Marine Invasive Species Transported by Vessel Hull Fouling: Potential Management Approaches

L. Scott Godwin
B. P. Bishop Museum
Department of Natural Science
Hawaii Biological Survey

Bernice Pauahi Bishop Museum
The State Museum of Natural and Cultural History
Honolulu, Hawaii
"Biological Islands"

Commercial Vessels
- Ballast Water
  - Planktonic Stages
  - Adult Stages
  - Resting Stages
- Sediments
  - Adult Stages
  - Resting Stages
- Hull Fouling
  - Adult Stages
  - Planktonic Stages

Private Vessels
- Hull Fouling
  - Adult Stages
  - Planktonic Stages
Aquatic Marine Invasive Species in Hawaii
Summary of Marine Invasive Species in Hawaii
(According to B.P. Bishop Museum, Hawaii Biological Survey)

Total Marine Alien Species = 343

Marine Invertebrates = 287
Macroalgae = 24
Flowering Plants = 12
Fish = 20
<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Species</th>
<th>% Established</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hull Fouling</td>
<td>212</td>
<td>90</td>
</tr>
<tr>
<td>Solid Ballast</td>
<td>21</td>
<td>90</td>
</tr>
<tr>
<td>Ballast Water</td>
<td>18</td>
<td>89</td>
</tr>
<tr>
<td>Intentional Release: Fishery</td>
<td>18</td>
<td>28</td>
</tr>
<tr>
<td>Parasites on Nonindigenous Species</td>
<td>8</td>
<td>88</td>
</tr>
<tr>
<td>Associated with Commercial Oysters (Unintentional)</td>
<td>7</td>
<td>100</td>
</tr>
<tr>
<td>Aquarium Release</td>
<td>3</td>
<td>67</td>
</tr>
</tbody>
</table>
Potential Management Strategies

• Dynamics of Port Arrivals
• Information Framework
  – Collaborative Efforts with Stakeholders
Components of Port Arrivals

Stochastic

High Risk

Towed Vessel Platforms

Derelict Vessels

Decommissioned Military

Personal Craft

Predictable

High Risk

Towed Vessel Platforms
Goal
Minimize marine alien species Introductions by hull fouling

Maximize effectiveness to State of Hawaii

Minimize impact to maritime industry & state economy

Central Authority

Proactive Measures

Monitoring Program

Risk Assessment Matrix

Outreach & Education

Reactive Measures

Rapid Response Strategy

Management Plan

Post-event Measures
Hypothetical Risk Matrix

Priority Vessels
- Towed Vessel Platforms
- Floating Drydocks
- Stochastic Events

? Last port of call outside Hawaii
- Yes
- Stop
- No

? Compliance Standards
- ISM Code
- Local codes of practice
- Yes
- Stop
- No

? Lay-up or inactive period
- < Time X
- Stop
- ≥ Time X
- Investigate

Ranking System
- Acceptable
- Stop
- Unacceptable
- Response & Action

Stop
Response & Action

1. Standard commercial Vessel (barge, container, tanker, bulk carrier fishing boat) or personal craft
   ACTION: Restrict time in port to essential operations only (cargo operations, fueling, loading stores)

2. Vessel or vessel platforms intent on long or permanent port stay (cargo barge, crane barge, drilling platforms, floating drydocks, decommissioned military, personal craft
   ACTION:
   A) Quarantine procedures
   B) Require out-of-water cleaning
Discussion – Hull Fouling

• **Important Marine Invasive Species Vector**

• **Philosophy: Minimize vs Prevent**
  - Monitor for High Risk Components
  - Employ Risk Matrix
  - Outreach and Education of Stakeholders