

# Addressing the Top Two Vectors of Aquatic Alien Introductions into Hawaii

Hawaii Biosecurity Update

January 24<sup>th</sup>, 2018

Jules Kuo - HI Ballast Water & Hull Fouling Coordinator

DLNR, DAR in c/o with PCSU



Aleutian Is

North Pacific Ocean

Tropic of Cancer

Hawaiian Islands

Equator

Galapagos Is

South Pacific Ocean

French Polynesia

Tropic of Capricorn

Pitcairn Is

Easter Is

Australia

Norfolk I

New Zealand

Japan

Taiwan

Philippines

Palau

Brunei

Malaysia

Indonesia

Timor-Leste

Papua New Guinea

Solomon Islands

Nauru

Kiribati

Tuvalu

Tokelau

Samoa

American Samoa

Vanuatu

Fiji

Niue

Tonga

Cook Is

New Caledonia

Ryukyu Is

Ogasawara Is

Northern Mariana Islands

Guam

Marshall Islands

Federated States of Micronesia

Christmas Is





# Aquatic Non-Indigenous Species (NIS) Established in Hawaii

Region	NIS spp	Reference
<b>Hawaii</b>	<b>417</b>	<b>Eldredge &amp; Carlton, 2009</b>
<b>Continental US</b>	450	Ruiz et al., 2014
<b>San Francisco Bay</b>	216	Hayden et al. 2009
<b>New Zealand</b>	206	Hayden et al. 2009
<b>Australia</b>	160	Hewitt et al., 2004
<b>Europe</b>	546	Gollasch, 2006

Ballast water and vessel biofouling are responsible for >75% of marine algae and invertebrate introductions in Hawaii (Davidson et al., 2014)

*Didemnum* spp.

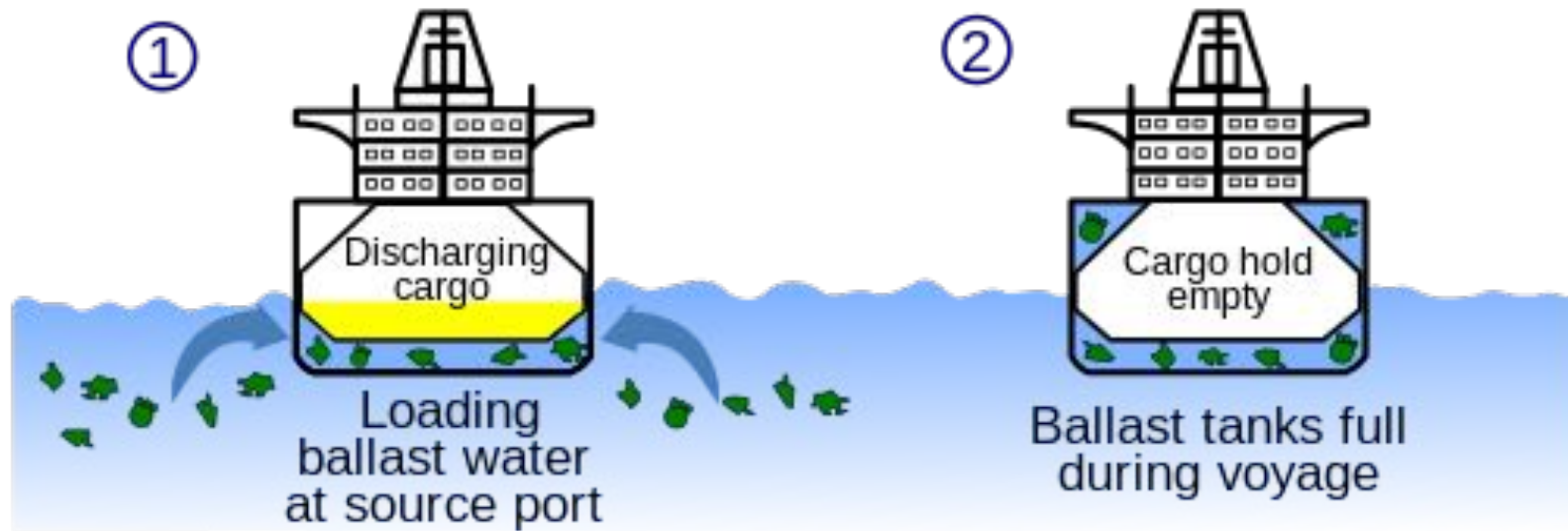


*Pennaria disticha*

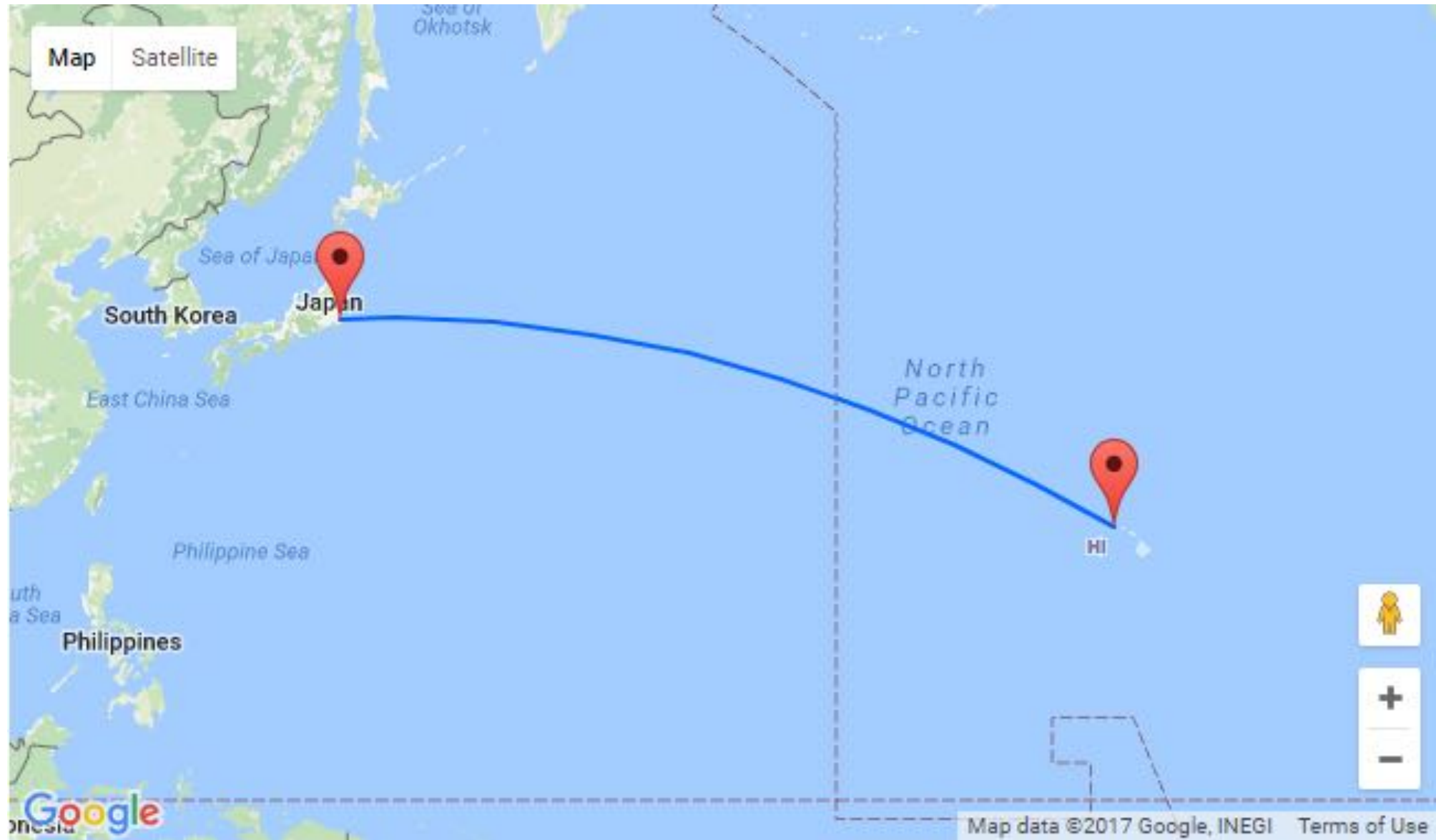


Photo credit: DLNR

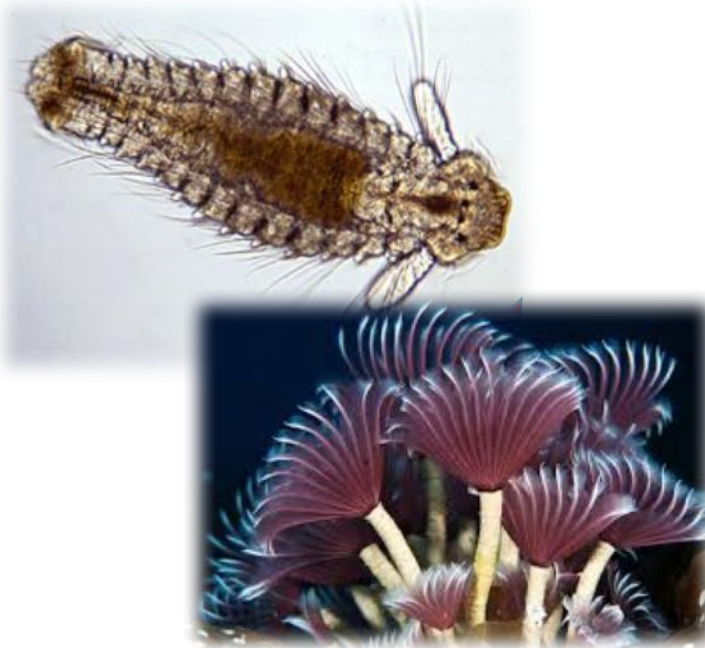
# What is Ballast Water (BW)?



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# What is Vessel Biofouling (BF)?



Photo credit: Franmarine

# Factors affecting Biofouling growth:

- **Microfouling** precedes **macrofouling**
- It attracts macro-organisms via chemical cues
- Biofilms are complex dynamic systems that contribute to biofouling

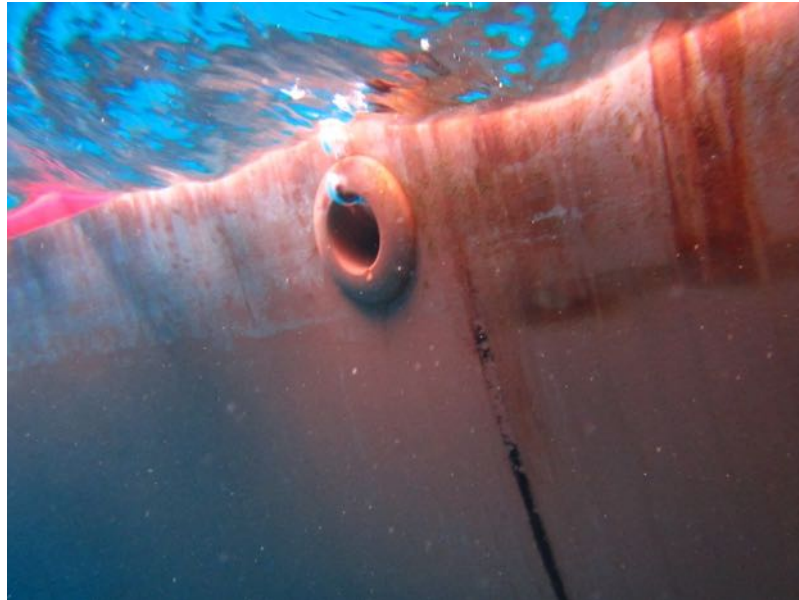
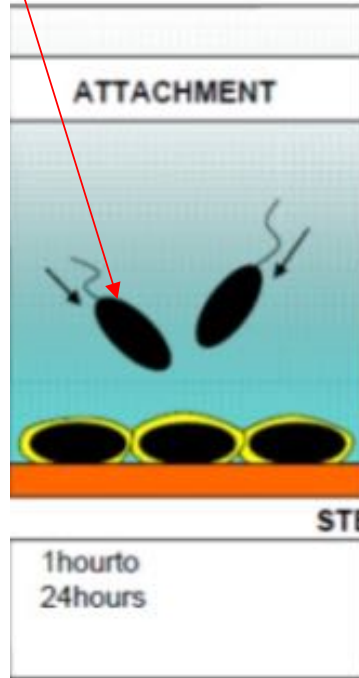
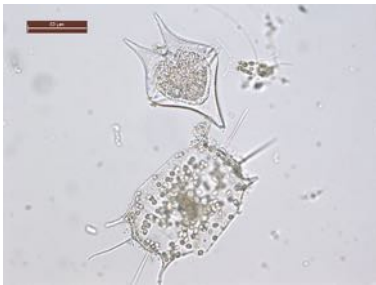
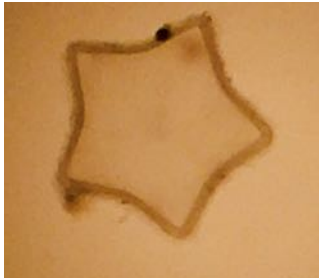
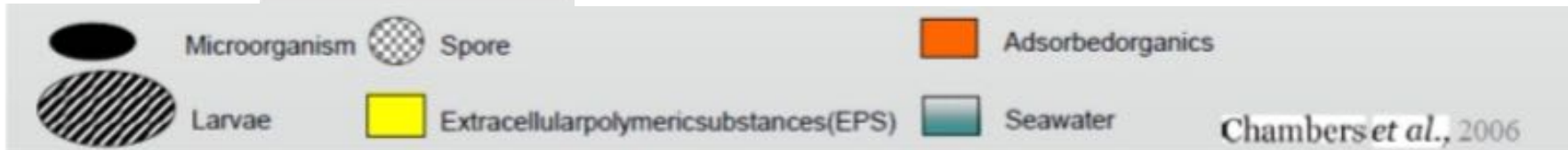


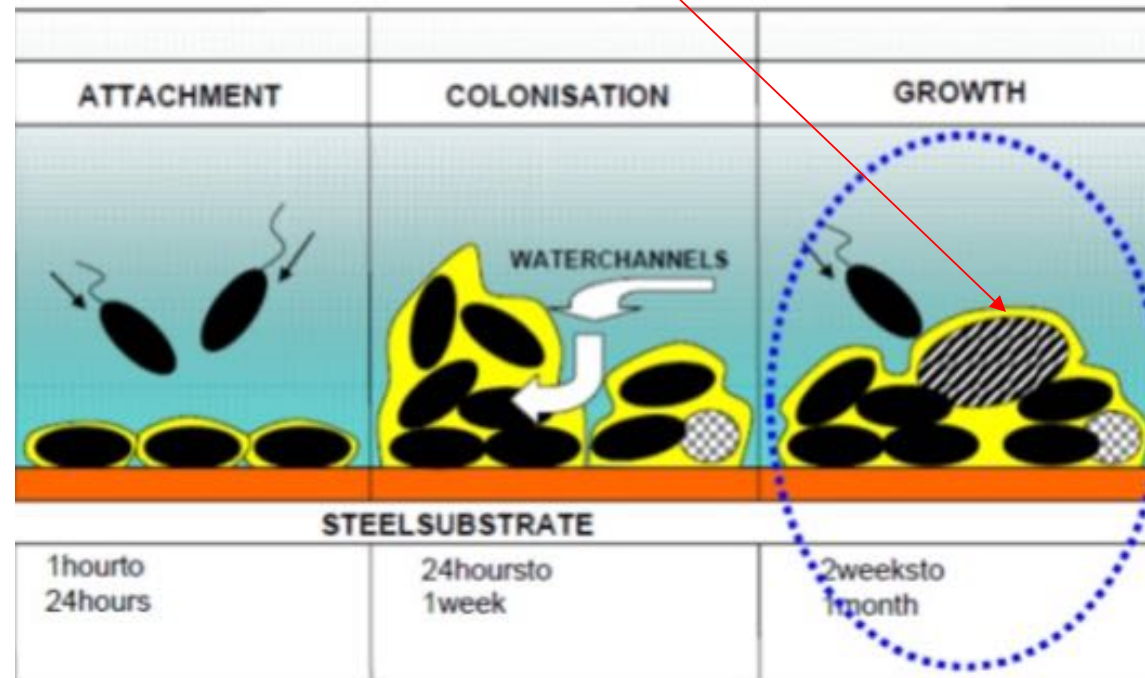
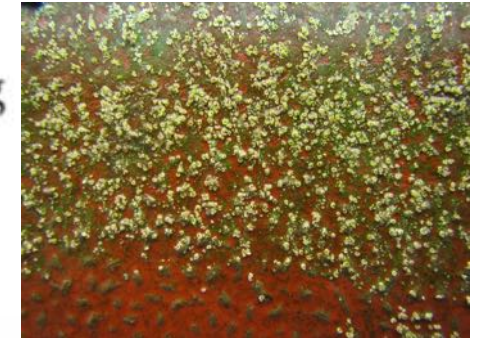
Photo credit: DLNR



# Factors affecting Biofouling growth:

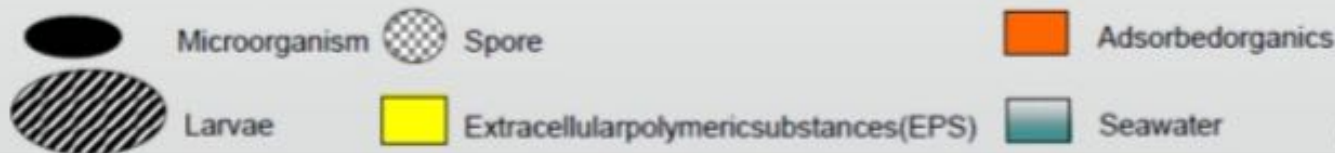
- **Microfouling** precedes **macrofouling**
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Photo credit: DLNR



*Complex Community*

**BIOFOULING**

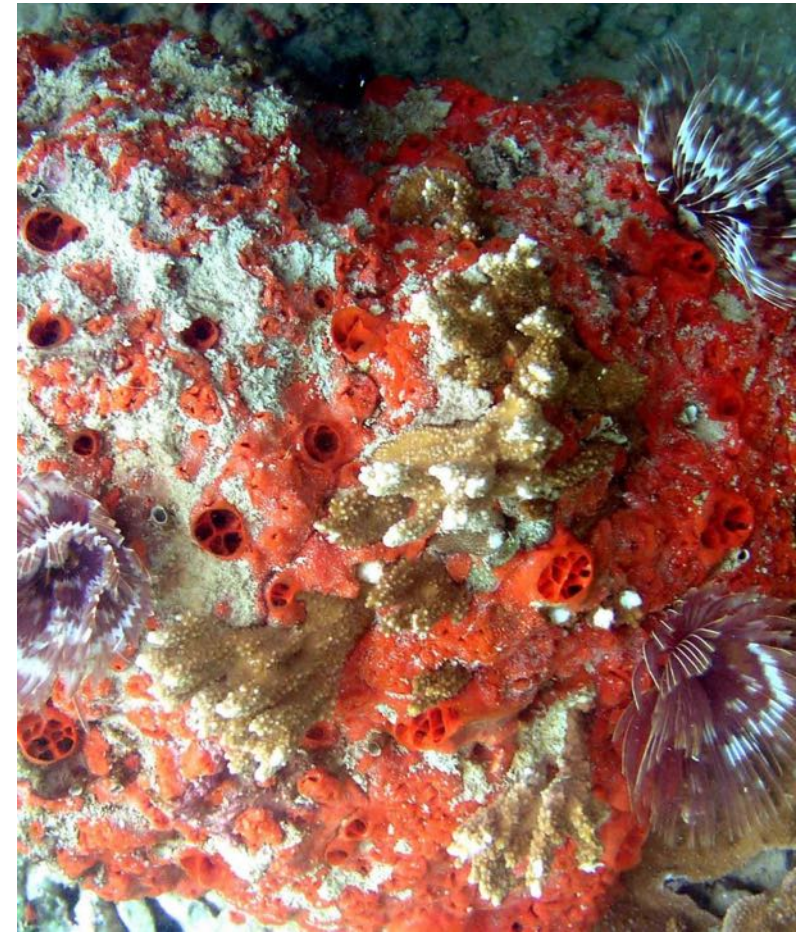


Chambers *et al.*, 2006

# Impacts of NIS becoming Invasive



*Euchema* spp. (Smothering Seaweed)



*Mycale armata* (Orange keyhole sponge) and *Sebellastarte spectabilis* (Feather duster worm)

# Impacts of NIS becoming Invasive



## International Dissemination of Epidemic *Vibrio cholerae* by Cargo Ship Ballast and Other Nonpotable Waters

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Received 12 December 1993/Accepted 25 April 1994

In 1991 and 1992, toxigenic *Vibrio cholerae* O1, serotype Inaba, biotype El Tor, was recovered from nonpotable (ballast, bilge, and sewage) water from five cargo ships docked in ports of the U.S. Gulf of Mexico. Four of these ships had taken on ballast water in cholera-infected countries; the fifth took on ballast in a noninfected country. Isolates examined by pulsed-field gel electrophoresis were indistinguishable from the Latin American epidemic strain, C6707; however, they differed significantly from the endemic Gulf Coast strain (VRL 1984), the sixth-pandemic strain (569-B), and a *V. cholerae* non-O1 strain isolated from a ship arriving from a foreign port. On the basis of our findings, the Food and Drug Administration recommended that the U.S. Coast Guard issue an advisory to shipping agents and captains requesting that ballast waters be exchanged on the high seas before entry of ships into U.S. ports.



# Addressing the Top Two Vectors of Aquatic NIS Transfer through Preborder Action

**§187A-32 Alien aquatic organisms; lead agency; rules.** (a) The department is designated as the lead state agency for preventing the introduction and carrying out the destruction of alien aquatic organisms through the regulation of ballast water discharges and hull fouling organisms. The department may establish an interagency team to address the concerns relating to alien aquatic organisms.

(b) The department may adopt rules in accordance with chapter 91, including penalties, to carry out the purposes of this part. The rules may include standards for the department and the United States Coast Guard to use as part of their respective inspection protocols. The rules may also include implementation of a course of action in relation to the arrival or pending arrival of a high risk vessel.

(c) The governor may enter into an agreement with the United States Secretary of Transportation to carry out the purposes of this part, including but not limited to the enforcement of state law. [L 2000, c 134, pt of §2]

# Preborder (Preventative)

Action	Ballast Water
Hawaii Administrative Rules	Amending HAR Ch13-76

AMENDING

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.

# Preborder (Preventative)

Action

Ballast Water

Vessel Biosecurity Risk Assessment

Yes, with limited 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 **22**

Onboard BW Management System

### Voyage Information

Arrival port (port and state)  **Hawaii**

Arrival date

Last port (port and country)  **United States**

Next port (port and country)  **United States**

Total ballast water on board  **cubic meters** Number of tanks in ballast

Number of tanks discharged

Alternative BW management conducted, per instructions from COTP

### 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





# Preborder (Preventative)

Action	Biofouling
Hawaii Administrative Rules	Drafting
Vessel Biosecurity Risk Assessment	Yes, case-by-case

**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)	___ hours OR ___ 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 most recent out-of-water maintenance:	Date [Day/Month/Year]: 04/15/2015 City/Port: _____ Country: _____
If NO, enter the delivery date and location where the vessel was built:	Delivery Date [Day/Month/Year]: _____ City/Port: _____ Country: _____
Anti-Fouling Paint (A/F Paint)	
Were the vessel's submerged portions 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): _____
For the most recent anti-fouling coating, what product (top coat A/F paint) was used for hull surfaces? Please list more than one if necessary and indicate what parts of the hull each product was used on?	For the <u>hull bottom</u> Manufacturer/Company: _____ Product Name: _____
	For the <u>hull sides</u> Manufacturer/Company: _____ Product Name: _____
Were additional anti-fouling coatings used for other submerged surfaces (e.g. rudder, thrusters, sea-chests)?	No <input type="checkbox"/> Don't know <input type="checkbox"/> Yes <input type="checkbox"/>
	If yes, what products were used Manufacturer/Company: _____ Product Name: _____ Manufacturer/Company: _____ Product Name: _____



# Border (Detection & Monitoring)

Action	Border (Detection & Monitoring)
Harbor & Reef Monitoring	Yes



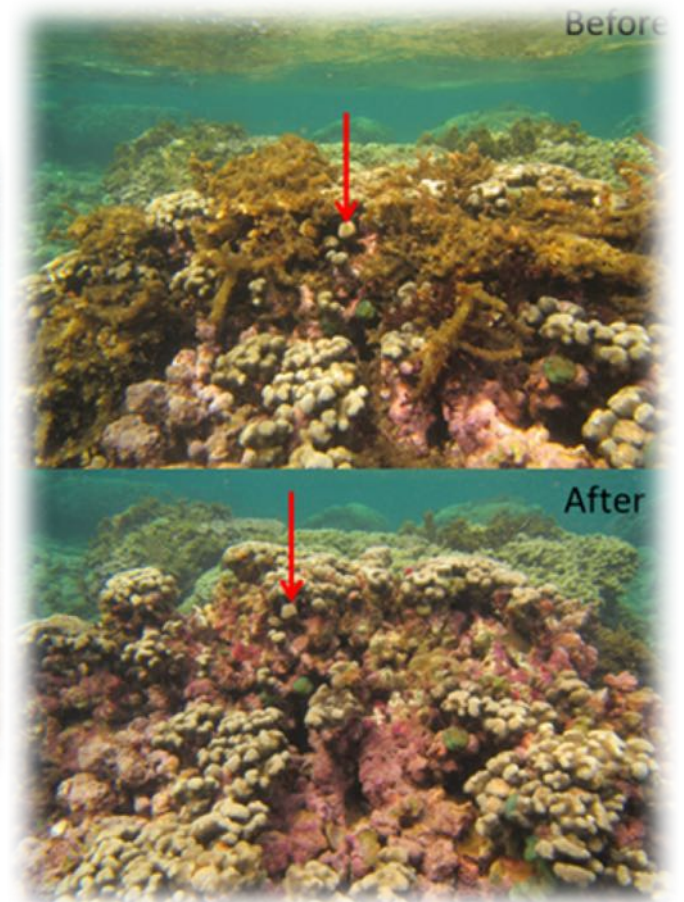
# Border (Detection & Monitoring)

Action	Border (Detection & Monitoring)
Harbor & Reef Monitoring	Yes
Japanese Tsunami Marine Debris	Yes
Invasive freshwater Salvinia	Yes



# Postborder (Control & Mitigation)

Action	Postborder (Control & Mitigation)
Invasive Algae Control in Kaneohe Bay	Removal by Supersucker & urchin grazing



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Invasive Algae Control in Kaneohe Bay	Removal by Supersucker & urchin grazing



# In Summary Top Two Vectors Best Addressed through Prevention

## What's at Risk?



Preborder  
(Prevention)

Border  
(Detection)

Postborder  
(Control)

# Strategic Planning

**What's at Risk?**

Tourism  
Watersheds  
Horticulture  
Native species  
Agriculture  
Our health and Resilience

**Hawaii Interagency Biosecurity Plan  
2017-2027**

**Hawai'i Ocean Resources  
Management Plan  
July 2013**

**Hawaii CDM Program  
Coastal Zone Management  
HAWAII STATE OFFICE OF PLANNING**

**FINAL VERSION**

**State of Hawai'i  
Aquatic Invasive Species (AIS)  
Management Plan**

**Main Hawaiian Islands**

**September 2003**

# Collaboration



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



# Funding Sources and Acknowledgements

