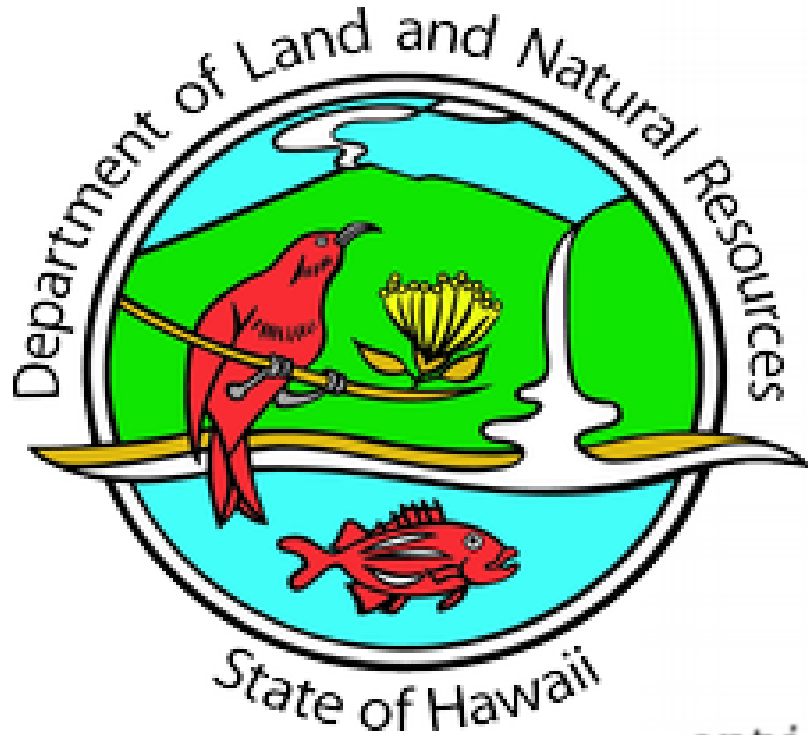
[L 2000, c 134, pt of §2]





# Division of Aquatic Resources

## Department of Land & Natural Resources



DEPARTMENT OF LAND AND NATURAL RESOURCES

Adoption of Chapter 13-76  
Hawaii Administrative Rules

August 10, 2007

### SUMMARY

Chapter 13-76, Hawaii Administrative Rules,  
entitled "Non-Indigenous Aquatic Species", is adopted.





# Division of Aquatic Resources

## Department of Land & Natural Resources

### Ballast Water Management Report

OMB number 1625-0069  
Exp. date: 31-Dec-2018

#### Vessel Information

Vessel name			
ID number	IMO number		
Country of Registry	Select country		
Owner/operator			
Type	Select vessel type	Gross Tonnage	
Ballast water volume units	cubic meters		
Total ballast water capacity	cubic meters	Number of tanks on ship	0
Onboard BW Management System			

#### Voyage Information

Arrival port (port and state)	Select state		
Arrival date			
Last port (port and country)	Select country		
Next port (port and country)	Select country		
Total ballast water on board	cubic meters	Number of tanks in ballast	
		Number of tanks discharged	
Alternative BW management conducted, per instructions from COTP	<input type="checkbox"/>		

#### Certificate of accurate information

By checking this box, I attest to the accuracy of the information provided and that ballast water management activities were in accordance with the ballast water management plan required by CFR 151.2050(g). ☒

Responsible Officer's name and title			
Report type	New report		
Submitted by		Contact information	

#### Ballast Water History

On the following page(s), provide the ballast water history for each tank discharged into the waters of the United States or to a reception facility, en route to or at the arrival port. Vessels entering the Great Lakes or Hudson River (north of George Washington Bridge) from beyond the US EEZ must also provide the history for empty tanks that underwent alternative management.

Submit report via e-mail

Submit report on-line

## Hawaii State Ballast Water Risk Assessment

- Primary assessment
  - Pre-border ballast water report submitted 24 hours before vessel arrival
- Secondary assessment
  - Onboard verification of documentation and system logs
- Tertiary assessment
  - Ballast water and sediment sampling to ensure compliance with effluent standards





# Division of Aquatic Resources

## Department of Land & Natural Resources

### RISK MATRIX (GENERAL RISK)

Total of 20 points

Maximum Points (Highest Risk) ← → Least Points (Lowest Risk)

<b>Discharging Ballast</b>	<b>10 Points</b> Vessel is discharging ballast water into Hawaii State waters			<b>0 Points</b> Vessel is retaining ballast water or does not have ballast water on board		
<b>Reporting Form Compliance</b>	<b>5 points</b> Form not submitted to DLNR	<b>4 points</b> Ballast water information was incomplete	<b>3 points</b> NBIC and DLNR data did not match	<b>2 points</b> Form was not submitted 24 hours prior to arrival	<b>1 point</b> Vessel information was incomplete or inaccurate	<b>0 points</b> Ballast Water form was submitted on time and accurate
<b>“Flagged” Vessels</b>	<b>5 Points</b> Vessel was added to “flagged” list due to; multiple forms incomplete/late, hasn’t submitted reporting forms to DLNR or has not been responsive to DLNR email requests for inquiry			<b>0 Points</b> Vessel was not added to “flagged” list		





# RISK MATRIX (TANK RISK)

Analyzes up to 20 tanks for a total of 80 points

Maximum Points (Highest Risk) ← → Least Points (Lowest Risk)

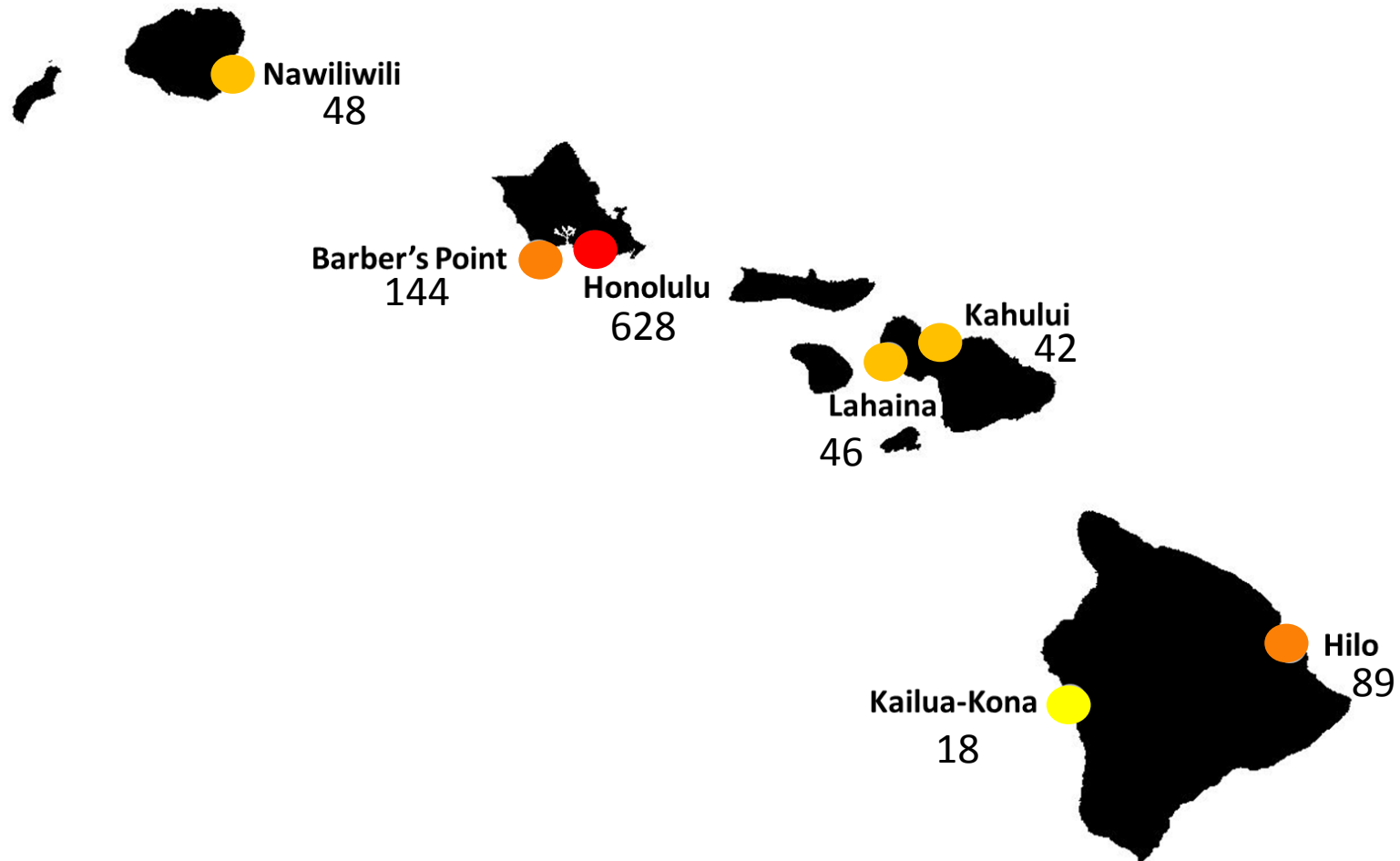
<b>Management System</b>	<b>2 Points</b> Tank was untreated and will be discharged into Hawaiian waters	<b>0 Points</b> Vessel is retaining ballast water or does not have ballast water on board	
<b>Tank Volume</b>  (Shapoori & Gholami, 2014)	<b>.5 Points</b> Tank volume is over 1,000 cubic meters	<b>.2 Points</b> Tank volume is between 100-1,000 cubic meters	<b>0 Points</b> Tank volume less then 100 cubic meters
<b>Tank Storage Time</b>  (Shapoori & Gholami, 2014)	<b>.5 Points</b> Tank storage time was less then 5 days	<b>0 Points</b> Tank storage time was longer then 5 days	
<b>Tank Water Source</b>  (Davidson et al., 2014)	<b>1 Points</b> Ballast water was obtained from a “high risk area”	<b>0 Points</b> Ballast water was not obtained from a “high risk area”	



# Division of Aquatic Resources

## Department of Land & Natural Resources

### Where Are Commercial Ships Arriving?



Total Arrivals in 2018=1021<sup>9</sup> vessels

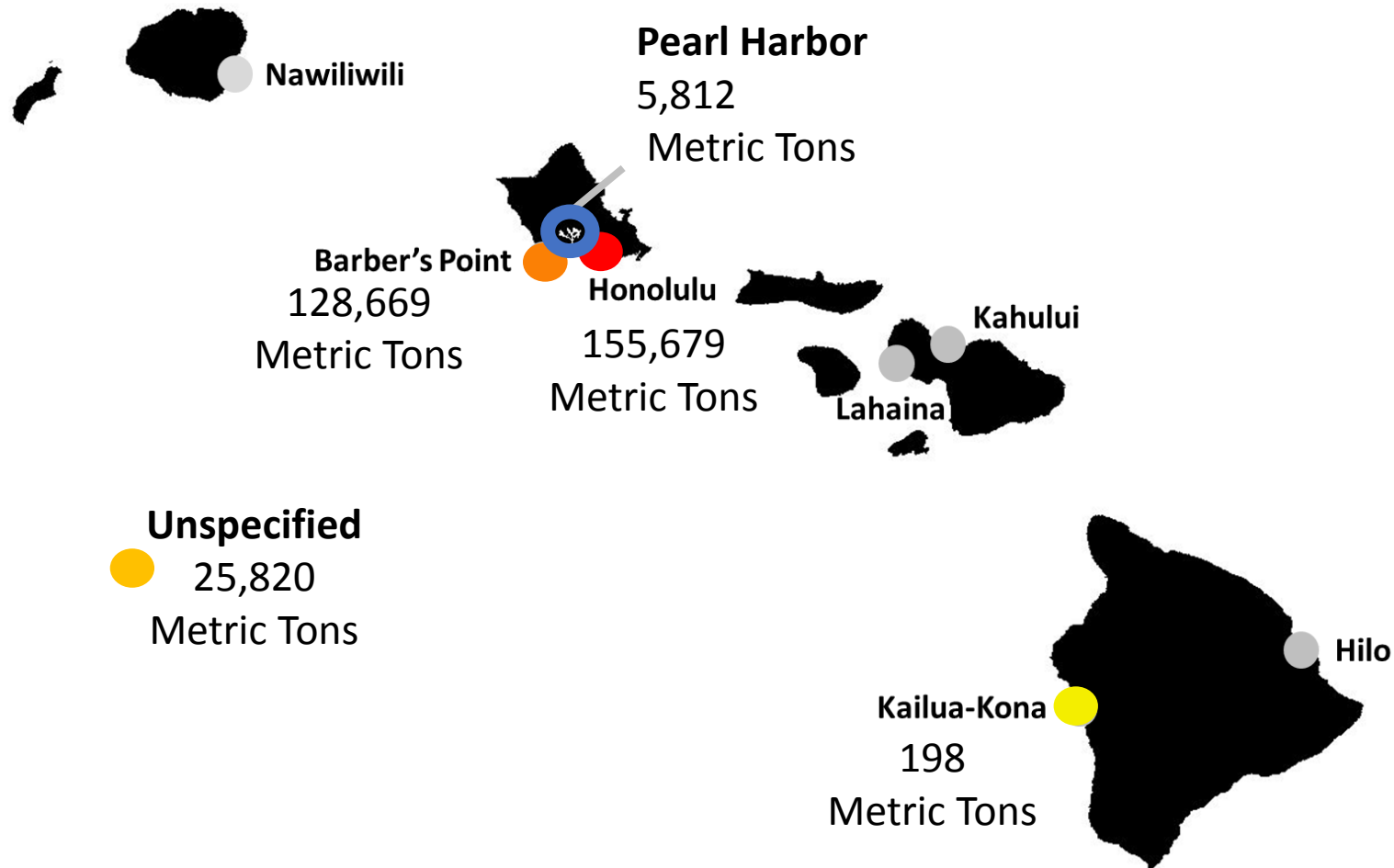




# Division of Aquatic Resources

## Department of Land & Natural Resources

### Volume of Ballast Water Discharged by Port



Olympic sized pool volume is 2500 Metric Tons

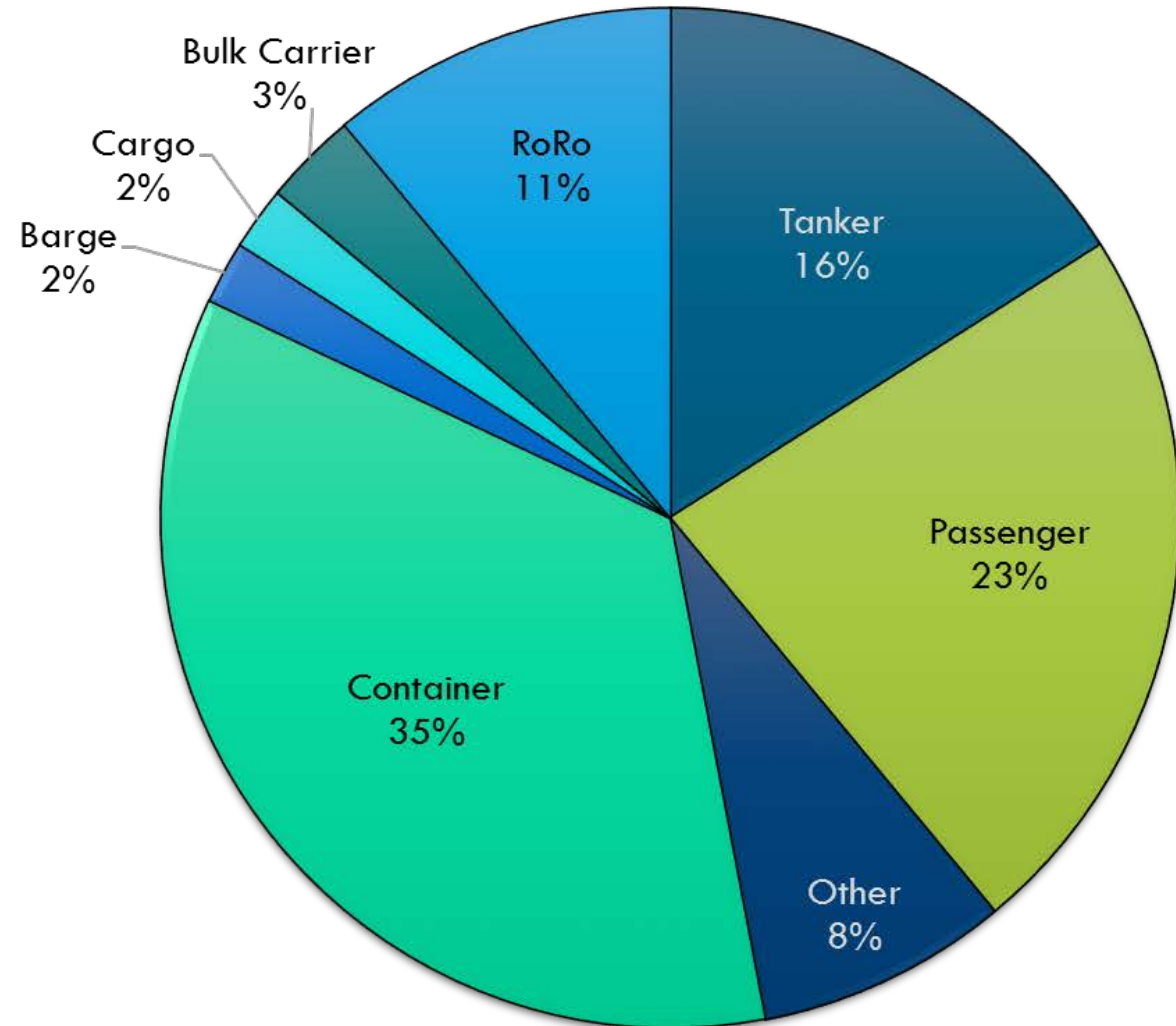
Total Ballast Water Discharge= 316,178 Metric Tons



# Division of Aquatic Resources

## Department of Land & Natural Resources

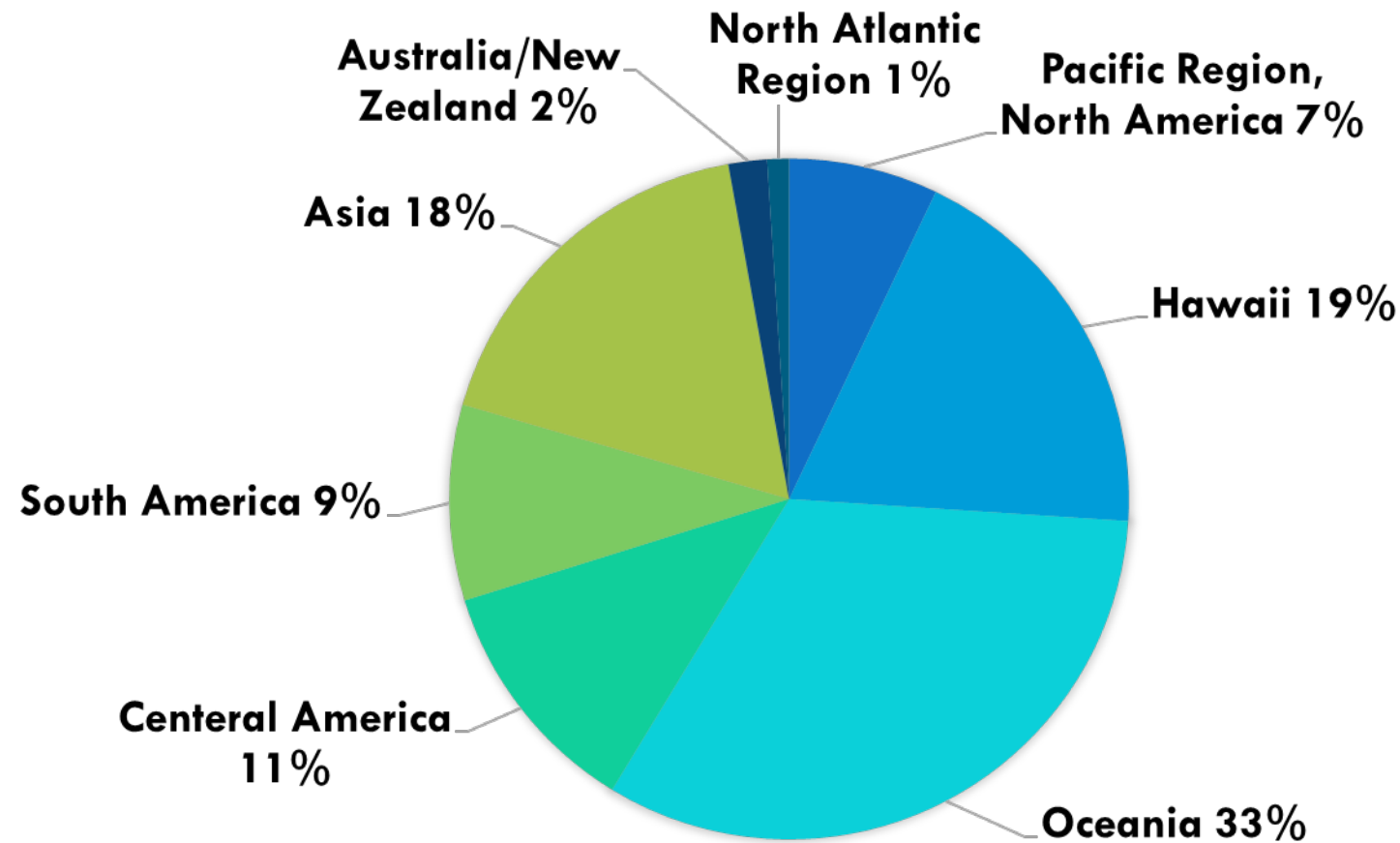
### Vessel Arrivals by Ship Type







# Ship Departure Locations Prior to Hawaii

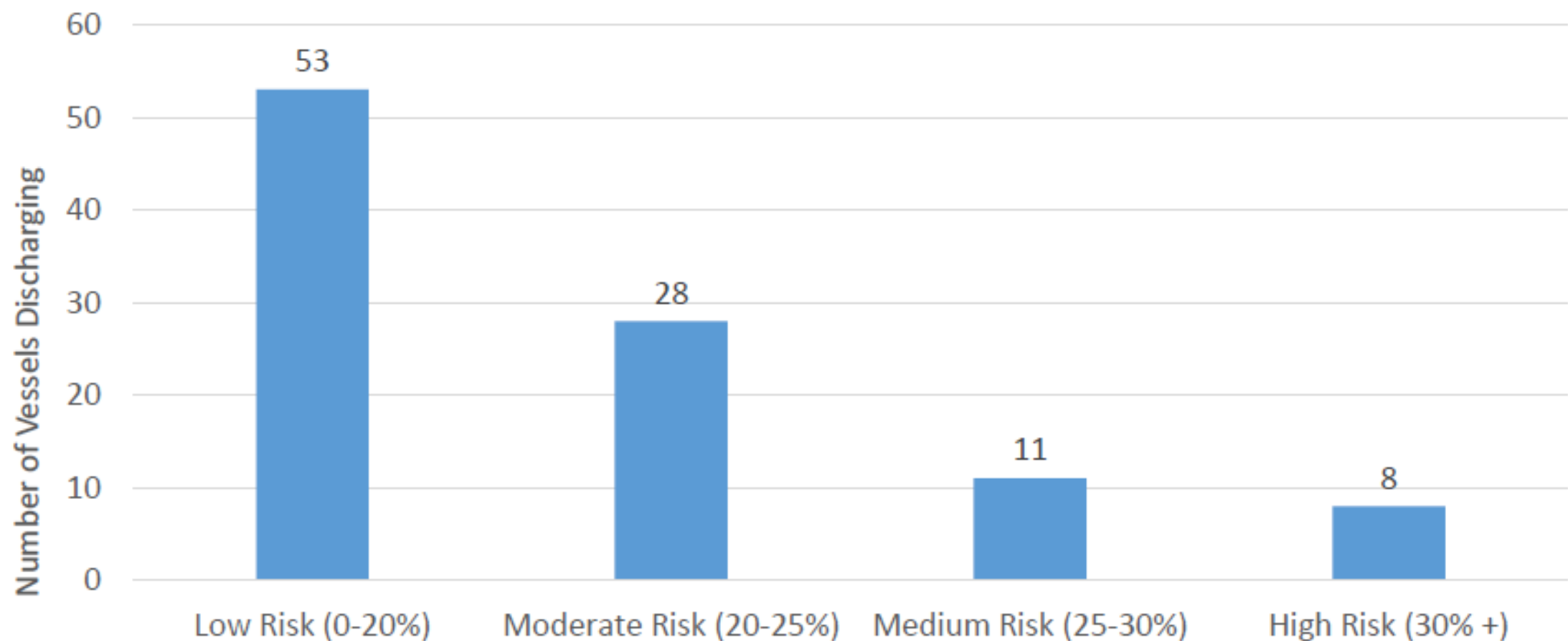




# Division of Aquatic Resources

## Department of Land & Natural Resources

### 2018 Data Risk Analysis



Risk categories

<sup>1</sup>  
Total Ships Discharged= 100





# Division of Aquatic Resources

## Department of Land & Natural Resources

# Hawaii State Ballast Water Risk Assessment



- Primary assessment
  - Pre-border ballast water report submitted 24 hours before vessel arrival
- Secondary assessment
  - Onboard verification of documentation and system logs
- Tertiary assessment
  - Ballast water and sediment sampling to ensure compliance with effluent standards



# Division of Aquatic Resources

## Department of Land & Natural Resources

# Hawaii State Ballast Water Risk Assessment



- Primary assessment
  - Pre-border ballast water report submitted 24 hours before vessel arrival
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  - Ballast water and sediment sampling to ensure compliance with effluent standards







Visiting Barry's clean vessel



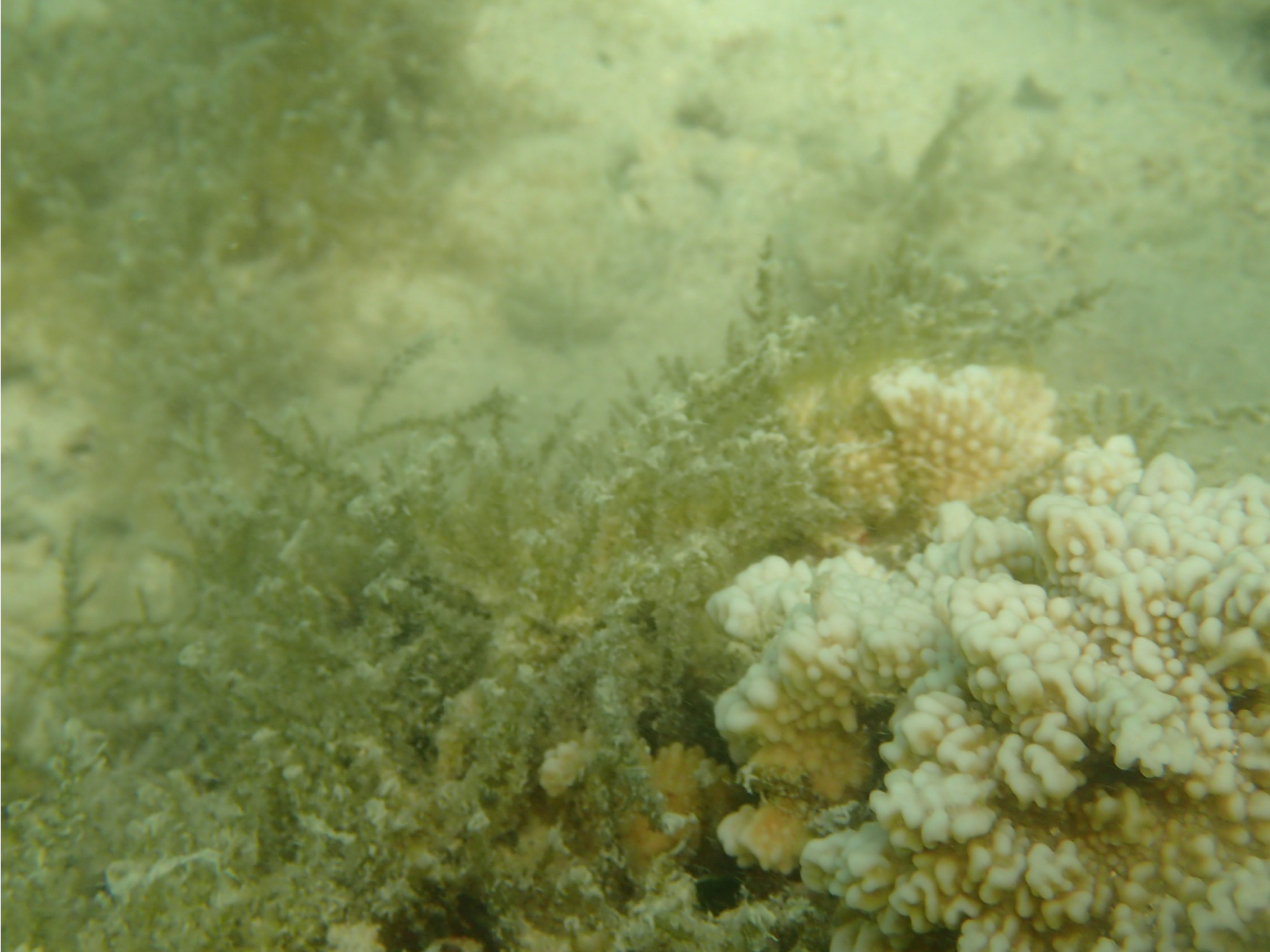


















# Hawai`i In-water cleaning (IWC) report

Zabin et al, 2017

- ~100 coastwise and foreign large vessels (commercial, military, yachts, fishing) vessels were cleaned in Hawai`i 2015
- Tools used include abrasive and non-abrasive; no IWCC tools were used



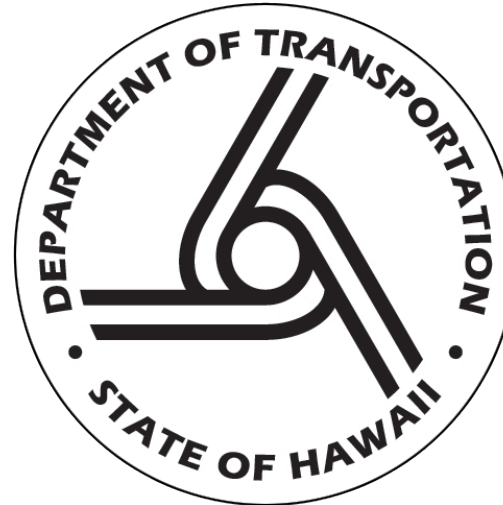
# Division of Aquatic Resources

## Department of Land & Natural Resources



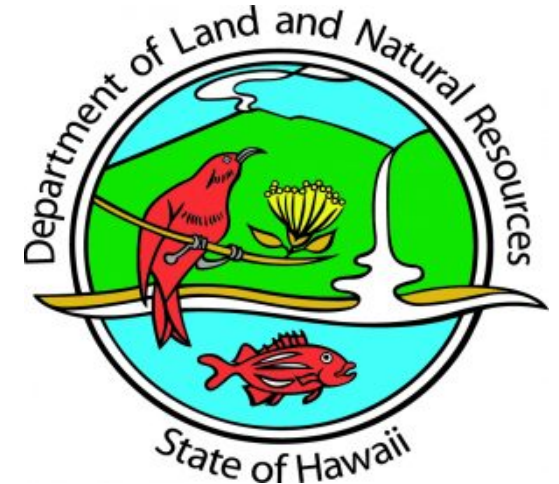
Hawaii Department of  
Health (DOH)  
**Clean Water Branch**

HRS Ch. 342D  
HAR Ch. 11-54



Hawaii Department of  
Transportation (DOT)  
**Harbors Division**

HRS 266-1  
HAR Ch 19-42-15



Hawaii Department of Land and  
Natural Resources (DLNR)  
**Division of Aquatic Resources**

HRS 187A-32  
HAR Ch13-76





# Division of Aquatic Resources

## Department of Land & Natural Resources

DAVID Y. SOE  
GOVERNOR OF HAWAII



HAWAII INVASIVE SPECIES COUNCIL  
1151 PUNCHBOWL ST., #125  
HONOLULU, HAWAII 96813

**VOTING MEMBERS**  
SUZANNE CASE  
DEPARTMENT OF LAND & NATURAL RESOURCES  
SCOTT ENRIGHT  
HAWAII DEPARTMENT OF AGRICULTURE  
KEITH KAWAOKA, DENV.  
DEPARTMENT OF HEALTH  
NICHOLAS CORDEIRO, PH.D.  
UNIVERSITY OF HAWAII  
LERO ABERNETHY  
OFFICE OF PLANNING, DEPARTMENT OF  
BUSINESS, ECONOMIC DEVELOPMENT &  
TOURISM  
DAVID RODRIGUEZ  
DEPARTMENT OF TRANSPORTATION

### DRAFT RESOLUTION 18-1

#### SUPPORTING EVALUATION AND IMPLEMENTATION OF BEST MANAGEMENT PRACTICES AND TECHNOLOGIES FOR VESSEL BIOFOULING MANAGEMENT AND COLLABORATION BY HISC AGENCIES IN THE DEVELOPMENT OF BIOFOULING MANAGEMENT REGULATIONS FOR HAWAII HARBORS

WHEREAS studies have shown biofouling on vessels to be an important means of transferring aquatic invasive species which, if established in new ecosystems, may pose threats to the environment, human health, property and resources; and

WHEREAS the Hawaii Interagency Biosecurity Plan 2017-2027 (Biosecurity Plan) recognizes that vessel biofouling has contributed between 35% and 78% of Hawaii's introduced and cryptogenic species and is ranked highest among all vectors of initial introduction in Hawaii; and

WHEREAS the Biosecurity Plan calls on the Department of Land and Natural Resources (DLNR), the Department of Health (DOH), and the Department of Transportation (DOT) to develop best ballast water and hull husbandry practices and proactive ballast water and hull cleaning standards for all nonmilitary vessels to minimize movement of AIS into Hawaii's ports, harbors, and marinas; and

WHEREAS Hawaii Revised Statutes section 187A-32 designates the DLNR as the lead state agency for preventing the introduction of alien aquatic organisms through the regulation of hull fouling organisms; and

WHEREAS the DOH is tasked with administering water pollution control regulations and enforcing water quality standards under Chapter 342D, Hawaii Revised Statutes; and

WHEREAS Hawaii Revised Statutes section 266-1 requires that all vessels and shipping within the commercial harbors and roadsteads of Hawaii shall be under the care and control of the DOT; and

RECOGNIZING that a high level of coordination between various state agencies will be required to develop and implement safe and effective measures for biofouling management in

biofouling removal technologies and have formally requested that Hawaii represent isolated tropical island climates for its program; and

WHEREAS, Chapter 194, Hawaii Revised Statutes, authorizes the Hawaii Invasive Species Council to advise and coordinate invasive species-related efforts with and between state, federal, international, and private programs, and to coordinate the State's position with regard to invasive species; now, therefore,

BE IT RESOLVED that the Hawaii Invasive Species Council recognizes that biofouling management in Hawaii's harbors is an important regulatory tool in preventing the introduction and spread of aquatic invasive species in Hawaii's harbors and nearshore waters; and

BE IT FURTHER RESOLVED that the members of the Hawaii Invasive Species Council direct relevant staff within their individual agencies to participate in an interagency team to review current findings and risk for the in-water cleaning of the slime layer on certain vessels, and create a process and conditions to allow low risk vessels to apply for an in-water cleaning permit; and

BE IT FURTHER RESOLVED that the Hawaii Invasive Species Council supports Hawaii's involvement in the Alliance for Coastal Technologies and the Maritime Environmental Resource Center's program for evaluating biofouling management technologies, including the addition of Hawaii as a study site for evaluation of these technologies; and

BE IT FURTHER RESOLVED that the Hawaii Invasive Species Council supports implementing evaluated best management practices and technologies that are scientifically demonstrated as safe and effective for managing biofouling on vessel hulls in Hawaii harbors; and

BE IT FURTHER RESOLVED that certified copies of this Resolution be transmitted to the Governor of Hawaii, the President of the State Senate, the Speaker of the State House of Representatives, and to the directors or chairpersons of each HISC agency.

Adopted by the Hawaii Invasive Species Council on the following date:

Suzanne D. Case, Department of Land & Natural Resources

Scott Enright, Department of Agriculture

Keith Kawaoka, D. Env., Department of Health

David Rodriguez, Department of Transportation



# Division of Aquatic Resources

## Department of Land & Natural Resources

HOUSE OF REPRESENTATIVES  
TWENTY-NINTH LEGISLATURE, 2018  
STATE OF HAWAII

H.C.R. NO. 130

### HOUSE CONCURRENT RESOLUTION

Overlapping jurisdictions regarding In-Water Cleaning

1 WHEREAS, biofouling, or biological fouling, is the

High level coordination need be  
taken between DOH, DOT, & DLNR

9 and

10

11 WHEREAS, studies have shown that biofouling on shipping  
12 vessels is an important vector of aquatic invasive species  
13 transfer, which, if established in new ecosystems, may pose

High level coordination need be  
taken among regional, national, and  
international gov't agencies and  
industry stakeholders

27 minimize movement of non-native aquatic organisms into Hawaii's  
28 ports, harbors, and marinas; and

### Hawaii In-Water Cleaning Resolution (2018)

1. Develop HI State biofouling  
standards and management  
requirements

2. Develop process for approving in-water  
biofouling management operations in HI  
commercial harbors

3. Participate in ACT IWCC Testing Project and  
perform IWC system efficacy testing in Hawaii





# Division of Aquatic Resources

## Department of Land & Natural Resources

### 1. Develop HI State biofouling standards and management requirements

MEPC 62/24/Add.1  
Annex 26, page 1

#### ANNEX 26

RESOLUTION MEPC.207(62)

Adopted on 15 July 2011

2011 GUIDELINES FOR THE CONTROL AND MANAGEMENT OF SHIPS' BIOFOULING  
TO MINIMIZE THE TRANSFER OF INVASIVE AQUATIC SPECIES

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,



- Documentation Requirements  
Biofouling Management Plan
- Biofouling Management  
Recordkeeping
  - Vessel Operational Profile  
(destinations, lay-up periods, etc)
- NZ's short-stay vs. long-stay vessel  
requirements
- AU's Vessel Compliance Scheme



# Division of Aquatic Resources

## Department of Land & Natural Resources

### 1. Develop HI State biofouling standards and management requirements



#### Hawaii Biofouling Questionnaire for commercial vessels

##### Vessel Information & Particulars

Vessel Name	
Official / IMO Number	
Vessel type (containership, barge etc)	
Responsible Officer's Name and Title (Person filling this form)	
Vessel/Company/Agent Email address	
Date of Submission (Day/Month/Year)	
Vessel Age (years)	
Vessel typical speed (laden speed in knots over the last four months)	
Vessel typical port residence time (hours or days)	<input type="text"/> hours OR <input type="text"/> days

##### Previous Dry Docking

Since delivery, has the vessel been removed from water for maintenance?	Yes <input type="checkbox"/> No <input type="checkbox"/>
If YES, enter the date and location of the <u>most recent</u> out-of-water maintenance:	Date (Day/Month/Year): 04/15/2015 City/Port: <input type="text"/> Country: <input type="text"/>
If NO, enter the delivery date and location where the vessel was built:	Delivery Date (Day/Month/Year): <input type="text"/> City/Port: <input type="text"/> Country: <input type="text"/>

##### Anti-Fouling Paint (A/F Paint)

Were the vessel's <u>submerged portions</u> coated with an anti-fouling paint (includes foul-release paint) during the out-of-water period listed above?	Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
If not, when was the last anti-fouling coating applied to the vessel?	Date of A/F paint application (Day/Month/Year): <input type="text"/> For the hull bottom: <input type="text"/>

### • Risk Assessments

#### • Primary

- Biofouling reporting form submission

#### • Secondary

#### • Tertiary





# Division of Aquatic Resources

## Department of Land & Natural Resources

### 1. Develop HI State biofouling standards and management requirements



- **Risk Assessments**

- Primary
- Secondary
  - Verify submitted biofouling documentation onboard
- Tertiary





# Division of Aquatic Resources

## Department of Land & Natural Resources

### 1. Develop HI State biofouling standards and management requirements

- **Risk Assessments**

- Primary
- Secondary
- Tertiary
  - Ground-truth via remotely operated vehicle (ROV) or SCUBA





## 2. Internal Approval Process for In-Water Cleaning Operations in Hawaii

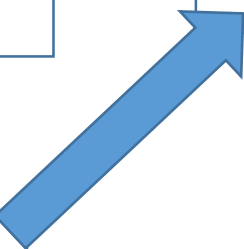
Vessel operator initiates application request for cleaning approval



Point of contact shares request with IWC Advisory Group



DLNR performs initial risk assessment and shares findings with IWC Advisory Group



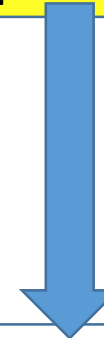
Concerns to be flagged and discussed with IWC Advisory Group



IWC Advisory Group conditionally approves application for propeller polishing



IWC Advisory Group  
To request more information from applicant



Vessel operator and/or vendor complies with request



Vessel operator and/or vendor does not comply with request or in a timely manner



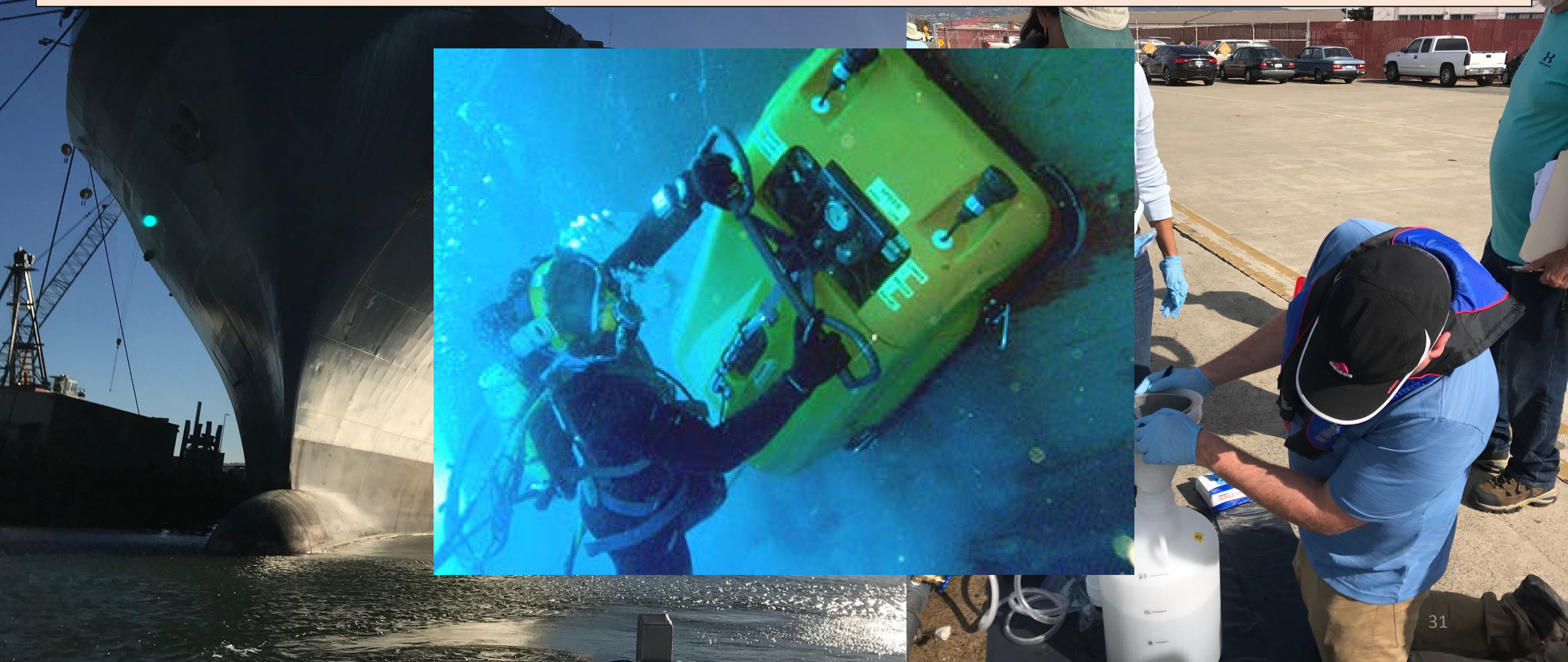
IWC Advisory Group denies application



# Division of Aquatic Resources

## Department of Land & Natural Resources

3. Participate in ACT IWCC Testing Project and perform IWC system efficacy testing in Hawaii







# Division of Aquatic Resources

## Department of Land & Natural Resources

HOUSE OF REPRESENTATIVES  
THIRTIETH LEGISLATURE, 2019  
STATE OF HAWAII

H.B. NO. **150**

### A BILL FOR AN ACT

RELATING TO AQUATIC BIOSECURITY.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF HAWAII:

- 1 SECTION 1. The legislature finds that the introduction and
- 2 spread of alien aquatic organisms poses an unprecedented th
- 3 to Hawaii's marine ecosystems, harbors, recreational activ:

THE SENATE  
THIRTIETH LEGISLATURE, 2019  
STATE OF HAWAII

JAN 24 2019

S.B. NO. **1162**

### A BILL FOR AN ACT

RELATING TO BIOSECURITY.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF HAWAII:

- 1 SECTION 1. The legislature finds that the introduction and

HOUSE OF REPRESENTATIVES  
THIRTIETH LEGISLATURE, 2019  
STATE OF HAWAII


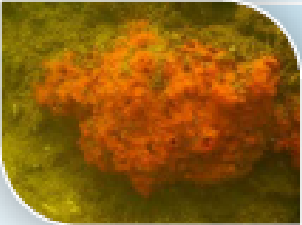

H.B. NO. **746**

### A BILL FOR AN ACT

RELATING TO AQUATIC BIOSECURITY.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF HAWAII:

The legislature finds that the introduction and

Aquatic Biosecurity Services		BW- ballast water, BF- biofouling	2019	2020	2021	2022
1) Host Alien Aquatic Organism Stakeholder customer service meetings			X	X	X	X
2) Validate BW rapid assessment tools to assist ships in monitoring their BW management system's efficacy			X	X		
 3) Monitor for species introductions to inform rapid response plans			X	X	X	X
4) Efficacy testing of vessel in-water cleaning systems			X	X	X	X
5) Conduct <u>primary</u> BW & BF biosecurity risk survey on 100% of qualifying vessels using reporting form data analysis processes			X	X	X	X
6) Conduct <u>secondary</u> BW & BF biosecurity risk survey on 25% of qualifying vessels - <i>board vessel to verify BW and BF logs</i>				X	X	X
7) Perform <u>tertiary</u> BW & BF biosecurity risk survey on 10% of qualifying vessels - survey BW & quantify BF					X	X
8) Review Hawaii's BW & BF Program performance for improvements			X	X	X	X
Budget Requirements			\$460K	\$700K	\$855K	\$904K
Anticipated staff recruits (cumulative total recruits)			5 (5)	4 (9)	2 (11)	0 (11)



## SENATE CONCURRENT RESOLUTION

URGING ALL APPLICABLE STATE AGENCIES TO WORK TOGETHER WITH INTERESTED STAKEHOLDERS, INCLUDING THE HONOLULU HARBOR USERS GROUP, IN ASSESSING THE RISK OF AQUATIC INVASIVE SPECIES TO HAWAII, VECTORS, AND POSSIBLE MITIGATIONS, IN PREPARATION FOR THE ESTABLISHMENT OF NEW FEDERAL STANDARDS IN 2022.

1 WHEREAS, the State of Hawaii depends on healthy marine  
2 environments and ecosystems to support its unique cultural  
3 practices and recreational resources, preserve Hawaii residents'  
4 quality of life, support local businesses, and provide habitat  
5 and sustenance for a multitude of native species – many of which  
6 are found nowhere else on Earth; and

7  
8 WHEREAS, healthy reefs protect homes and infrastructure by  
9 mitigating the impacts of storm events; and

10  
11 WHEREAS, nearshore marine environments support the Hawaii  
12 tourism, aquaculture, and fisheries industries, at an estimated  
13 \$4,000,000,000 in gross revenue per year; and

14  
15 WHEREAS, aquatic invasive species have proven to be  
16 devastating on some nearshore reef environments in Hawaii and  
17 waters worldwide, harming the functioning of marine ecosystems,  
18 public health, and industries; and

19  
20 WHEREAS, the recognized vectors for the introduction of  
21 aquatic invasive species to Hawaii's marine environment are  
22 vessel ballast water and biofouling, which account for more than  
23 half of all non-native marine and estuarine species, followed by  
24 escapes or purposeful introduction from aquaculture, pet trade,  
25 and research, with arrival and possible establishment of species  
26 through marine debris; and




27  
28 WHEREAS, the Hawaii Interagency Biosecurity Plan 2017-2027:  
29

2019-2357 SCR SMA.doc



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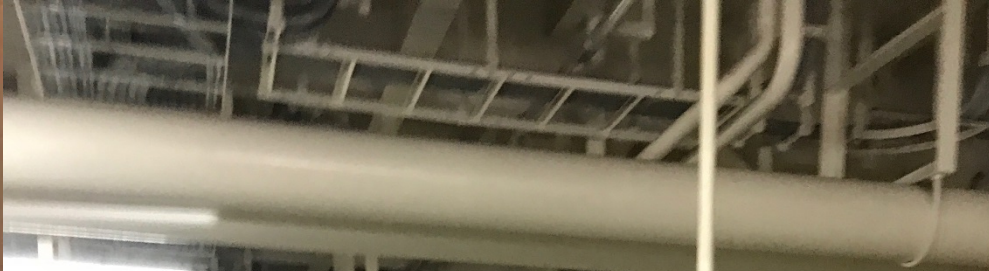
## Hawaii Aquatic Biosecurity Resolution (2019)

Aquatic Biosecurity Services		BW- ballast water, BF- biofouling	2019	2020	2021	2022
1) Host Alien Aquatic Organism Stakeholder customer service meetings			X	X	X	X
2) Validate BW rapid assessment tools to assist ships in monitoring their BW management system's efficacy			X	X		
 3) Monitor for species introductions to inform rapid response plans			X	X	X	X
4) Efficacy testing of vessel in-water cleaning systems			X	X	X	X
5) Conduct <u>primary</u> BW & BF biosecurity risk survey on 100% of qualifying vessels using reporting form data analysis processes			X	X	X	X
6) Conduct <u>secondary</u> BW & BF biosecurity risk survey on 25% of qualifying vessels - <i>board vessel to verify BW and BF logs</i>				X	X	X
7) Perform <u>tertiary</u> BW & BF biosecurity risk survey on 10% of qualifying vessels - survey BW & quantify BF					X	X
8) Review Hawaii's BW & BF Program performance for improvements			X	X	X	X
Budget Requirements			<del>\$460K</del>	<del>\$700K</del>	<del>\$855K</del>	<del>\$904K</del>
Anticipated staff recruits (cumulative total recruits)			<del>5 (5)</del>	<del>4 (9)</del>	<del>2 (11)</del>	<del>0 (11)</del>





It's a clean hull!







# Division of Aquatic Resources

## Department of Land & Natural Resources



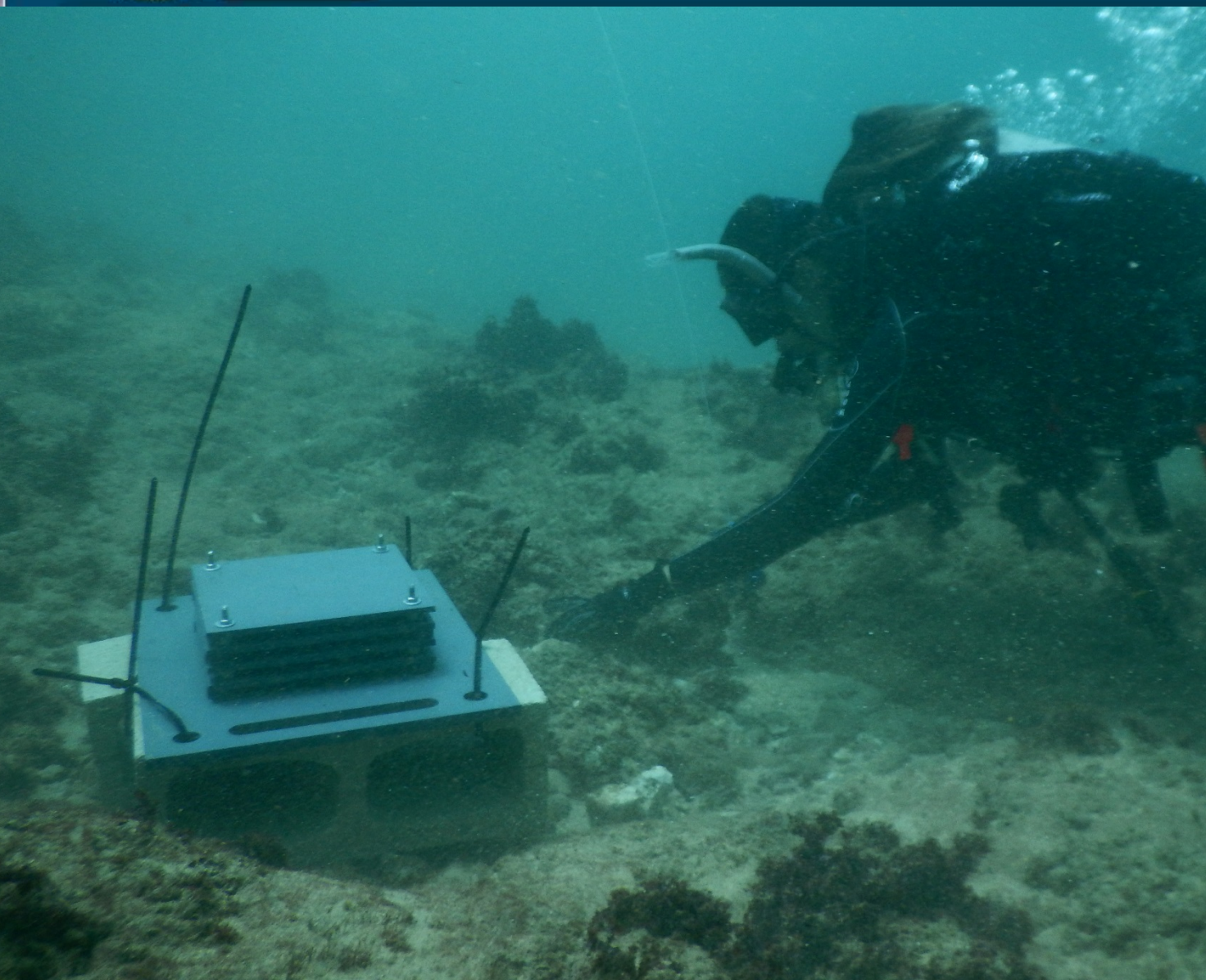
- **Vessel Incidental Discharge Act (VIDA)**
  - Signed into law Dec 2019
  - Transfers State's regulatory/enforcement authority for 27 vessel incidental discharges (including ballast water and hull husbandry effluent) to EPA & USCG
  - EPA to develop compliance standards within 2 years and USCG to develop enforcement standards/policies within following 2 years; consultation periods TBD
  - States may work in coordination with USCG to enforce standards




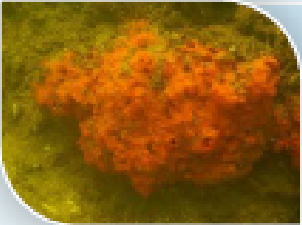



# Division of Aquatic Resources

## Department of Land & Natural Resources





Aquatic Biosecurity Services		BW- ballast water, BF- biofouling	2019	2020	2021	2022
1) Host Alien Aquatic Organism Stakeholder customer service meetings			X	X	X	X
2) Validate BW rapid assessment tools to assist ships in monitoring their BW management system's efficacy			X	X		
 3) Monitor for species introductions to inform rapid response plans			X	X	X	X
4) Efficacy testing of vessel in-water cleaning systems			X	X	X	X
5) Conduct <u>primary</u> BW & BF biosecurity risk survey on 100% of qualifying vessels using reporting form data analysis processes			X	X	X	X
6) Conduct <u>secondary</u> BW & BF biosecurity risk survey on 25% of qualifying vessels - <i>board vessel to verify BW and BF logs</i>				X	X	X
7) Perform <u>tertiary</u> BW & BF biosecurity risk survey on 10% of qualifying vessels - survey BW & quantify BF					X	X
8) Review Hawaii's BW & BF Program performance for improvements			X	X	X	X
Budget Requirements			\$460K	\$700K	\$855K	\$904K
Anticipated staff recruits (cumulative total recruits)			5 (5)	4 (9)	2 (11)	0 (11)





# Division of Aquatic Resources

## Department of Land & Natural Resources

### Aquatic Alien Introductions in Hawaii

Region	Aquatic NIS spp	Reference
<b>Hawaii</b>	<b>&gt;350</b>	<b>Eldredge &amp; Carlton 2009; Godwin and Bolick, in prep 2017</b>
<b>Continental US</b>	450	Ruiz et al., 2014
<b>New Zealand</b>	206	Hayden et al. 2009
<b>Australia</b>	160	Hewitt et al., 2004
<b>Europe</b>	546	Gollasch, 2006















# Natural and Cultural Resources





# Aquaculture Industry







Tourism Industry

# Fishing industry and Recreational Fishing Community





# Ballast Water & Biofouling Program

Hawai`i Division of Aquatic Resources



## Collaboration

Work with maritime industry, local community, scientists, and government and stakeholders to develop solutions to prevent aquatic alien species introductions.



## Prevention

Conduct ballast water and vessel biofouling risk assessments, implement regulations and work to improve vessel compliance.



## Detection

Document prevalence and spread of introduced aquatic alien species to inform rapid response, control, and eradication efforts.



## Outreach & Education

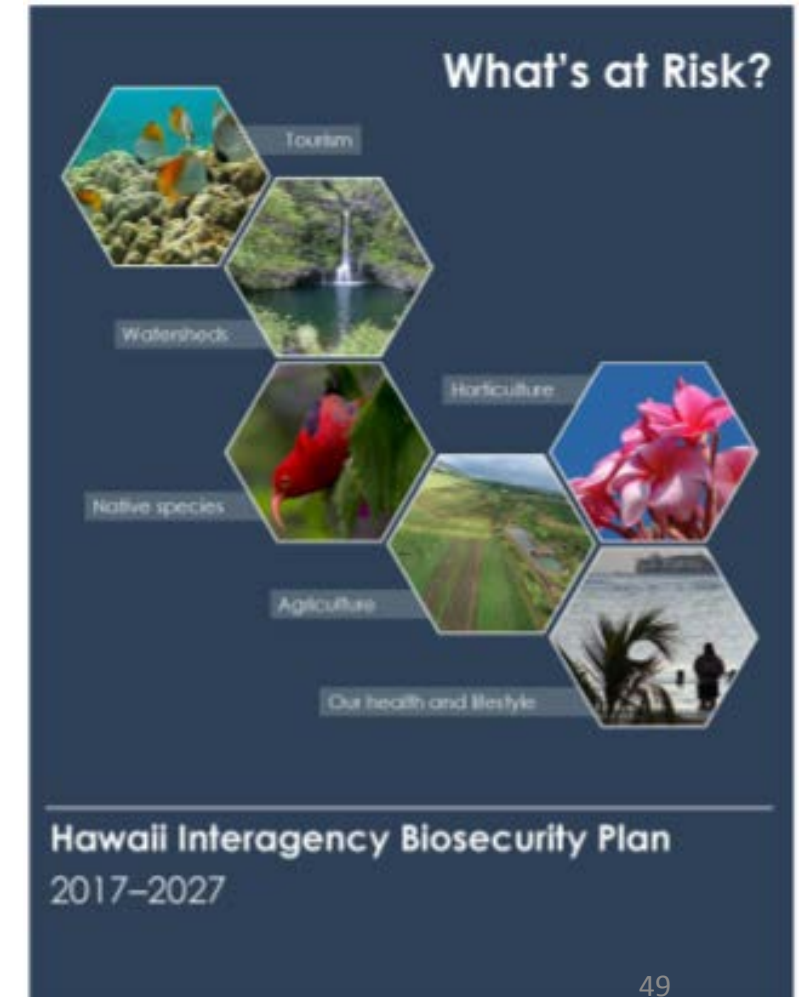
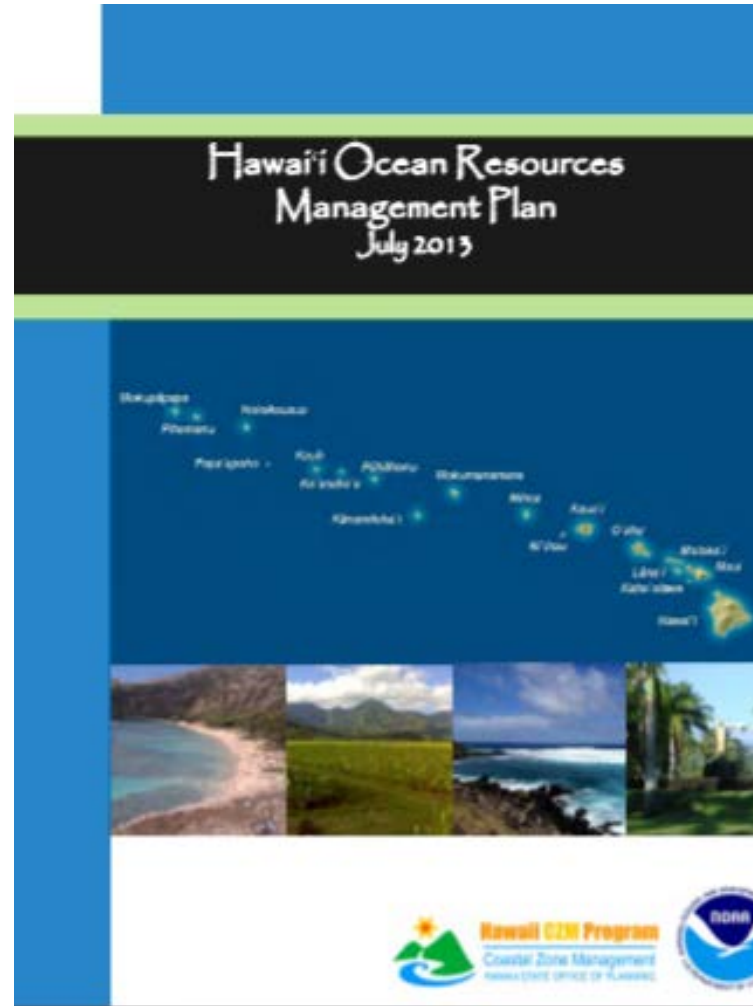
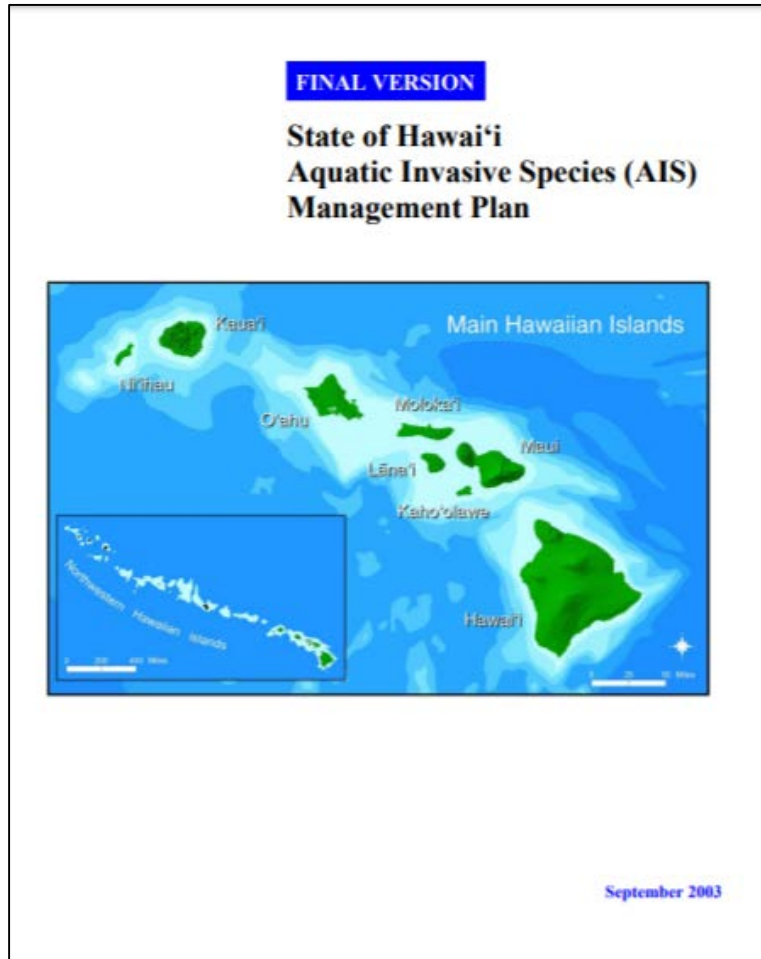
Provide information to the communities and create involvement in opportunities to protect Hawai`i's valuable aquatic resources.



# Division of Aquatic Resources

## Department of Land & Natural Resources

### Strategic Plans





# Tackling the Problem through Collaboration



Military, federal, state agency stakeholders, commercial/recreational maritime industry, scientists, vector management system vendors, national/international experts



# Funding Sources and Acknowledgements





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