

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

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"Biological Islands"

Commercial
Vessels

Private
Vessels

Ballast Water
Planktonic Stages
Adult Stages
Resting Stages

Hull Fouling
Adult Stages
Planktonic Stages

Sediments
Adult Stages
Resting Stages

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

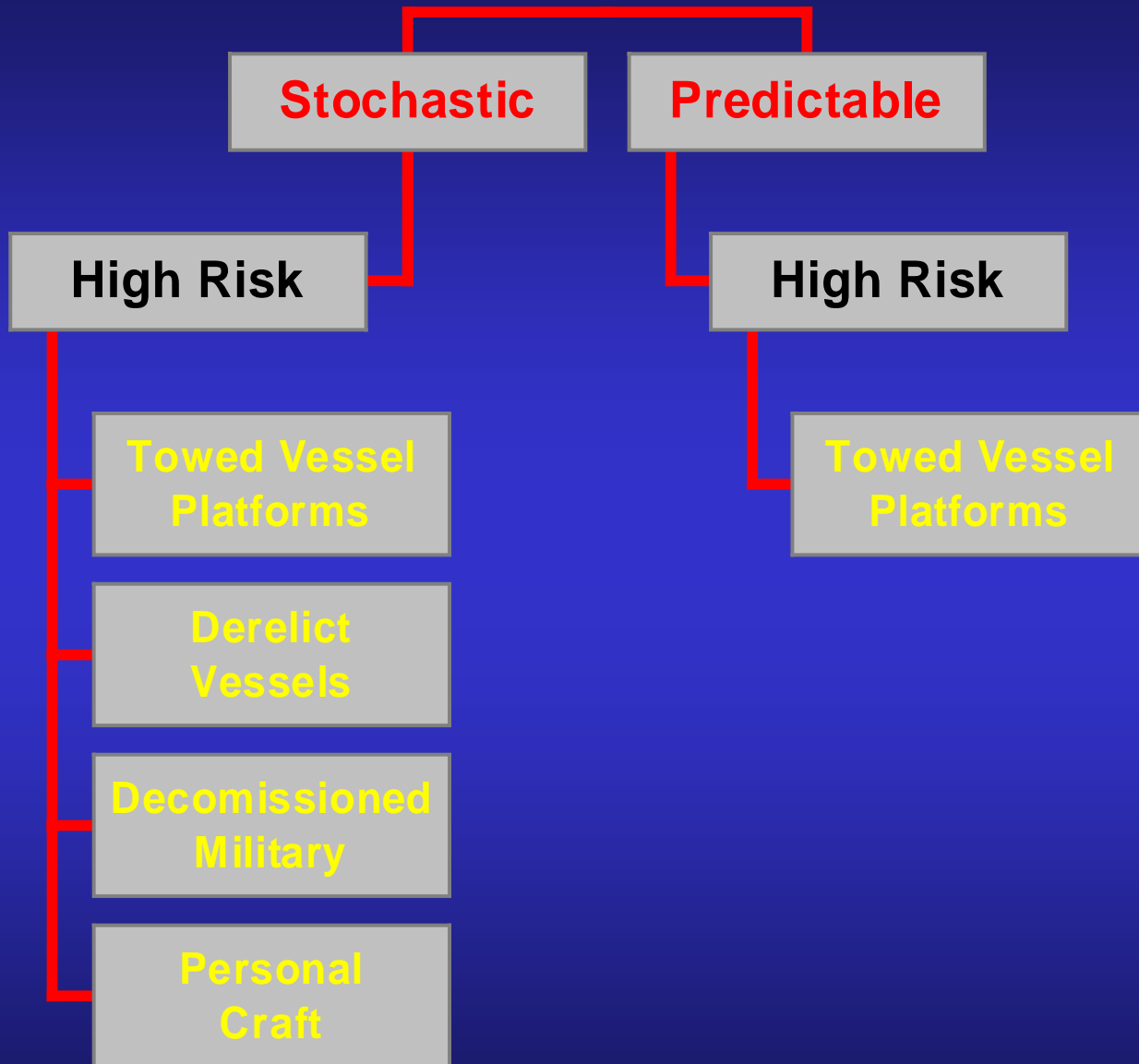
TRANSPORT MECHANISMS FOR MARINE NONINDIGENOUS SPECIES: MARINE INVERTEBRATES

Mechanism	Species	% Established
Hull Fouling	212	90
Solid Ballast	21	90
Ballast Water	18	89
Intentional Release: Fishery	18	28
Parasites on Nonindigenous Species	8	88
Associated with Commercial Oysters (Unintentional)	7	100
Aquarium Release	3	67

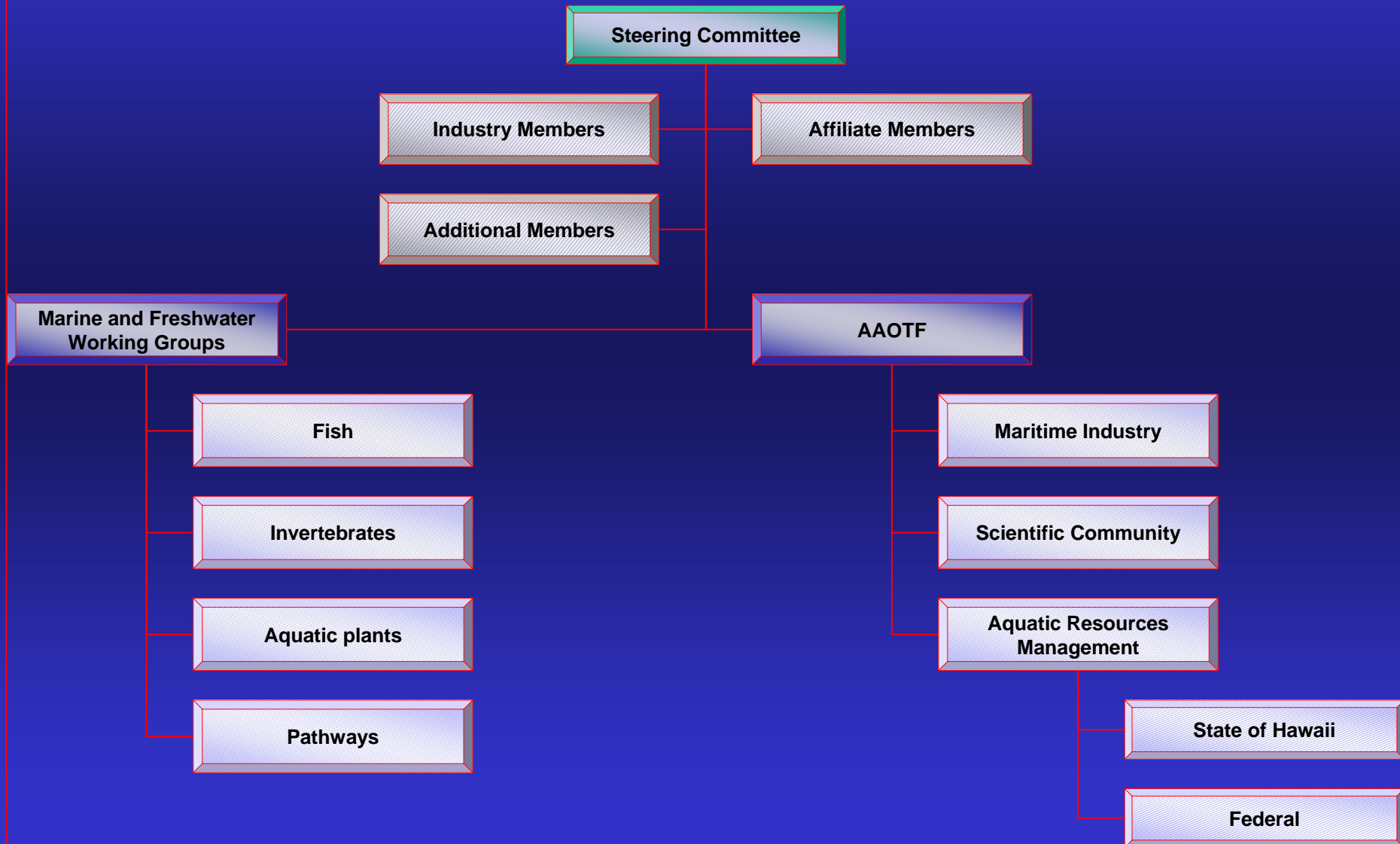
Potential Management Strategies

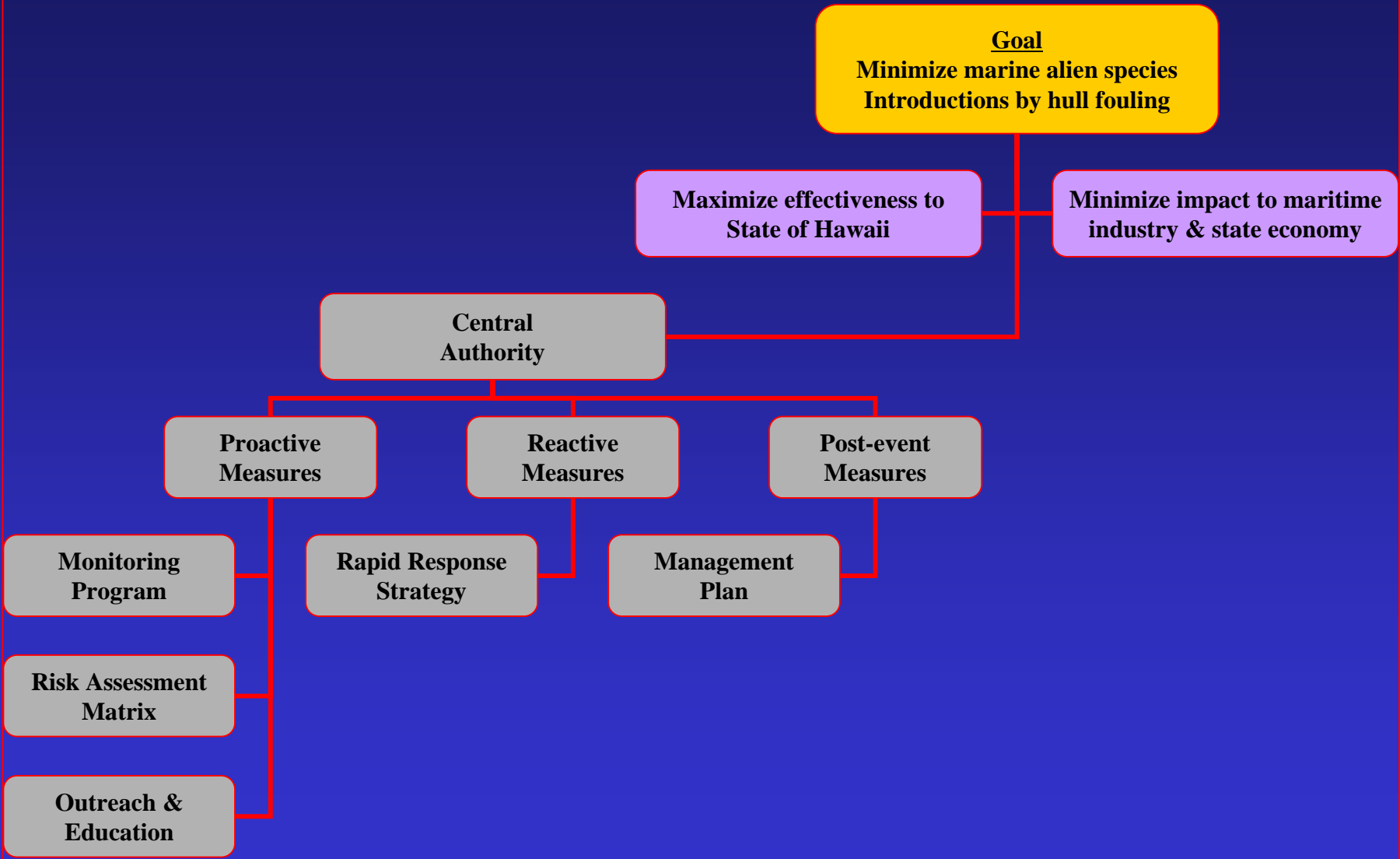
- **Dynamics of Port Arrivals**
- **Information Framework**
 - **Collaborative Efforts with Stakeholders**

Components of Port Arrivals



HI Aquatic Invasive Species Management Plan: Stakeholder Framework





Hypothetical Risk Matrix

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

? Last port of call outside Hawaii

Yes

No

Stop

? Compliance Standards
•ISM Code
•Local codes of practice

Yes

Stop

No

? Lay-up or inactive period

< Time X

> Time X

Stop

Investigate

Ranking System

Acceptable

Unacceptable

Stop

Response & Action

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**

