Marine Invasive Species: Global Insights

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Global Invasive Species Programme
Outline

- Background
- Legal and Institutional Basis
- Prevention
- Management
- Coordination
- Resources
The Organization

An international partnership dedicated to tackling the global threats of invasive species through policy development, awareness raising & information exchange.

GISP Partnership:
- CABI (host of Secretariat in Nairobi)
- IUCN – The World Conservation Union
- South African National Biodiversity Institute (SANBI)
- The Nature Conservancy (TNC)

Objectives
1. Development, adoption and implementation of science-based policies and systems of governance;
2. Awareness of threats posed by, and solutions for, addressing invasive species;
3. Exchange of information for broader uptake by decision-makers.
Background

• Marine invasive species impact >80% of world’s coasts
• Most significant pathways
  1. International shipping (ballast & hull fouling)
  2. Aquaculture
  3. Canal construction
  4. Aquarium trade
  5. Live seafood trade
• 80% unintentional
• Some species introduced by more than one pathway
## Background - Most Invaded Regions

### Table 1. Key pathways for most invaded ecoregions

<table>
<thead>
<tr>
<th>Ecoregion</th>
<th>Number of harmful species (% of total)</th>
<th>Pathways (% of harmful species)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern California</td>
<td>56 (66%)</td>
<td>Shipping (71%); aquaculture (71%)</td>
</tr>
<tr>
<td>North Sea</td>
<td>47 (64%)</td>
<td>Shipping (83%); aquaculture (57%)</td>
</tr>
<tr>
<td>Western Mediterranean</td>
<td>43 (66%)</td>
<td>Shipping (77%); aquaculture (55%)</td>
</tr>
<tr>
<td>Oregon, Washington, Vancouver</td>
<td>41 (65%)</td>
<td>Aquaculture (73%); shipping (68%)</td>
</tr>
<tr>
<td>Levantine Sea</td>
<td>36 (50%)</td>
<td>Canal (61%); shipping (58%)</td>
</tr>
<tr>
<td>Puget Trough/Georgia Basin</td>
<td>35 (64%)</td>
<td>Aquaculture (74%); shipping (69%)</td>
</tr>
<tr>
<td>Celtic Seas</td>
<td>33 (66%)</td>
<td>Shipping (76%); aquaculture (67%)</td>
</tr>
<tr>
<td>Aegean Sea</td>
<td>31 (53%)</td>
<td>Shipping (55%); canal (52%)</td>
</tr>
<tr>
<td>Southern California Bight</td>
<td>31 (72%)</td>
<td>Shipping (81%); aquaculture (71%)</td>
</tr>
<tr>
<td>Hawaiian Islands</td>
<td>31 (42%)</td>
<td>Shipping (68%); aquaculture (39%)</td>
</tr>
</tbody>
</table>

*Species may be known or likely to be transported via more than one pathway

(Molnar et al., 2008)

Marine Invasive Species (Seward, Alaska, 3-4 March 2010)
Background - Impacts

• Fisheries (commercial, recreational, customary)
• Aquaculture
• Biodiversity
• Shipping
• Infrastructure
• Coastal tourism
• Human health

Marine Invasive Species (Seward, Alaska)
Legal and Institutional Basis

- International law
  - International Maritime Organization
    - Convention on the Management of Ship’s Ballast Water and Sediments
    - Hull fouling under discussion by technical working group
  - Convention on Biological Diversity
  - World Trade Organization
  - UN Convention on the Law of the Sea
  - Convention on the Law of the Non-Navigational Use of International Watercourses
  - FAO Code of Conduct for Responsible Fisheries
  - ICES Code of Conduct for the Introduction and Transfer of Marine Organisms
  - International Plant Protection Convention

- Regional frameworks
  - Initiatives (issue/function specific)
  - Intergovernmental bodies (scientific, management, policy)
  - Strategies and cooperative actions

- National context (councils, strategies/plans, legislation/regulations)

- State context (councils, strategies/plans, legislation/regulations)

Marine Invasive Species (Seward, Alaska, 3-4 March 2010)
Working at Scale: A Nested Approach

Governments, Civil Society

Regional Bodies, Networks

Conventions, UN Organizations, International NGOs
Prevention

Vectors/Pathways

- Ballast (cargo – bulk & container, recreational boats, cruise ships)
- Hull fouling
- Trade in live organisms (unintentional/deliberate release)
  - Aquaculture
  - Pet trade
  - Live bait
  - Live food fish
  - Ornamentals
- Infrastructure (oil platforms)
- Canals/waterways
- Recreational and scientific gear (boots, fishing gear)
Prevention

Intentional vs Unintentional

Marine Alien Species Introductions

Intentional
- Authorised/ Legal
  - Directly released into wild
  - Released into captivity

Unintentional
- Unauthorised
  - Escaped or intentionally released

Non-Shipping
- Associated with fisheries/mariculture

Shipping Related
- Associated with Aquariums (private, public, research)
- Ballast water
- Biofouling
Prevention

Risk Analysis

- Assessment of risks
  - Pathways of introduction
  - Species for intentional introduction
- Evaluation according to level of acceptable risk
- Consideration of mitigation/management measures
- Communication of risks and decisions

Hotspots for Bioinvasion from Ballast Water (Drake & Lodge, 2004)

Sampling of Ballast Water Sources for Oakland (Ruiz, 2005)

Marine Invasive Species (Seward, Alaska, 3-4 March 2010)
Prevention

Risk Analysis

- Forecasting and niche modelling
- Examination of dynamics likely to change propagule pressure
  - Climate change (warming waters, new shipping routes)
  - Trade (changes in cargo volumes, fluctuations in energy costs)

Marine Invasive Species (Seward, Alaska, 3-4 March 2010)

Highest Risk Sea Routes for *Anopheles Gambiae*
(Tatem, Hay & Rogers, 2006)
Changes in Trade Patterns

Figure 2  Centers of world trade growth, Koppen-Geiger bioclimatic zones
Management

Pre-border (Prevention)
- Ballast water requirements (reporting, discharge, processing)
- De-fouling
- Permit process for intentional introductions
- Black, white, grey lists for species

At Border (Monitoring)
- Sanitary/Phytosanitary requirements for specific goods (e.g., live bait, live fish, pathogen/disease)
- Ship inspection
- Quarantine (goods, vehicles)
- Port surveys

Post-border (Control / Eradication)
- Monitoring/early detection
- Rapid response
- Invasive species management and restoration
- Restricted areas for particular activities
New Zealand - Marine Biosecurity

Pre-border (Prevention)

- Ballast water reporting and management requirements, including Import Health Standard for Ships Ballast Water
- De-fouling public outreach and development of regulations and cleaning facilities (esp. targeting yachts and oil exploration rigs)
- Risk analysis for:
  - Biofouling
  - High risk ports (e.g., ballast from Hobart Bay, Port Philip Bay)
  - Introduction of new organisms
- Identification of high risk species
  - Wakame (*Undaria pinnatifida*)
  - North Pacific seastar (*Asteria amurensis*)
  - Mediterranean fanworm (*Sabella spallanzanii*)
  - Asian clam (*Potamocorbula amurensis*)
  - European green crab (*Carcinus maenas*)
  - Chinese mitten crab (*Eriocheir sinensis*)

Marine Invasive Species (Seward, Alaska, 3-4 March 2010)
New Zealand - Marine Biosecurity

At Border

- Import Health Standards
  - Marine fish for pet food
  - Fish food and fish bait
  - Antarctic fish
  - Ornamental fish and marine invertebrates
- Individual action plans for 6 priority marine species
- Port surveys
- Ship inspections (physical/records)

Post-border

- Marine surveillance (16 major ports, plus secondary and pristine habitats)
- Rapid response and management plans [Mediterranean fanworm (*Sabella spallanzanii*), sea squirt (*Styela clava*), brown mussel (*Perna perna*)]
- Restricted areas for gathering of seafood (e.g., concerns over toxic dinoflagellates)
- Incursion response protocol (agency and management responsibilities)

Marine Invasive Species (Seward, Alaska, 3-4 March 2010)
Resources

• Funding
  • User fees
  • Private sector
  • Contributions/levies to state/federal funds (e.g., oil spill recovery)
  • Critical particularly for rapid response

• Research
  • Sea Grant Programs and Universities
  • Governmental experts/agencies worldwide

• Knowledge networks
  • Internet resources (list-servers, taxonomic tools)
  • Learning networks
  • Invasive species management experts/SWAT teams
Coordination

- Inter-agency mechanisms (invasive species councils/working groups; inter-state; federal)
- Regional initiatives
- Private sector and other stakeholder engagement
- Outreach and awareness
Coordination - Regional Examples

- Asia Pacific Economic Cooperation (APEC): Marine Resources Conservation Working Group
- Micronesia Biosecurity Plan (Guam US military build-up)
- Caribbean marine invasive species strategy
- North European and Baltic Network on Invasive Alien Species (NOBANIS)
- UNEP Regional Seas & GloBallast
- Regional fisheries and marine councils
Take Home Messages

- International points of leverage – activities and efforts that can be used to achieve local goals
- Regional collaboration – formal and informal networks provide opportunities for collaboration, learning and the potential to float all boats
- Strategies & Action Plans – don’t reinvent the wheel, but do include an implementation plan with assigned tasks, agencies and timeline
- Technology – lack of tools driving prevention efforts, but don’t discount development of new technologies and methods

Marine Invasive Species (Seward, Alaska, 3-4 March 2010)
Thank you!

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