

MARINE NON-NATIVE SPECIES: FROM FUNDAMENTAL ECOLOGY TO MANAGEMENT SOLUTIONS



Ecostructure is an interdisciplinary research project seeking to understand the role of artificial structures & climate change in the spread of non-native species (NNS) around the Irish Sea. Increased frequencies of extreme weather events and gradual climate warming have enhanced the likelihood of introduction and secondary spread of NNS in coastal seas. Ports and marinas are particularly susceptible to the introduction of NNS owing to the lack of boundaries in our oceans and coastal seas, and the free movement of commercial and recreational vessels. Ecostructure focuses on furthering our understanding of NNS biology and developing biosecurity tools for ports and marinas to reduce the risk of spread.

Ecostructure non-native species research aims to:

1. Improve understanding of the **biology** of key non-native species, including the ecology of invasion success and the genetic determinants of successful NNS.
2. **Engage with stakeholders** to understand barriers to implementing biosecurity within marinas and ports.
3. Develop **biosecurity tools** for marinas and ports, including testing environmental DNA techniques for early detection of NNS.

NON-NATIVE ECOLOGY & BIOLOGY

Characteristics of the recipient community



Characteristics of the non-native species

- Research through Ecostructure will focus on the characteristics of the fouling community found within marinas, allowing fundamental ecology to inform research into management and biosecurity solutions.
- Ecostructure aims to increase our understanding of how different components of diversity, including species richness and evenness, influence invasion success.

- Ecostructure will use conventional genetic techniques and next generation sequencing technologies to understand the genetic factors that may be influencing the spread of the marine NNS, *Didemnum vexillum* (carpet sea squirt), including understanding why *D. vexillum* spreads more rapidly in some areas versus others.
- Samples have been collected from sites around the Irish Sea, Galway Bay and Kent. Genetic analysis is ongoing.



Left: biological surveys of the fouling community in marinas. Right: understanding *D. vexillum* genetics



ENGAGING WITH STAKEHOLDERS

Workshop with Irish Sea marina operators February 2018

Aims:

- To understand the barriers and drivers to biosecurity planning in marinas (**Session 1**).
- To understand the strengths and weaknesses of specific biosecurity tools (**Session 2**).

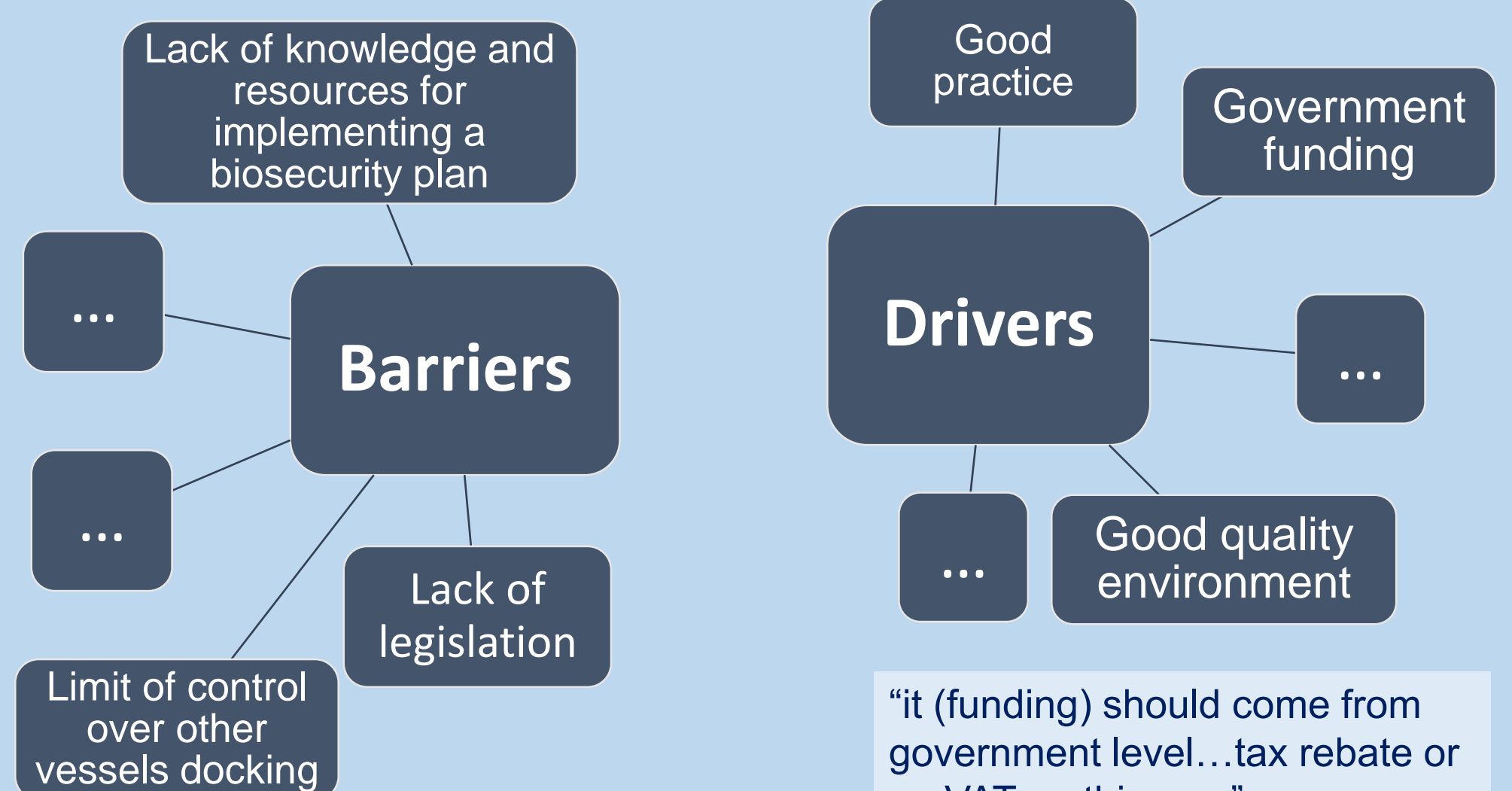
Who:

- 7 marinas from around the Irish Sea were represented including yacht clubs, commercial businesses and marinas owned and managed by local government.

Session 1: Biosecurity planning:

"...for people who wouldn't know, like myself, how to do something like that, I'd be looking for templates...how to put the 6, 10, step process in place..."

"I think its good practice...showing awareness of the environment..."

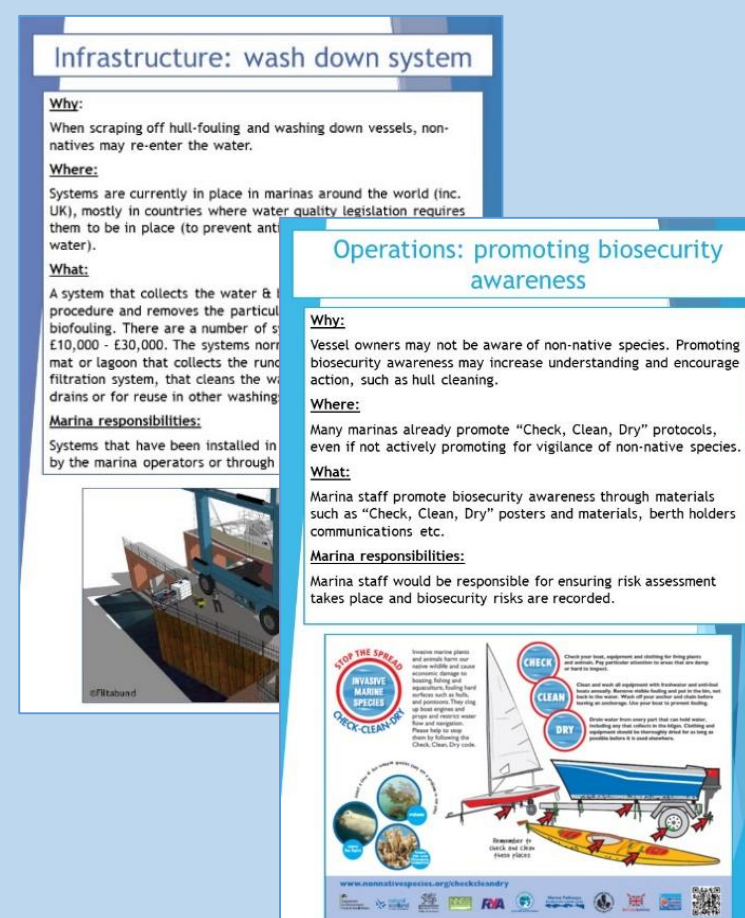


"...regardless of what we do...because we have commercial shipping and up to 100 vessels a year coming in the harbour...they have to be the ones to target initially..."

"it (funding) should come from government level...tax rebate or no VAT on things..."

Left: Selected barriers to biosecurity planning. Above: Selected drivers of biosecurity planning.

Session 2: Biosecurity tools



Participants discussed 4 operational biosecurity interventions and 4 infrastructure interventions, all of which are either in practice or under development.

Overall, results indicate that biosecurity interventions should be supported by **simple guidance, legislation and financial support**, alongside robust, digestible **evidence** of the **cost-effectiveness** of any intervention in reducing the risk of non-native species introductions.

BIOSECURITY TOOLS

Early detection using eDNA metabarcoding techniques

- Environmental DNA, or eDNA, is DNA left by organisms in their environment, through mechanisms including reproduction, shedding and excretion.
- NNS may be detectable in marine eDNA before they are detectable by conventional survey techniques.
- Ecostructure will test metabarcoding, an approach that characterises the whole community, as an early detection tool for marina environments and test its efficacy for common fouling taxa.



Left: Collecting and filtering water samples for eDNA analysis. Right: a prototype in-water quarantine berth.

Developing biosecurity devices for marinas

- A potential vector in marinas and ports is hull fouling, which may harbour NNS.
- Previous research at Bangor University has investigated the efficacy of an in-water quarantine berth to kill fouling on vessels without the additional risk of moving the vessel or removing it from the water.
- To date, the berth has been tested with both liquid chemicals and ozone.
- Ecostructure will continue research into the system and its feasibility as a biosecurity tool.

