• Inshore monitoring and citizen science
  (Cornish Wildlife Trust and the Marine Biological Association)

• Inshore monitoring and comparison of monitoring methods
  (Bangor University and Natural Resource Wales)

• Off-shore monitoring
  (Scottish Association of Marine Science and Cefas/Marine Biological Association)
Predicting and Monitoring the Introduction of Marine Non-Native Species into GB and Ireland

Hannah Tidbury and Paul Stebbing
Structure

• Identification of introduction hotspots

• The merit of risk based surveillance

• The use of existing monitoring programmes
Management of NNS Crucial

- Meet new Alien Invasive species EU regulations

- Prevention and early detection of introduction and early mitigation most effective where possible
Focus on introduction pathways

1. Key pathways and mechanisms

2. Intensity of introduction pathways activity

3. Highlight where NNS may be more likely to be introduced

4. Inform and target biosecurity, monitoring and surveillance.
Introduction Pathways

Shipping
- Hull fouling
  - ballast water

Aquaculture Imports
- intentional for food
- accidental contamination

Recreational Boating
- Hull fouling

Natural Dispersal
- Ocean current
Pathway Activity Assessment - Methods

Sought Data for Year 2012

Split into 50km coastal grid squares

Scored each grid based on activity of pathway within that grid

Scores scaled to between 0 and 100 and colour graded grid according to score

Cefas
Automatic Identification System (AIS) data from Marine Traffic

Number of voyages

Number of different ports traffic comes from

Grid Scores

Pathway Activity Assessment - Shipping
Pathway Activity Assessment - Shipping

- Commercial shipping activity hotspots
  - Thames
  - Immingham
  - Dover
  - Tees
  - Dublin
  - Southampton
Pathway Activity Assessment

Recreational boating
- Number of predicted cruising routes
- Intensity of cruising routes

Aquaculture
- Number of imports
- Influence of ocean current
- Proximity to landmass

Natural dispersal

Scores
- Number of predicted cruising routes
- Intensity of cruising routes
Pathway Activity Assessment - Summary

- Highlight areas where relative activity is high

- Indicate areas where likelihood of introduction is increased.
Application – Towards a Surveillance Programme

- Pathway assessment used to inform management strategies, specifically surveillance.

- One option is risk based surveillance

- Merit of risk based surveillance over non risk based?
The merit of risk based surveillance

• Simulation

• Quantify time taken to detect introduction with different monitoring strategies
  1. Random
  2. Light risk based
  3. Heavy risk based
The merit of risk based surveillance

Optimum = light risk-based surveillance
Conclusions – hotspots of introduction and risk based surveillance

• Data analysis and mathematical simulation provide fundamental information for the development of surveillance strategy
Monitoring and surveillance

- Monitoring and surveillance crucial for management of NNS and assessment of efficacy of measures in the future.
- Currently no specific monitoring for NNS
- However, currently other marine monitoring undertaken
- Potential to adapt current monitoring to detect NNS??
Assessment of current marine monitoring

- Non-Statutory
  - Recording schemes
  - Societies
  - Research groups and organisations
  - Local record centres and recording groups

- Statutory
  - MPA monitoring
  - The Clean Seas Environmental Monitoring (CSEMP)
  - Ground Fish Surveys
  - Aggregate Levy Sustainability fund (ALSF) monitoring
  - Water Framework Directive
  - Monitoring of dredged material disposal sites (SLAB5)
### Current Statutory monitoring – Coverage

<table>
<thead>
<tr>
<th>Monitoring programme</th>
<th>Total number of sites</th>
<th>Number (Proportion) of sites within 1 NM of coast</th>
<th>Number (proportion) of sites further than 1 NM from coast</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSEMP</td>
<td>48</td>
<td>0 (0%)</td>
<td>48 (100%)</td>
</tr>
<tr>
<td>Groundfish survey</td>
<td>949</td>
<td>4 (0.4%)</td>
<td>945 (99.6%)</td>
</tr>
<tr>
<td>WFD</td>
<td>194</td>
<td>194 (100%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>SLAB5</td>
<td>367</td>
<td>34 (9.3%)</td>
<td>333 (90.7%)</td>
</tr>
<tr>
<td>MPA</td>
<td>12,877</td>
<td>12,235 (95%)</td>
<td>642 (5%)</td>
</tr>
<tr>
<td>Aggregates</td>
<td>90</td>
<td>0 (0%)</td>
<td>(100%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monitoring programme</th>
<th>Total number of sites</th>
<th>Estimated number of sites to be surveyed per annum</th>
<th>Number (proportion) of sites within 1 NM</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0</td>
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<tr>
<td>Groundfish survey</td>
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<td>4 (0.4%)</td>
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<tr>
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<td>1 (0.27%)</td>
</tr>
<tr>
<td>MPA</td>
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<tr>
<td>Aggregates</td>
<td>90</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>
### Current Statutory monitoring – potential to detect NNS

<table>
<thead>
<tr>
<th>Group</th>
<th>Example NIS within each ecosystem facet</th>
<th>Potential for monitoring Programmes to detect NIS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Genus</td>
<td>Species</td>
</tr>
<tr>
<td>Fish</td>
<td>Athelina</td>
<td>buoyi</td>
</tr>
<tr>
<td>Epifauna</td>
<td>Didemnum</td>
<td>vexillum</td>
</tr>
<tr>
<td></td>
<td>Pliolittorina</td>
<td>sinensis</td>
</tr>
<tr>
<td></td>
<td>Urosalpinx</td>
<td>cinerea</td>
</tr>
<tr>
<td></td>
<td>Caprella</td>
<td>mutica</td>
</tr>
<tr>
<td></td>
<td>Crassostrea</td>
<td>gigas</td>
</tr>
<tr>
<td></td>
<td>Crepidula</td>
<td>fornicata</td>
</tr>
<tr>
<td></td>
<td>Stylochus</td>
<td>clava</td>
</tr>
<tr>
<td></td>
<td>Homarus</td>
<td>americanus</td>
</tr>
<tr>
<td></td>
<td>Undaria</td>
<td>pinnatifida</td>
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<td>Aelita</td>
<td>succinea</td>
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<td>Naisplana</td>
<td>lineata</td>
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<td></td>
<td>Suberites</td>
<td>mausa</td>
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<td></td>
<td>Spatella</td>
<td>anglica</td>
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<td>Jamieson</td>
<td>brasiliensis</td>
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<td>Infana</td>
<td>Tapes</td>
<td>philippinarum</td>
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<td></td>
<td>Petricola</td>
<td>philadelfica</td>
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<td></td>
<td>Clymenella</td>
<td>forrumpia</td>
</tr>
<tr>
<td>Planktonic</td>
<td>Odonolina</td>
<td>sinensis</td>
</tr>
</tbody>
</table>
Current Statutory monitoring at high risk locations
Monitoring and surveillance – Conclusions

- Quantification of NNS abundance may be limited
- Data management and accessibility requires work
- Baseline data needed to more accurately determine change
- Target species list and reporting protocol needed
- Current monitoring provides good basis for monitoring programme for NNS but additional coverage of high risk sites crucial
Thank you

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