Marine Non-Natives Workshop

Stuart Jenkins
School of Ocean Sciences
Programme

09:00  Arrival, tea and coffee (bring your own mug)
09:30  Welcome and Introduction by Stuart Jenkins
10:00  Presentation on Marine Non-native Animals by Paul Brazier
10:45  Tea and coffee break
11:00  Animals practical
12:30  Lunch (provided)
13:15  Presentation on Marine Non-native Plants by Gabe Wyn
14:00  Plants practical
15:15  Presentation on Didemnum in Holyhead by Ashley Cordingley
15:30  Discussion (Recording, reporting and management) by Lucy Kay
16:00  Finish
Contents

1) Introduction to marine non-natives

2) Ongoing research at SOS on marine non-natives
Non-native species

• Non native species: ‘a species introduced (i.e. by human action) outside its natural past or present distribution’

• Invasive non-native species: ‘those whose introduction and/or spread threaten biological diversity or have other unforeseen impacts’
How abundant are marine non-natives in the UK?

Figure 7. Proportion of marine records that are of non-native species (running means based on 5-year running totals); values for GB are derived from those from the separate countries, weighted by the square root of their land area.

From Hill et al 2009 Developing an indicator of the abundance, extent and impact of invasive non-native species Report to Defra
But not all non-natives are invasive

- Dispersal potential
- Colonisation of natural and semi-natural habitats
- Adverse impacts on native species
- Alteration of ecosystem function

(for marine species mostly based on guesswork)

From: Hill et al 2009 Developing an indicator of the abundance, extent and impact of invasive non-native species Report to Defra (WC0718)
Invasive species in the highest threat category in Great Britain

<table>
<thead>
<tr>
<th>(a) Marine plants</th>
<th>(d) Freshwater animals</th>
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</thead>
<tbody>
<tr>
<td><em>Sargassum muticum</em> (Jap Weed, Wire Weed)</td>
<td><em>Pacifastacus leniusculus</em> (Signal Crayfish)</td>
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<td><em>Undaria pinnatifida</em> (Japanese Kelp, Wakame)</td>
<td><em>Procambarus clarkii</em> (Red Swamp Crayfish)</td>
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<tr>
<td><em>Codium fragile ssp. tomentosoides</em> (Green Sea Fingers)</td>
<td><em>Corbcula fluminea</em> (Asian Clam)</td>
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<td><em>Dreissena polymorpha</em> (Zebra Mussel)</td>
<td><em>Pseudorosario parva</em> (Topmouth Gudgeon)</td>
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<td><em>Sander lucioperca</em> (Pikeperch, Zander)</td>
<td><em>Lithobates salusianus</em> (American Bullfrog)</td>
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<td><em>Trachemys scripta</em> (Common Slider Turtle)</td>
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<tr>
<th>(b) Marine animals</th>
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<tbody>
<tr>
<td><em>Trachelinum ipomoea</em> (a bryozoan)</td>
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<tr>
<td><em>Watersipora subitorquata</em> (a bryozoan)</td>
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<tr>
<td><em>Corophium sextonae</em> (an amphipod)</td>
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<tr>
<td><em>Gammarus tigrinus</em> (an amphipod)</td>
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<tr>
<td><em>Eminius modestus</em> (an acorn barnacle)</td>
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<td><em>Solidobalanus fallax</em> (a barnacle)</td>
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<tr>
<td><em>Eriocheir sinensis</em> (Chinese Mitten Crab)</td>
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<td><em>Rhitonopeus harrisii</em> (Dwarf Crab)</td>
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<tr>
<th>(c) Freshwater plants</th>
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<tr>
<td><em>Crassula helmsi</em> (New Zealand Pigmyweed)</td>
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<td><em>Hydrocotyle ranunculoides</em> (Floating Pennywort)</td>
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<tr>
<td><em>Ludwigia grandiflora</em> (Uruguayan Hampshire-purslane)</td>
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<td><em>Myriophyllum aquaticum</em> (Parrot's-feather)</td>
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<th>(e) Terrestrial plants</th>
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<tbody>
<tr>
<td><em>Botrylloides violaceus</em> (a tunicate)</td>
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<tr>
<td><em>Corella cymoza</em> (a tunicate)</td>
</tr>
<tr>
<td><em>Didemnum vexillum</em> (a tunicate)</td>
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<tr>
<td><em>Styela clava</em> (Leathery Sea Squirt)</td>
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<th>(f) Terrestrial animals</th>
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<tr>
<td><em>Achillea millefolium</em> (New Zealand Flatworm)</td>
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<tr>
<td><em>Harmania axynula</em> (Harlequin Ladybird)</td>
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<tr>
<td><em>Branta canadensis</em> (Canada Goose)</td>
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<td><em>Oxyura jamaicensis</em> (Ruddy Duck)</td>
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<tr>
<td><em>Cervus nippon</em> (Sika Deer)</td>
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<tr>
<td><em>Muntiacus reevesi</em> (Reeves' Muntjac)</td>
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<tr>
<td><em>Mustela vison</em> (American Mink)</td>
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</table>

From: Hill et al 2009
Developing an indicator of the abundance, extent and impact of invasive non-native species Report to Defra (WC0718)
Marine plants
Sargassum muticum (Jap Weed, Wire Weed)
Undaria pinnatifida (Japanese Kelp, Wakame)
Codium fragile ssp. tomentosoides (Green Sea Fingers)

Marine animals
Tricellaria inopinata (a bryozoan)
Watersipora subtorquata (a bryozoan)
Corophium sextonae (an amphipod)
Gammarus tigrinus (an amphipod)
Elminius modestus (an acorn barnacle)
Solidobalanus fallax (a barnacle)
Eriocheir sinensis (Chinese Mitten Crab)
Rhithropanopeus harrisii (Dwarf Crab)
Crassostrea gigas (Pacific Oyster)
Crepidula fornicata (Slipper Limpet)
Rapana venosa (Rapa Whelk)
Anguillicola crassus (Swim-bladder Nematode)
Botrylloides violaceus (a tunicate)
Corella eumyota (a tunicate)
Didemnum vexillum (a tunicate)
Styela clava (Leathery sea squirt)
What is the extent of invasive non natives influence?

Figure 8. Summed extent of invasive non-native species in countries within Great Britain; one diagram shows totals summed over all environments, the others show totals for marine, freshwater and terrestrial species separately.
Current projects in Wales

Frederike Groner and Stuart Jenkins

Eilir Morgan and Chris Richardson

Katrin Bohn, Stuart Jenkins and Chris Richardson

ALIENS II project
MARINE ALIENS II
Controlling Marine Invasive Species by Targeting Vectors of Dispersal

Funded by: The Esmée Fairbairn Foundation
Specific objectives:

• Quantification of non-native species associated with the high risk anthropogenic vector: hull fouling of commercial and recreational vessels
• Classification of ports/marinas in terms of hull fouling potential
• Development of a monitoring system for the early detection of invasive marine species on vessel hulls, in ports/marinas
The presence and abundance of target alien species within marinas in North Wales

ALIENS II project

1) Holyhead
2) Victoria Dock, Caernarfon
3) Pwllheli
4) Conwy and 5) Deganwy
Stress tolerance in native and invasive colonial ascidians

Frederike Gröner and Stuart Jenkins
Model 1: The Founder Effect

Donor population

Random sample

Founder population

Low genotypic diversity

Population mean stress tolerance ↓
Model 2: Pre - Selection

Donor population

Pre-selection

Founder population
Low genotypic diversity
But: Increase in the frequency of stress-tolerant genotypes

Population mean stress tolerance ↑
Model 3: Multiple Invasions

High genotypic diversity

Population mean stress tolerance
Experimental set-up
Apply salinity stress and measure response variables:

• Respiration
• Growth
• Death
ANOVA

species
\[ F = 17.89 \quad p \leq 0.001 \]
salinity
\[ F = 34.2 \quad p \leq 0.001 \]
species*salinity
\[ F = 1.47 \quad p = 0.24 \]

Tukey’s HSD Test \( p \leq 0.05 \)

n=11

Mean ± 95 % Conf. Interval

Growth under Hyposalinity
Mortality under Pulsed Hyposalinity

![Graph showing survival rates over time for native and invasive species.]

- **Survival** (%)
- **Time of experiment (days)**
- **Cessation of stressor**

Log-Rank Test:
- Z = 4.53, p ≤ 0.001

n = 11
The Non-Native Chilean Oyster
(*Tiostrea chilensis*) population in the
Menai Strait: Diary of an Invader

Eilir Hedd Morgan

osp83a@bangor.ac.uk  (Supervisor: Prof. Chris Richardson)

1. What is the present population extent in the Menai Strait?

2. What are the factors that are affecting its spread?

3. What are the likely effects on the native biota if invasion was to intensify in the near future?
Significant increase in the intensity of aquaculture activities and other anthropogenic activities (e.g. winkle picking) is thought to have played a part in the spread of *Tiostrea chilensis* in the Menai Strait.
Spat settlement has occurred in the Menai Strait between June and September 2009, with highest densities observed in areas of high adult densities.

Mean size eaten when presented singly, 5 in each size class = 15-25mm shell length

Slightly smaller for mussels = 10-20mm shell length

Very similar calorific value:

Oyster = 20.5k j g⁻¹

Mussel = 19.8k j g⁻¹
**Crepidula fornicata** in Wales
– An Invader on its Way North?

Katrin Bohn, Prof. C.A. Richardson,
Dr. S.R. Jenkins

Bangor Mussel Producers Association
Distribution of *C. fornicata*

- **Native range of *C. fornicata***:
  - North American Atlantic coast

- **Invasion of *C. fornicata*** in Europe:
  - 1st record in Europe: Liverpool Bay (1872)
  - Spread across Europe (F, NL, B, D, ...)
  - 1st record in Wales: Milford Haven (1953)

*From: Blanchard 1997*
Delivering Alien Invasive Species Inventories for Europe

Biological invasions by non-native or 'alien' species are one of the greatest threats to the ecological and economic well-being of the planet.

Alien species can act as vectors for new diseases, alter ecosystem processes, change biodiversity, disrupt cultural landscapes, reduce the value of land and water for human activities and cause other socio-economic consequences for man.

To help those tackling the invasive species challenge, this website provides a 'one-stop-shop' for information on biological invasions in Europe.

This website is the result of the DAISIE project, funded by the European Commission under the Sixth Framework Programme (Contract Number: SSPI-CT-2003-511202). Click here for more information about DAISIE.

Please note that the DAISIE database behind this website is continually being updated. The current version is only provisional for invertebrates and fungi where a large amount of data is currently being incorporated and corrections are being made.

To cite DAISIE, please use:
DAISIE European Invasive Alien Species Gateway (http://www.europe-aliens.org)

To cite specific DAISIE content, please use (e.g.):

www.europe-aliens.org/
To start exploring use the search box at the top right of every page.
The Data Archive for Seabed Species and Habitats (DASSH)

DASSH is the UK Marine Data Archive Centre for benthic survey data of both species and habitats. DASSH provides digital archive facilities for benthic datasets and a digital repository for benthic images and video.

DASSH aims to safeguard data (past and future) and make that data available as a national information resource to support marine science and better stewardship of the marine environment. To that end, DASSH provides access to datasets via an on-line catalogue of both metadata and data via this Web site and the National Biodiversity Network (NBIN).

DASSH is an initiative of the Marine Biological Association (MBA) funded by the Department for the Environment, Food and Rural Affairs (Defra). DASSH is built on the existing extensive data and dissemination skills of the Marine Life Information Network (MarLIN), the library expertise of the National Marine Biological Library (NMBL) and the MBA's historical role in marine science.

DASSH works with the Marine Environmental Data and Information Network (MEDIN) and collaborates with existing marine Data Archive Centres (mDACs) to develop and comply with national metadata and data standards.
www.nonnativespecies.org

The Invasive Non-Native Species Framework Strategy for Great Britain

Welcome to the GB non-native species secretariat website

In 2003 a Strategy was developed to meet the challenge posed by invasive non-native species in Great Britain. This website supports the Strategy by providing information about invasive non-native species, the work that is being done to tackle them across Great Britain, and providing tools to help those working in this area.

Read more about what we do

Protecting our natural heritage from invasive species

www.nonnativespecies.org