Compiling and testing of biological risk assessments for the invasion of alien species with ballast water
Content

- HELCOM recommendations and existing risk assessments
- In case studies different ballast water risk assessments were tested
- Gaps
- Australien Ballast Water Risk Assessment
<table>
<thead>
<tr>
<th>HELCOM RECOMMENDATION</th>
<th>Background data</th>
<th>Risk assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moskow Declaration 2010</td>
<td>Harmful species?</td>
<td>Environmental conditions assessment:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Species-specific risk assessment:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>information: shipping</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ability to disperse naturally</td>
</tr>
<tr>
<td></td>
<td></td>
<td>level of uncertainty</td>
</tr>
</tbody>
</table>

- Harmful species?
- Environmental conditions assessment:
  - Species-specific risk assessment:
  - information: shipping
  - ability to disperse naturally
  - level of uncertainty

Gollasch 1996
Gollasch & Leppäkoski 2007
Ljungberg 2009
Proposal of a risk assessment developed by the North Sea Ballast Water Opportunity Australien Risk assessment GloBallast BWRA
Testing Risk assessments

1. **Collection of abiotic and biotic data from ports**

- Literature research
- Helcom
- Internet research
- Asking colleagues for data and specialists

**Difficulties: Lack of information**

- for the Baltic via Helcom data availability is quite good, but some information are still missing
- For the North Sea it is very time consuming to collect the relevant information
Testing Risk assessments

1. Collection of abiotic and biotic data

2. Decision which harbours should be tested
Testing Risk assessments

2. Decision of the test harbours

1) **Intra North Sea:**
   From Antwerp to Hamburg
   Reasons: busy and huge ports, comparable salinity, species don’t have the ability to distribute naturally between these ports

2) **North Sea -> Baltic Sea:**
   From Hamburg to Klaipeda
   Reasons: busy ports, comparable salinity, species don’t have the ability to distribute naturally between these ports

3) **Intra Baltic Sea:**
   From Kiel to Klaipeda
   Reasons: busy ports, no comparable salinity, species don’t have the ability to distribute naturally between these ports
Testing Risk assessments

1. Collection of abiotic and biotic data
2. Decision which harbours were tested
3. Comparing the abiotic and biotic data
4. Running different 3 different Ballast Water Risk Assessments
Testing Risk assessments

4. Running different Risk Assessments

1.) The proposal of a risk assessment developed by the North Sea Ballast Water Opportunity (NSBWO)

2.) Gollasch & Leppäkoski 2007

3.) Ljungberg 2009
Testing Risk assessments

1. Collection of abiotic and biotic data
2. Decision which harbours were tested
3. Comparing the abiotic and biotic data
4. Running different 3 different Ballast Water Risk Assessments
5. Evaluation of the results
1) Case study intra North Sea
### Comparing the abiotic and biotic data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Antwerp</th>
<th>Hamburg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance from coast (km)</td>
<td>88</td>
<td>107</td>
</tr>
<tr>
<td>Tidal range (m)</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Monthly average mean temperature (°C)</td>
<td>0-17</td>
<td>0-17</td>
</tr>
<tr>
<td>Water temperature (°C)</td>
<td>2.9-23.6</td>
<td>0-25</td>
</tr>
<tr>
<td>Salinity (PSU)</td>
<td>0.4-11.3</td>
<td>0</td>
</tr>
</tbody>
</table>
3. Comparing the abiotic and **biotic** data

- Bacteria
- Phytoplankton
- Zooplankton
- Zoobenthos
- Fish
### Benthic Alien species

#### Table: Alien species in Hamburg and Antwerp/Scheldt

<table>
<thead>
<tr>
<th>Class</th>
<th>Species</th>
<th>Hamburg</th>
<th>Antwerp/Scheldt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrozoa</td>
<td>Cordylophora caspia</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Hirudinea</td>
<td>Dugesia tigrina</td>
<td>YES</td>
<td>YES</td>
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<td>Oligochaeta</td>
<td>Psammomercystes moravicus</td>
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<td>Branchiura sowerbyi</td>
<td>YES</td>
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<td></td>
<td>Fossaria multisetosus</td>
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<td>YES</td>
</tr>
<tr>
<td>Polychaeta</td>
<td>Marenzelleria neglecta</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hypania invalida</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Marenzelleria wireni (=viridis)</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Diptera</td>
<td>Dohrniphora cornuta</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Amphipoda</td>
<td>Corophium curvispinum</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Crangonyx pseudogracilis</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Dikerogammarus villosus</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Gammarus tigrinus</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Incisocalliope aestivalius</td>
<td></td>
<td></td>
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<td>Melita nitida</td>
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<td>YES</td>
</tr>
<tr>
<td></td>
<td>Orchestia caviguna</td>
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<td>YES</td>
</tr>
<tr>
<td>Cirripedia</td>
<td>Balanus improvisus</td>
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<td>YES</td>
</tr>
<tr>
<td>Decapoda</td>
<td>Atyaephyra desmaresti</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Eriocheir sinensis</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Hemigrapsus takanol</td>
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</tr>
<tr>
<td></td>
<td>Palaemon macrodactylus</td>
<td></td>
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</tr>
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<td></td>
<td>Rhithropanopeus harrisii</td>
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<tr>
<td>Isopoda</td>
<td>Synitotea laeviisalis</td>
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</tr>
<tr>
<td>Tanaidae</td>
<td>Sin universities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mysidacea</td>
<td>Hemimysis anomala</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bivalvia</td>
<td>Corbicula fluminea</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Dreissena polymorpha</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Dreissena (rostriformis) bugensis</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Mya arenaria</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Mytilopsis leucophaeta</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Petricola pholadiformis</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Rangia cuneata</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td>Gastropoda</td>
<td>Physella acuta</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Potamopyrgus antipodarum</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Viviparus viviparbus</td>
<td></td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Ferrisia fragilis/wautieri</td>
<td></td>
<td>YES</td>
</tr>
</tbody>
</table>

#### 3. Comparing the abiotic and biotic data

Data from: Krieg 2011, Soor et al. 2010; Kerckhoff et al. 2007; Piesschaert et al. 2009
Rangia cuneata can be defined as **Harmful species** due to the following IMO criteria:

- **Evidence of prior introduction**
  
  Since 2005, only in Belgium (Verween et al. 2006)

- **Demonstrated impacts** on environment, economy, human health, property or resources
  
  Hazardous biofouling, clogging water intakes and cooling systems

- **Strength and type of ecological interactions**
  
  High filtration capacity for detritus and phytoplankton, possible ability to outcompete native filter feeders

- **Relationship with ballast water as a vector**
  
  Yes

- **Current distribution within biogeographic region and in other biogeographic regions**
  
  Only Belgium, from Gulf of Mexico, east coast USA
Running the proposed NSBWO Risk Assessment

1. Target species present in one or both ports?
   - Yes: Target species equally common in both ports?
     - Yes: Do ports have very different salinities (=30PSU Difference)?
       - Yes: Is more than one target species present?
         - Yes: Does >1 species tolerate wider ranges of salinity?
           - Yes: HIGH RISK
           - No: MEDIUM RISK
         - No: LOW RISK
       - No: Does the ports have the same salinity rage or differ by no more than 10 PSU?
         - Yes: Does the species Tolerate wider ranges of salinity?
           - Yes: HIGH RISK
           - No: MEDIUM RISK
         - No: LOW RISK
     - No: Is more than one target species present?
       - Yes: Does >1 species tolerate wider ranges of salinity?
         - Yes: HIGH RISK
         - No: LOW RISK
       - No: LOW RISK
   - No: NO

2. Target species equally common in both ports?
   - Yes: NO
   - No: NO
• Running the proposed NSBWO Risk Assessment
4. Running the proposed NSBWO Risk Assessment

Target species present in one or both ports?

1. **YES**
   - Rangia cuneata

2. **NO**
   - LOW RISK
4. Running the proposed NSBWO Risk Assessment

- Target species present in one or both ports? 1
  - Yes: Target species equally common in both ports? 2
    - Yes
    - No: Do ports have very different salinities (=30PSU Difference)? 3
      - Yes: NO EXEMPTION can be granted
      - No
    - NO
  - No: Do the ports have the same salinity range or differ by no more than 10 PSU? 7
    - Yes: HIGH RISK
    - No

Rangia cuneata
From Antwerp to Hamburg

<table>
<thead>
<tr>
<th></th>
<th>Hamburg</th>
<th>Antwerp</th>
<th>Risk</th>
<th>Risk level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salinity</td>
<td>0</td>
<td>0,4-11,3</td>
<td>high</td>
<td>3</td>
</tr>
<tr>
<td>Temperature</td>
<td>0-17</td>
<td>0-17</td>
<td>high</td>
<td>3</td>
</tr>
<tr>
<td>Voyage duration</td>
<td>370 nm</td>
<td></td>
<td>high</td>
<td>3</td>
</tr>
<tr>
<td>Intra North Sea shipping</td>
<td>yes</td>
<td>(yes)/?</td>
<td>(1)/3</td>
<td></td>
</tr>
<tr>
<td>Total Risk</td>
<td></td>
<td></td>
<td>(10) 12</td>
<td>(medium) extreme</td>
</tr>
</tbody>
</table>
2) Case study North Sea -> Baltic

<table>
<thead>
<tr>
<th></th>
<th>Hamburg</th>
<th>Klaipeda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salinity (PSU)</td>
<td>0</td>
<td>0,5-7</td>
</tr>
<tr>
<td>Temperature</td>
<td>EAB</td>
<td>EAB</td>
</tr>
</tbody>
</table>
From Hamburg to Klaipėda

<table>
<thead>
<tr>
<th>Species</th>
<th>Hamburg Port</th>
<th>Klaipėda Port</th>
<th>Klaipėda lagoon</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amphioda</strong></td>
<td>Chaetogammus warpachowskyi</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Chelicorophium curvispinum</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Dikerogammarus villosus</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Echinogammarus ischnus</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Gammarus tigrinus</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Obesogammarus crassus</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Pontogammarus robustoides</td>
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<td>YES</td>
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<tr>
<td><strong>Bivalvia</strong></td>
<td>Corbicula fluminea</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
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<td>Dreissena (rostriformis) bugensis</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Dreissena polymorpha</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Mya arenaria</td>
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<td>YES</td>
</tr>
<tr>
<td></td>
<td>Mytilopsis leucophaeta</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Petricola pholadiformis</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Cirripedia</strong></td>
<td>Balanus improvisus</td>
<td>(YES)</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Decapoda</strong></td>
<td>Atyaephyra desmaresti</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Eriocheir sinensis</td>
<td>YES</td>
<td>YES</td>
</tr>
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<td>Palaemon macrodactylus</td>
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<td>YES</td>
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<td>Rhithropanopeus harrisi</td>
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<td>YES</td>
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<td></td>
<td>Physella acuta</td>
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<td>YES</td>
</tr>
<tr>
<td></td>
<td>Potamopyrgus antipodarum</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Viviparus viviparus</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Hirudinea</strong></td>
<td>Dugesia tigirna</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Hydrozoa</strong></td>
<td>Cordylophora caspia</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Mysis</strong></td>
<td>Hemimysis anomala</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Limnomysis benedeni</td>
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<td>YES</td>
</tr>
<tr>
<td></td>
<td>Paramysis lacustris</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Oligochaeta</strong></td>
<td>Branchiura sowerbyi</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td><strong>Polychaeta</strong></td>
<td>Hypania invalida</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Marenzelleria neglecta</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td></td>
<td>Marenzelleria viridis</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

Data from Krieg 2011  Data from Olenin 2005
4. Running the proposed NSBWO Risk Assessment

Target species present in one or both ports?

1

YES

LOW RISK

NO

Borsonia murrellii adult male
Photo: Yvanec 2014
4. Running the proposed NSBWO Risk Assessment

Target species present in one or both ports?  
1. NO
   - NO EXEMPTION can be granted

   YES
   - Target species equally common in both ports?  
     2. YES
        - YES
        - NO

     NO
     - NO
     - Do ports have very different salinities (=30PSU Difference)?  
       3. YES
          - YES
          - NO

       NO
       - NO
       - Do the ports have the same salinity range or differ by no more than 10 PSU?  
         7. YES
            - YES
            - NO

         NO
         - NO
         - YES

         HIGH RISK
## Gollasch & Leppäkoski 2007

### From Hamburg to Klaipeda

<table>
<thead>
<tr>
<th></th>
<th>Hamburg</th>
<th>Klaipeda</th>
<th>Risk</th>
<th>Risk level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salinity</td>
<td>0</td>
<td>0,5-7</td>
<td>yes</td>
<td>3</td>
</tr>
<tr>
<td>Temperature zone</td>
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<td>EAB</td>
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<td>3</td>
</tr>
<tr>
<td>Voyage duration</td>
<td>487 nm</td>
<td></td>
<td>high</td>
<td>3</td>
</tr>
<tr>
<td>Intra Baltic shipping</td>
<td>No</td>
<td></td>
<td>yes</td>
<td>3</td>
</tr>
<tr>
<td>Total Risk calculation</td>
<td></td>
<td></td>
<td>12</td>
<td>extreme</td>
</tr>
</tbody>
</table>
Dikerogammus villosus

Hamburg

Klaipeda

Photo: Simon Devin

© D Minchin, 2008
Corbicula fluminea

The map shows the distribution of Corbicula fluminea in Europe, with specific locations marked as Hamburg and Klaipeda.
### 3a) Case study intra Baltic

#### Ballast Water Risk Assessment Test

<table>
<thead>
<tr>
<th></th>
<th>Kiel/Fjord</th>
<th>Gothenburg</th>
<th>Klaipeda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salinity (PSU)</td>
<td>19.5</td>
<td>13.1-18.2</td>
<td>&lt; 8</td>
</tr>
<tr>
<td>Temperature</td>
<td>EAB</td>
<td>EAB</td>
<td>EAB</td>
</tr>
<tr>
<td>Target species:</td>
<td>No</td>
<td>No</td>
<td>YES</td>
</tr>
<tr>
<td>Dreissena polymorpha</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Dreissena polymorpha can be defined as a Harmful species due to the following IMO criteria:

- **Evidence of prior introduction**
  
  Since 1915, in Germany from Caspian Sea

- **Demonstrated impacts on environment, economy, human health, property or resources**
  
  Clogging water intakes and cooling systems

- **Strength and type of ecological interactions**
  
  High filtration capacity, ability to outcompete native filter feeders and fish

- **Relationship with ballast water as a vector**
  
  Yes

- **Current distribution within biogeographic region and in other biogeographic regions**
Kleipeda-Gothenburg

- The species is established in Kleipeda port

1. **Scale of investigation**: Ports & surrounding waters
2. **Comparison of environmental conditions**:
   1. Kleipeda has considerably lower salinity (except for surface water)
   2. Temperature in ports quite similar
   3. Overlap of environmental conditions low?
3. *D. polymorpha* one of the "100 of the worst" invasive species according to DAISIE
4. **Ports separated by** waters with significantly different environmental conditions?
5. A requirement for species'-specific risk assessment
6. **Target species** only in Kleipeda
7. **Life history** and physiological tolerances
8. Volume of ballast water discharged?
9. Conclusion: the risk is unknown?

<table>
<thead>
<tr>
<th>Port</th>
<th>Surface / Seafloor temperature (°C)</th>
<th>Surface / Seafloor salinity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Annual min</td>
<td>Annual max</td>
</tr>
<tr>
<td>Klaipeda, LIT</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Gothenburg2, SWE</td>
<td>1.4</td>
<td>3.3</td>
</tr>
</tbody>
</table>
4. Running the proposed NSBWO Risk Assessment

Target species present in one or both ports?

1. YES

1. NO

LOW RISK
4. Running the proposed NSBWO Risk Assessment

- Target species present in one or both ports? 1
  - Yes
  - No

- Target species equally common in both ports? 2
  - Yes
  - No

  - Do ports have very different salinities (≥30PSU Difference)? 3
    - Yes
    - No

    - Do the ports have the same salinity range or differ by no more than 10 PSU? 7
      - Yes
      - No

    - Is more than one target species present? 8
      - Yes
      - No

    - Low Risk

  - Does the species tolerate wider ranges of salinity? 9
    - Yes
    - No

    - Medium Risk

- Ljungberg 2009
  - Unknown risk:
  - Due to life history and physiological tolerances of D.polymorpha, no natural spread ability
## Risk assessment for the Baltic

<table>
<thead>
<tr>
<th></th>
<th>Kiel</th>
<th>Klaipeda</th>
<th>Risk</th>
<th>Risk level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salinity</td>
<td>19,5</td>
<td>0,5-7</td>
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Klaipeda -> Gothenburg Total risk calculation 9 (medium risk)
Distribution of Dreissena polymorpha from DAISIE

Legend:
- Known in country
- Known in CGRS square
- Known in sea
- Native in country
- Native in CGRS square
- Assumed native range
3b) Case study intra Baltic

Ballast Water Risk Assessment Test
Hamina-Kokkola

- The species established in eastern Gulf of Finland

1. **Scale of investigation**: Ports & surrounding waters
2. **Comparison of environmental conditions**:  
   1. Both ports have freshwater
   2. Temperature regime is similar
   3. Overlap of environmental conditions (T, salinity) is high
3. *D. polymorpha* one of the “100 of the worst” invasive species according to DAISIE
4. Ports are separated by waters with somewhat different environmental conditions
5. A requirement for species-specific risk assessment
6. Between the ports *Target species* is only found in Hamina
7. Life history and physiological tolerances
8. Not so vital to know volumes of BW discharged
9. Conclusion: the risk is low

<table>
<thead>
<tr>
<th>Port</th>
<th>Surface / Seafloor temperature (°C)</th>
<th>Surface / Seafloor salinity</th>
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<tr>
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4. Running the proposed NSBWO Risk Assessment

Target species present in one or both ports?

1

YES

NO

LOW RISK
Running the proposed NSBWO Risk Assessment

1. Target species present in one or both ports?
   - YES
   - NO

2. Target species equally common in both ports?
   - YES
   - NO

3. Do ports have very different salinities (=30PSU Difference)?
   - YES
   - NO

4. Do the ports have the same salinity range or differ by no more than 10 PSU?
   - YES
   - NO

Ljungberg -> low risk due to life history and physiological tolerances of D.polymorpha, natural spread ability

HIGH RISK
Gollasch & Leppäkoski 2007

Risk assessment for the Baltic

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Distribution Dreissena polymorpha from DAISIE

Legend

- Known in country
- Known in CGRS square
- Known in sea
- Native in country
- Native in CGRS square
- Assumed native range

© KUCORPI, 2008
Target species present in one or both ports? 1

YES

Target species equally common in both ports? 2

YES

DO species have the ability for natural spread? 3

YES

LOW RISK

NO

DO species Tolerate wider Ranges of salinity? 4

YES

LOW RISK

NO

DO ports have very different salinities (=30PSU Difference)? 5

NO

Do the ports have the same salinity range or differ by no more than 10 PSU? 6

NO

MEDIUM RISK

YES

LOW RISK

Is more than one target species present? 7

NO

NO

NO

NO

NO

NO

LOW RISK

YES

HIGH RISK

YES

LOW RISK

YES

HIGH RISK

YES

HIGH RISK

YES

LOW RISK

NO

Does the species Tolerate wider range of salinity? 8

YES

HIGH RISK

NO

Is more than one target species present? 9

NO

LOW RISK

YES

MEDIUM RISK

NO

NO

NO

NO

NO

NO

LOW RISK

YES

HIGH RISK

YES

LOW RISK

YES

HIGH RISK

YES

LOW RISK

NO

Does the species Tolerate wider ranges of salinity? 10

YES

MEDIUM RISK

NO

NO

NO

NO

NO

LOW RISK

YES

HIGH RISK

YES

LOW RISK

YES

HIGH RISK

YES

LOW RISK

NO

Does >1 species tolerate wider ranges of salinity? 11

YES

HIGH RISK

NO

NO

NO

NO

NO

LOW RISK

YES

HIGH RISK

YES

LOW RISK

YES

HIGH RISK

YES

LOW RISK

NO

Does the species Tolerate wider ranges of salinity? 12

YES

MEDIUM RISK

NO

NO

NO

NO

NO

LOW RISK

YES

HIGH RISK

YES

LOW RISK

YES

HIGH RISK

YES

LOW RISK

NO

Does >1 species Tolerate wider ranges of salinity? 13

YES

HIGH RISK

NO

NO

NO

NO

NO

LOW RISK

YES

HIGH RISK

YES

LOW RISK

YES

HIGH RISK

YES

LOW RISK

NO

Does >1 species Tolerate wider ranges of salinity? 14

YES

HIGH RISK

NO

NO

NO

NO

NO

LOW RISK

YES

HIGH RISK

YES

LOW RISK

YES

HIGH RISK

YES

LOW RISK

NO

Does the species Tolerate wider range of salinity? 15

YES

MEDIUM RISK
Many steps are necessary for finding/defining target species:

1) Comparing species lists in both ports and surrounding areas

2) Looking for reasons why species were only found in one of the ports (e.g. sampling method adequate?)

3) Are the species, that are only found in one port harmful or not:
   3a) as I did, we can use the 5 points proposed by the IMO
   3b) we can use the risk assessment BPI proposed by Olenin et al. 2007
**Rangia cuneata**  
in the Scheldt

species information from Verween et al. 2006

<table>
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<th><strong>ADR class:</strong></th>
<th>the species occurs in high numbers in one locality</th>
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<tbody>
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<td><strong>Impact code:</strong></td>
<td>No displacement of native species, although AS may be present. Ranking of native species according to quantitative parameters in the community remains unchanged. Type-specific communities are present</td>
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<td><strong>Ecosystem functioning:</strong></td>
<td>? Strong filter feeder?</td>
<td>= E1 – E2?</td>
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<td><strong>BPI =</strong></td>
<td>1 or 2</td>
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</table>
It is shown, that

- Up to now no RA exists that takes into account all recommendations of HELCOM
- Especially the ability of naturally disperse, uncertainty
- It is important to have information concerning the colonization of the surrounding areas of the ports, also from the rivers
Gaps

• No basic port surveys

• No special monitoring for alien species

• Integration of level of uncertainty and ability of species to disperse naturally in the RA
The Australien Ballast Water Risk Assessment

**High risk:** all salt water from ports and coastal waters outside Australia’s territorial sea

**discharge:** prohibited anywhere inside Australia’s territorial sea

**Low risk:**
- freshwater from any source
- BW that has been exchanged (mid ocean)
- BW of which at least 95% was taken up in mid ocean
- BW of which at least 95% was taken up inside Australia’s territorial sea

**Exemptions:**
- Pre-approved for domestic vessels only
- Case-by-case for international vessels, domestic vessels on high risk voyages and vessels failing the to manage BW following an extraordinary event
Marine pest incursions in Australia

- **Queensland**
  - Previously intercepted
  - Not presently established in Australia
  - *Mytilopsis sallei*
  - *Perna viridis*

- **New South Wales**
  - *Carcinus maenas*
  - *Crassostrea gigas*
  - *Sabella spallanzanii*
  - *Caulerpa taxifolia*
  - *Codium fragile ssp tomentosoides*

- **Victoria**
  - *Carcinus maenas*
  - *Musculista senhousia*
  - *Crassostrea gigas*
  - *Undaria pinnatifida*
  - *Asterias amurensis*
  - *Varicorbul a gibba*
  - *Sabella spallanzanii*
  - *Codium fragile ssp tomentosoides*

- **South Australia**
  - *Carcinus maenas*
  - *Crassostrea gigas*
  - *Sabella spallanzanii*
  - *Caulerpa taxifolia*

- **Western Australia**
  - *Musculista senhousia*
  - *Sabella spallanzanii*

- **Tasmania**
  - *Carcinus maenas*
  - *Musculista senhousia*
  - *Crassostrea gigas*
  - *Undaria pinnatifida*
  - *Asterias amurensis*
  - *Varicorbul a gibba*
  - *Sabella spallanzanii*
  - *Codium fragile ssp tomentosoides*

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<th>Domestic ballast import rank</th>
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<th>Port Kembla</th>
<th>Gladstone</th>
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<th>Fremantle</th>
<th>Botany_Bay</th>
<th>Geelong</th>
<th>Port_Darling</th>
<th>Port_Hedland</th>
<th>Sydney</th>
<th>Toowoomba</th>
<th>Adelaide</th>
<th>Devonport</th>
<th>Dampier</th>
<th>Geraldton</th>
<th>Burnie</th>
<th>Westernport</th>
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<td>Portland</td>
<td>20 Victoria</td>
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</tr>
<tr>
<td>Port_Sanvac</td>
<td>22 South Australia</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Hobart</td>
<td>23 Tasmania</td>
<td>0</td>
<td>0</td>
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<td></td>
</tr>
</tbody>
</table>

1 = high risk
0 = low risk

Discharge ports
‘To’ ports

Uptake ports “from” ports
Risk Assessment decision

Are you seeking a formal exemption for a particular ship to permit discharge of unmanaged ballast water at its next port?

Yes  No

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Application for Exemption to Discharge Unmanaged Ballast Water via Risk Assessment. Step 1/4 - enter vessel details

NOTE: Details entered will be forwarded to the relevant authority at the vessel's next port of arrival for ballast water management verification purposes. Please ensure accuracy. Penalties may apply as a result of false information being provided.

Vessel Search

Enter IMO number, call sign or vessel name, then click continue

IMO number
Call sign
Vessel name: test vessel 1

Continue

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Application for Exemption to Discharge Unmanaged Ballast Water via Risk Assessment. Step 3/4 - confirm vessel details

Please insure all vessel and ballast tank details are full and correct, then click Continue.

**VESSEL DETAILS**

<table>
<thead>
<tr>
<th>Vessel name</th>
<th>Test vessel 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMO</td>
<td>1</td>
</tr>
<tr>
<td>Call sign</td>
<td>test vsl</td>
</tr>
<tr>
<td>Flag country</td>
<td>Malaysia</td>
</tr>
<tr>
<td>Total length (m)</td>
<td>125.6</td>
</tr>
<tr>
<td>Gross tonnage</td>
<td>21339</td>
</tr>
<tr>
<td>Net tonnage</td>
<td>0</td>
</tr>
<tr>
<td>Ballast capacity (m³)</td>
<td>10000</td>
</tr>
<tr>
<td>Vessel type</td>
<td>container ship</td>
</tr>
<tr>
<td>Comment</td>
<td>test vessel 1</td>
</tr>
</tbody>
</table>

**BALLAST TANK DETAILS**

<table>
<thead>
<tr>
<th>Tank type</th>
<th>Name</th>
<th>Tank capacity (m³)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilge</td>
<td>23</td>
<td>100</td>
<td>test only</td>
</tr>
<tr>
<td>Afrpeak</td>
<td>ap</td>
<td>300</td>
<td>test only</td>
</tr>
<tr>
<td>Double bottom</td>
<td>db1p</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Double bottom</td>
<td>db1s</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Double bottom</td>
<td>db2p</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Double bottom</td>
<td>db2s</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Double bottom</td>
<td>db3p</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Forepeak</td>
<td>fp</td>
<td>750</td>
<td></td>
</tr>
<tr>
<td>Forpeak</td>
<td>fp1</td>
<td>1000</td>
<td></td>
</tr>
<tr>
<td>Heeling tank</td>
<td>ht</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Heeling tank</td>
<td>ht</td>
<td>450</td>
<td></td>
</tr>
<tr>
<td>Top side tank</td>
<td>ts1p</td>
<td>865.5</td>
<td></td>
</tr>
<tr>
<td>Water ballast tank</td>
<td>wbld4s</td>
<td>500</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Edited details will be forwarded to the Australian Ballast Water Unit for confirmation purposes.

Do you intend to discharge ballast water at the next port?  **YES**  **NO**

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Application for Exemption to Discharge Unmanaged Ballast Water via Risk Assessment. Step 4/4 - enter all details for Test vessel 1 (1) and Apply.

Enter details of ALL ballast water to be discharged at next port, confirm details are correct and in full, then click on Apply and wait for decision.

<table>
<thead>
<tr>
<th>Planned arrival date at berth</th>
<th>Planned ports of call</th>
<th>List ALL sources of ballast water to be discharged and uptake dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>17/Sep/2011</td>
<td>Melbourne</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name tank</th>
<th>Tank type</th>
<th>Tank capacity (m³)</th>
<th>Uptake date, uptake port/s and BW uptake volume (m³)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>ap</td>
<td>Aftpeak</td>
<td>300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Bilge</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>db1p</td>
<td>Double bottom</td>
<td>1000</td>
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<tr>
<td>db1s</td>
<td>Double bottom</td>
<td>1000</td>
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<td>db2p</td>
<td>Double bottom</td>
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<tr>
<td>db2s</td>
<td>Double bottom</td>
<td>1000</td>
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<td></td>
</tr>
<tr>
<td>db3p</td>
<td>Double bottom</td>
<td>1000</td>
<td>13/Sep/2011 Port Macquarie</td>
<td>test only</td>
</tr>
<tr>
<td>fp</td>
<td>Forpeak</td>
<td>750</td>
<td>11/Sep/2011 Brisbane</td>
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</tr>
<tr>
<td>fp1</td>
<td>Forpeak</td>
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<td>ht</td>
<td>Hooing tank</td>
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<td>Hooing tank</td>
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</tr>
<tr>
<td>tst1p</td>
<td>Top side tank</td>
<td>665.5</td>
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<tr>
<td>wbt4s</td>
<td>Water ballast tank</td>
<td>500</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Risk Assessment, step 4/4: Test vessel 1 (1)

DECISION ON APPLICATION FOR EXEMPTION TO DISCHARGE UNMANAGED BALLAST WATER.

This decision is only valid for this journey and is only applicable to the details entered in the application. If any details relating to the vessel, the voyage (including dates) or the ballast water change, prior to intended discharge, this Decision becomes null and void and a new Application for Exemption will be required to be lodged.

<table>
<thead>
<tr>
<th>Risks at discharge port</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ballast water sourced from PORT MACQUARIE is LOW RISK for this voyage and may be discharged in the port of Melbourne.</td>
</tr>
<tr>
<td>Ballast water sourced from BRISBANE is LOW RISK for this voyage and may be discharged in the port of Melbourne.</td>
</tr>
</tbody>
</table>

NOTE: Any low risk ballast water that is mixed with high risk ballast water is deemed to be HIGH RISK for this journey and cannot be discharged in port.

This form should be printed out and kept onboard the vessel and produced on request by an authorised inspector.

Exemption Number : 1579

Print details

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Risk Assessment, step 4/4: Test vessel 1 (1)

DEcision on Application for Exemption to Discharge Unmanaged Ballast Water.

This decision is only valid for this journey and is only applicable to the details entered in the application. If any details relating to the vessel, the voyage (including dates) or the ballast water change, prior to intended discharge, this decision becomes null and void and a new Application for Exemption will be required to be lodged.

Risks at discharge port

Ballast water sourced from Melbourne is HIGH RISK for this voyage and cannot be discharged in the port of Port Macquarie. This water must be managed in accordance with the Australian Ballast Water Management Arrangements. Pest species are: *Asterias amurensis*, *Carcinus maenas*, *Sabella spallanzani*, *Jodarla phalangia*, *Vaironiella gibba.*

NOTE: Any low risk ballast water that is mixed with high risk ballast water is deemed to be HIGH RISK for this journey and cannot be discharged in port.

This form should be printed out and kept onboard the vessel and produced on request by an authorised inspector.

Exemption Number: 1580

Print details

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**Asterias amurensis** (Japanese seastar)

**General Information**

*Lutken, 1871*

*Asterias amurensis* is a large seastar with a small central disc and five distinct arms that taper to pointed tips. It is predominantly yellow in colour and often seen with purple or red detail on its upper surface. There are numerous small spines with sharp edges on the upper body surface that are arranged irregularly along the arm edges. On the underside of the body, these spines line the groove in which the tube feet lie, and join up at the mouth in a fan-like shape. The underside is a uniform yellow in colour. Fully grown individuals can reach 40-50 cm in diameter.

**Taxonomy**

- **Phylum**: Echinodermata
- **Subphylum**: Asterozoa
- **Class**: Asteroidea
- **Order**: Fordcupulatida
- **Family**: Asteridae

**Synonyms**

- *Aisterias anomalae*
- *Aisterias rathbunii nortonensis*
- *Aisterias rathbunii var. anom*
- *Aisterias rathbunii var. nort*
- *Asterias amurensis f. acervispinis*
- *Asterias amurensis f. flabelifera*
Thank you for your attention!!