

# **MARINE INVASIVE SPECIES: Identification Workshop**

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**Royal Gourock Yacht Club**

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Clubbed tunicate *Styela clava* covering mussel lines in Prince Edward Island, Canada

# Introduction

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- Non-native – species introduced outside their native range
- Invasive non-native (INNS) – species that threaten biodiversity or cause economic damage
- In UK, estimated to cost to economy is £1.7 billion per annum, including £7.1 million per annum to aquaculture industry alone (Williams et al. 2010)
- Number of species have already been linked with significant fish kills worldwide and clearance costs from aquaculture sites and marinas (e.g., *Karenia mikimotoi*, *Styela clava*, *Crepidula fornicata*, *Didemnum vexillum*)
- In 2011, Wildlife and Natural Environment (WANE) (Scotland) Act (2011) was passed by Scottish Government and includes a requirement to notify the existence of specific INNS in

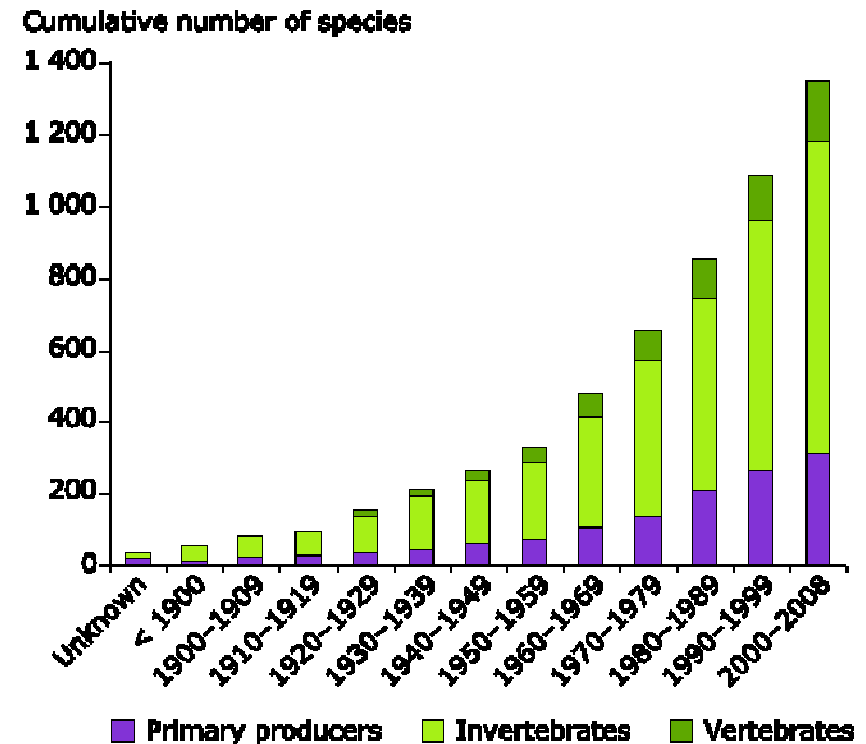
# Objectives

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- To increase awareness of the types of INNS already established in UK and Scottish waters (particularly the Clyde) and how to identify them
- To introduce potential impacts of INNS, vectors, pathways, and methods of control
- To discuss the pros and cons of various sampling techniques for INNS
- To highlight the reporting procedure for INNS

# Invasive Non-Native Species

- Alien species are a 'serious impediment to conservation' (Article 8; Convention on Biological Diversity)
- 'Deadly Duo' – Invasives and climate change (Nagoya, 2010)
- Number of alien species rapidly growing and severely impacting biodiversity (Hulme 2007)
- Insufficient information available to facilitate meaningful management decisions



Alien species in European marine/estuarine waters (Oct 2008). Source: European Environment Agency 2009

# UK/ Scottish Perspective on Marine INNS

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- Ninety marine and brackish water alien species have been recorded in the UK, 58 are established (Minchin et al. 2012).
- Approx. 17 non-native species have been recorded in Scotland
- *Didemnum vexillum* (Carpet Sea Squirt) - most recent *invasive* alien species to be sighted in Scottish waters
- GB Non Native Species Secretariat – main co-ordinating body
- Marine Aliens Programme (2004 – 2011) – first co-ordinated research programme for marine alien species

The colonial carpet sea squirt *Didemnum vexillum* found in the Clyde in November 2009 by SAMS INNS Survey team

# INNS - Impacts

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Biological introductions are widely recognised as a major threat to species diversity, these threats include:

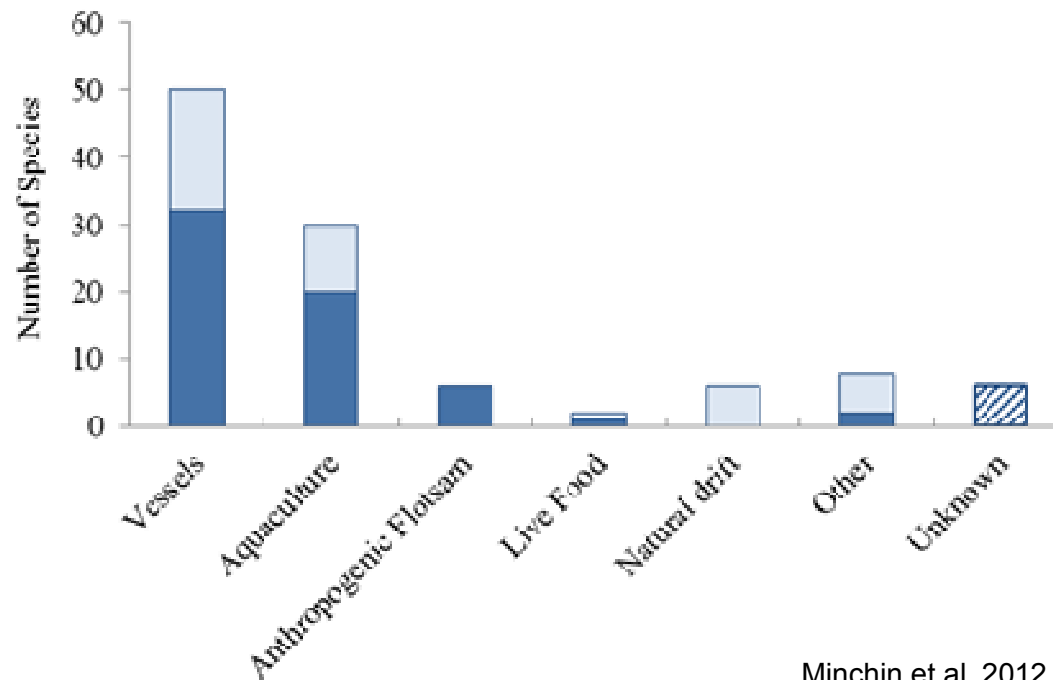
- Habitat modification (e.g., *Crassostrea gigas*, *Eriocheir sinensis*)
- Changes in ecosystem functioning (e.g. *Dreissena polymorpha*)
- Disease transfer and genetic effects such as hybridisation with native species
- Yield reduction in fisheries (e.g. North American comb jellyfish *Mnemiopsis leidyi*) / aquaculture production (e.g. Clubbed tunicate *Styela clava*)
- Blockage of cooling water systems and drains (e.g., jellyfish *Rhopilema nomadica*)

Massive reefs of the Pacific oyster *Crassostrea gigas* in Nieuwpoort, Belgium, January 2005. Photo courtesy of MUMM (Kerckhof et al. 2006)

# INNS - Vectors

A vector is used to describe how a species is transported, either via physical means (e.g. ballast water, vessel hulls) or agent (e.g. commercial oyster movement).

Vessels (including ballast water and hull fouling) and aquaculture were found to introduce the greatest number of INNS to British marine and brackish waters between <1850 and 2010 (Minchin et al. 2012).



Minchin et al. 2012 Aquatic Invasions



# INNS – Ballast Water

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- Shipping moves 3 to 5 billion tonnes of ballast water internationally each year.
- Ballast water is essential to the safe and efficient operation of modern shipping, providing balance and stability to un-laden ships.
- Estimated that at least 7,000 different species are being carried in ships' ballast tanks around the world.
- Large proportion species unable to survive...BUT
- Introduction of many invasive alien species has been attributed to ballast water exchange.

# INNS – Hull Fouling

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- Macrofouling found to occur on 59% yachts sampled in Scotland in 2006 (n = 866) (Ashton et al. 2006)
- Average of 4 NNS per yacht (n=63); 12 NNS found on yachts sampled on S coast of England (J. Bishop, pers. comm.)
- Average of 10.8 NNS per marina/harbour surveyed on S coast of England (Arenas et al. JMBA 2006)
- Niche areas, particularly propellor shafts, base of the keel are high risk sites for colonisation by NNS

Considerable fouling can occur on recreational vessels, this one included patches of *D. vexillum* (R. Holt, pers. comm.)

# INNS – Hull Fouling

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Dry Dock Sampling (Marine Scotland Science, 2009) – Nine vessels sampled in Aberdeen; two non-native species found on vessel hulls - *Austroelminius modestus* (Darwin's barnacle) and *Caprella mutica* (Japanese skeleton shrimp). Unable to examine sea chests.

# INNS – Aquaculture

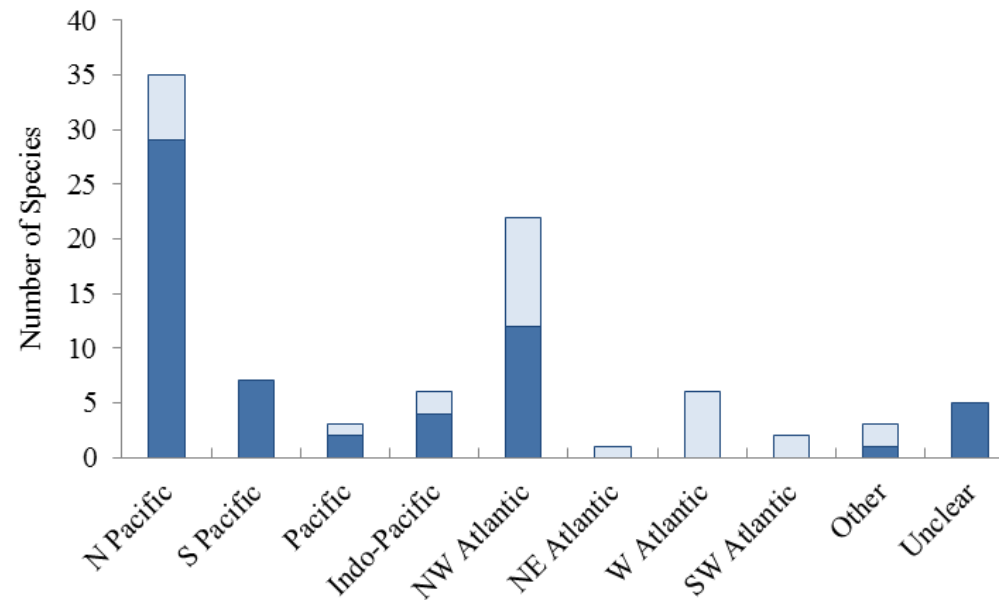
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- Intentional introductions
  - Occur in many regions of the world
  - Contribute significantly to the expansion of the industry
  - Main global species - the Pacific white shrimp *Penaeus vannamei*, the Atlantic salmon *Salmo salar* and the Pacific cupped oyster *Crassostrea gigas*
- Unintentional introductions
  - Annual cost to GB aquaculture industry is £7.1 million (underestimate?)
  - Fouling of structures and cultured species (e.g. *Styela clava*, *Didemnum vexillum*)
  - Competition for space and/or other resources (e.g. Slipper limpet *Crepidula fornicata*)

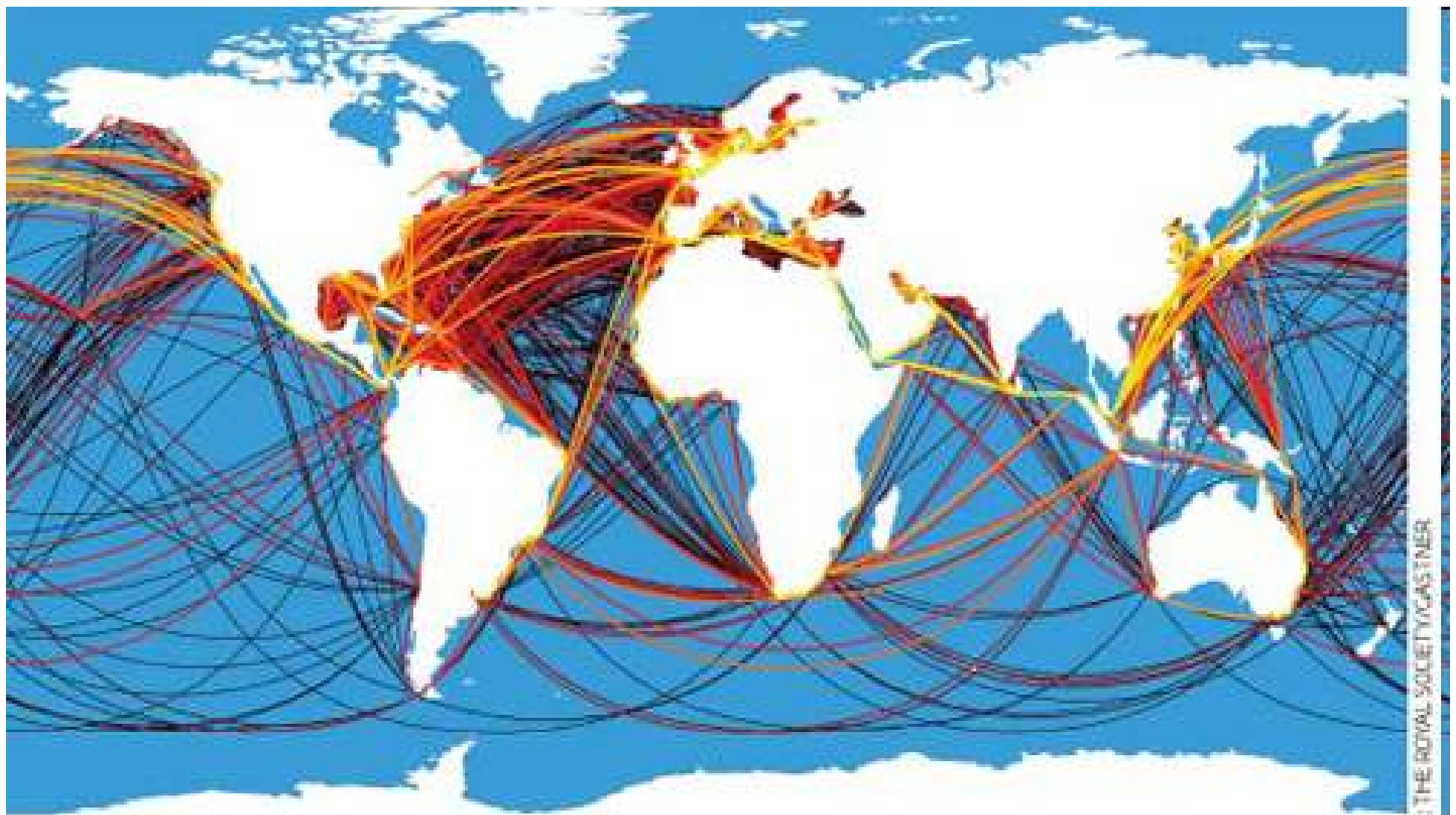
Slipper Limpet  
*Crepidula fornicata*

# INNS – Regions of Origin

- INNS have become established in British waters from all over the world
- Greatest number of established INNS in British waters originate from regions at a similar latitude (e.g. N Pacific, NW Atlantic)
- Smaller numbers of INNS originated from Mediterranean, Ponto-Caspian Sea and Polar Seas



Minchin et al. 2012 Aquatic Invasions



SOURCE: THE ROYAL SOCIETY/GASTNER

Shipping journeys in 2007 ● <10 ● 100 ● 500 ● 1000 ● 5000

## Map to show the links between ports of 16,363 cargo ships during 2007

Kaluza, Kölzsch, Gastner & Blasius (2010). The complex network of global cargo ship movements *Journal of the Royal Society Interface* arXiv: 1001.2172v1

# Thank you!

**NEXT COURSE:  
CPD SAMS 2 Day Marine Invasive Species  
Workshop | 4-5 Oct 2012**

[www.sams.ac.uk/education/short-courses/marine-invasive-species](http://www.sams.ac.uk/education/short-courses/marine-invasive-species)

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