The Technical Basis For Pathway Management

TOS Partnership Meeting

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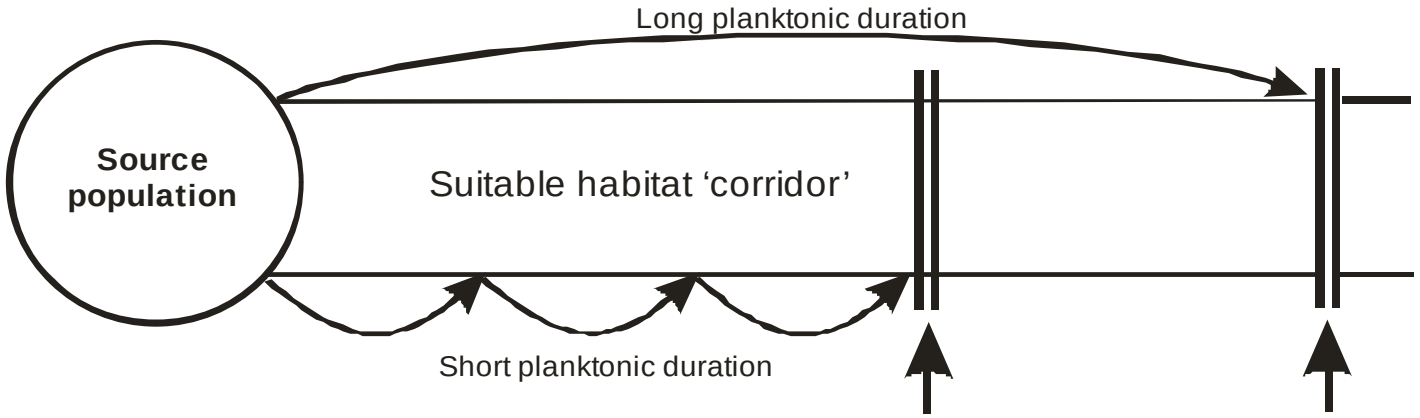
Context: natural vs human-mediated spread

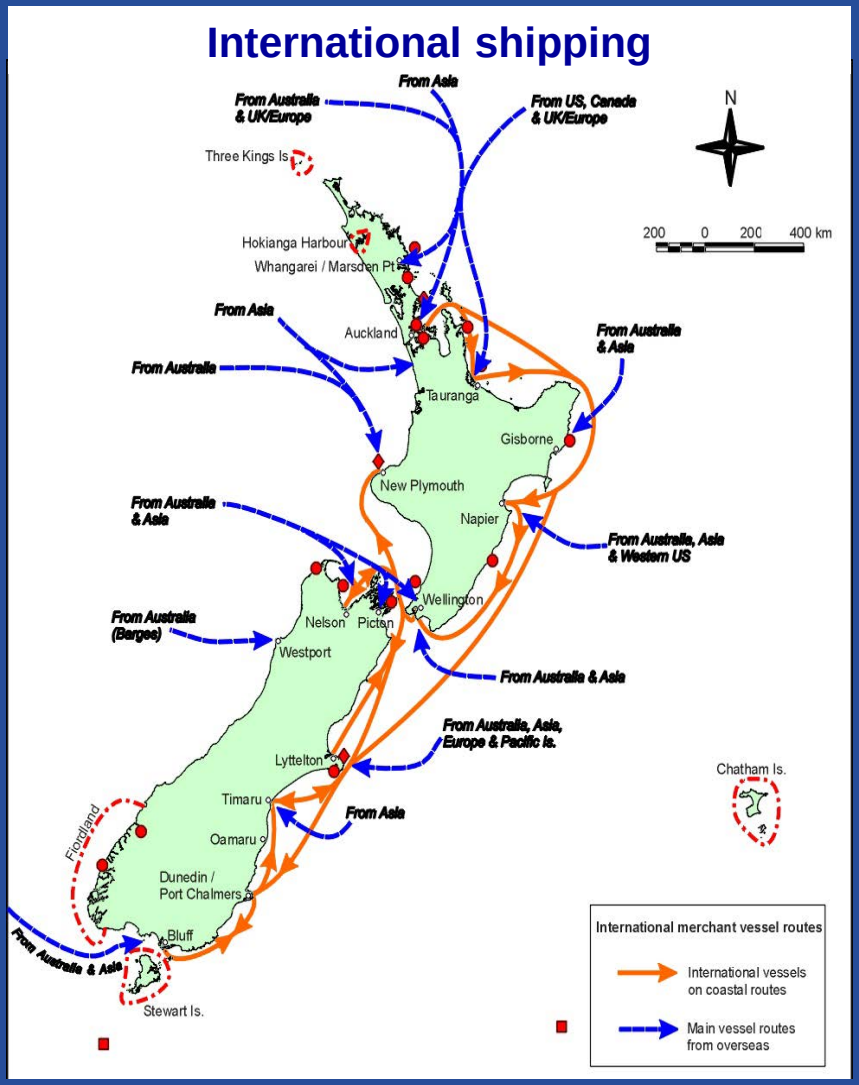
Most marine invasive species have limits to their natural spread:

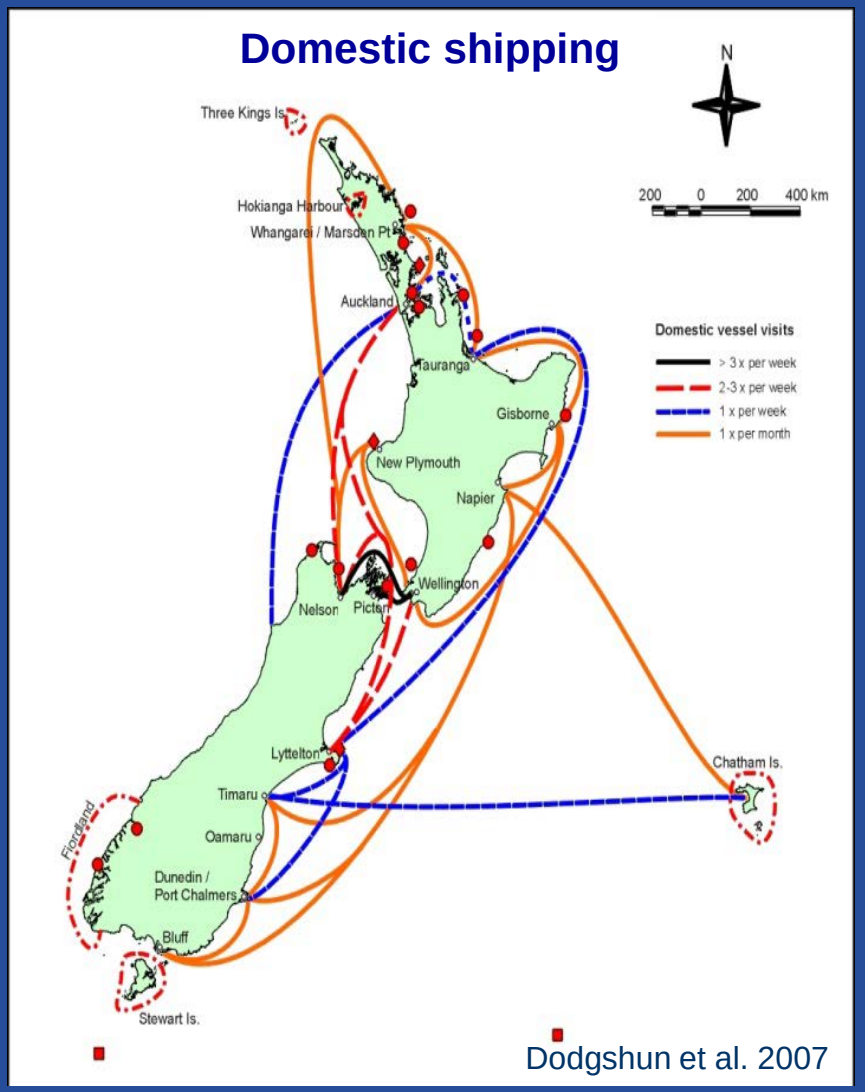
- May encounter unsuitable habitat
- Reproductive life-stages have finite time drifting with water currents



Forrest et al. 2009

Human activities exacerbate spread





Dodgshun et al. 2007

Domestic risk pathways and mechanisms

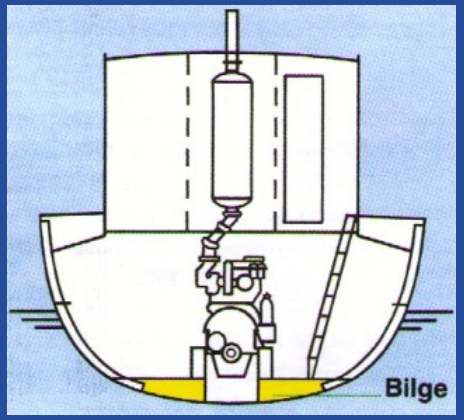
Ballast water

Recreational boat fouling

Aquaculture

Sea chests

Bilge water



Biofouling

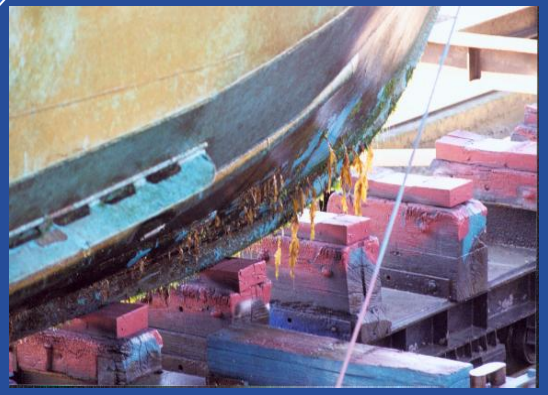
Sediment

Biofouling in Nelson marina

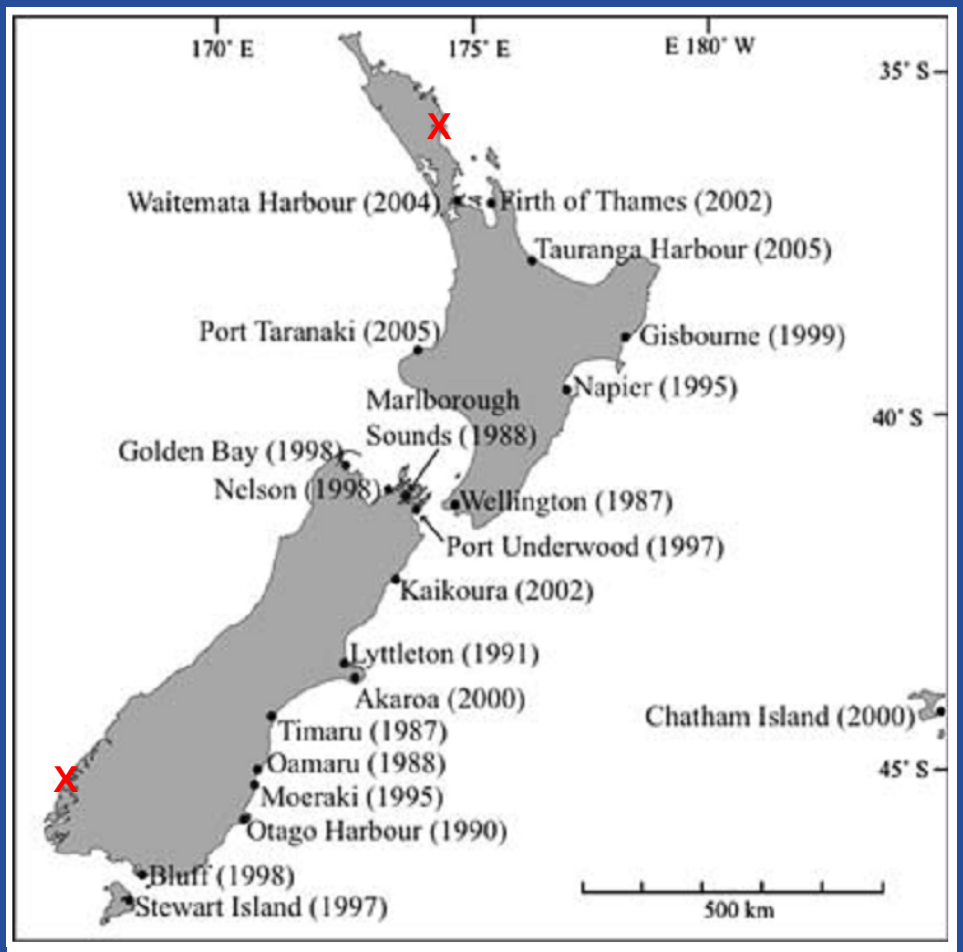
Rationale for pathway management

- Prevention preferable to cure - once a pest becomes established it's hard to get rid of
- Inclusive of a broad suite of species & life-stages, and risk mechanisms (e.g. fouling, bilge, infected gear/stock)
- Inclusive of known and potential pests, irrespective of their geographic origins (e.g. key aquaculture pests are native)
- Benefits protection of regional endemism and biodiversity (internal border management)
- Has benefits even for exotic pests that are well-established

Asian kelp *Undaria*



Undaria distribution in NZ



Russell et al. 2009

Have the tools, resources and expertise to manage vessels and other pathways

Cleaning

Plastic wrapping

Inspection

Effective antifouling

Wet/dry docks

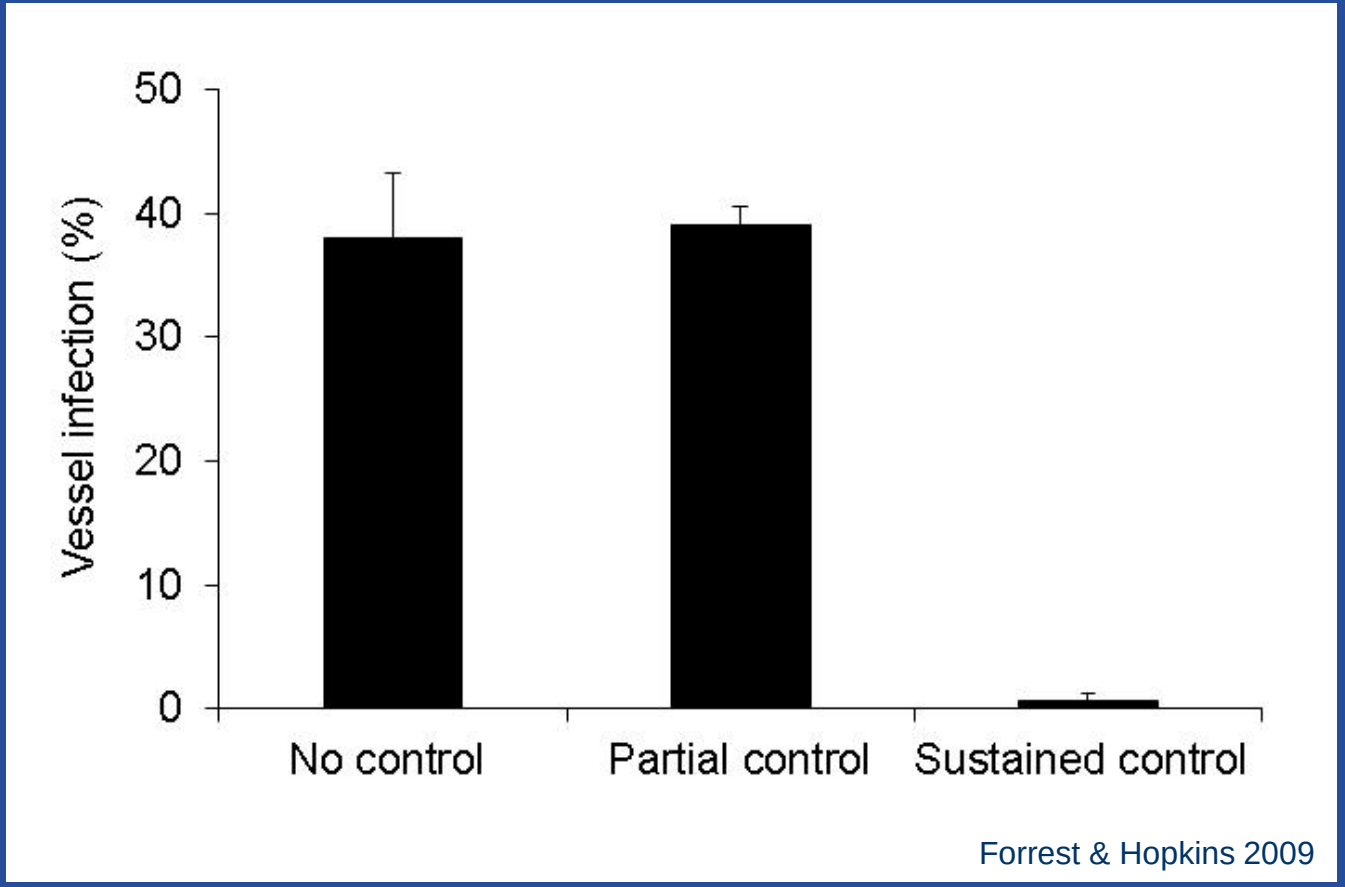
Fab dock

In-water cleaning

….we also know how to kill marine pests using range of eco-friendly chemicals: bleach, vinegar, heat, lime, brine, freshwater, detergents, disinfectants

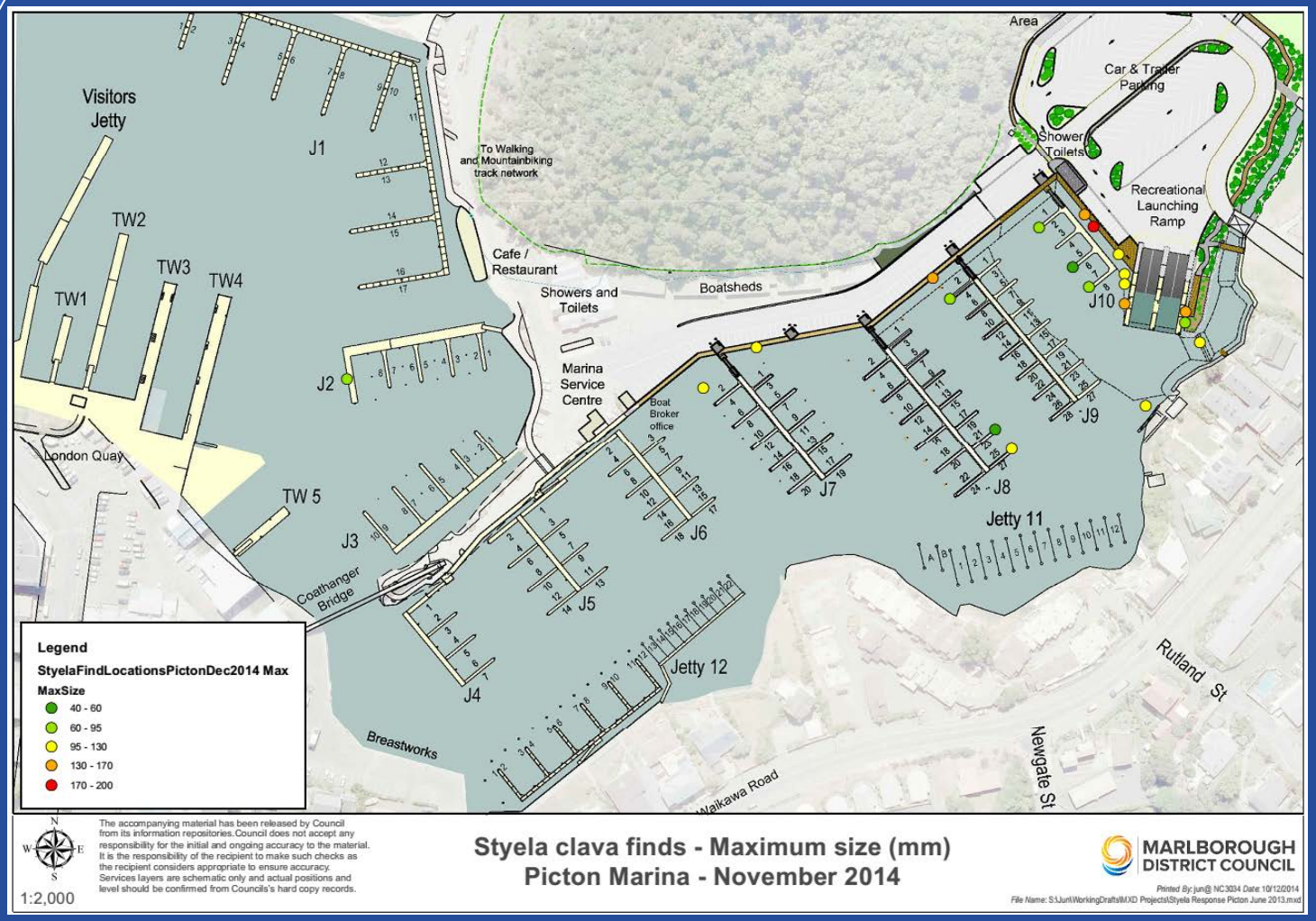
Intensive population control can reduce vessel infection

Vessel infection by *Undaria* under different levels of population control in southern NZ



Forrest & Hopkins 2009

Population control example in the TOS



Do the benefits justify the costs/effort?

- Risk model applied to recreational boat biofouling
- Based on managing the 15% or 30% of most heavily fouled boats
- Reduce rate of pest incursion by ca. 30-80% = incursion rate changes from ca. 1 pest per 4 years at present to 1 per 6-20 years
- Benefit:cost ratio ranging from 2 to 30

Risk assessment framework

Status quo risk:	RU = PI * PPD * V * I
Managed risk:	RMi = PIi′ * PPDi′ * V * I
Benefit/Cost:	RRMi = (RU – RMi)/CMi

P_I	= probability of introducing pest species
P_{PD}	= probability of establishment at pest density
V	= value at risk ($)
I	= percent impact on value
C	= cost of management

Assumptions re effectiveness

Efficacy scenario	P(treatment success)	x	P(boater compliance)	=	Management efficacy
Low efficacy	0.80		0.50		0.40
High efficacy	0.95		0.90		0.86

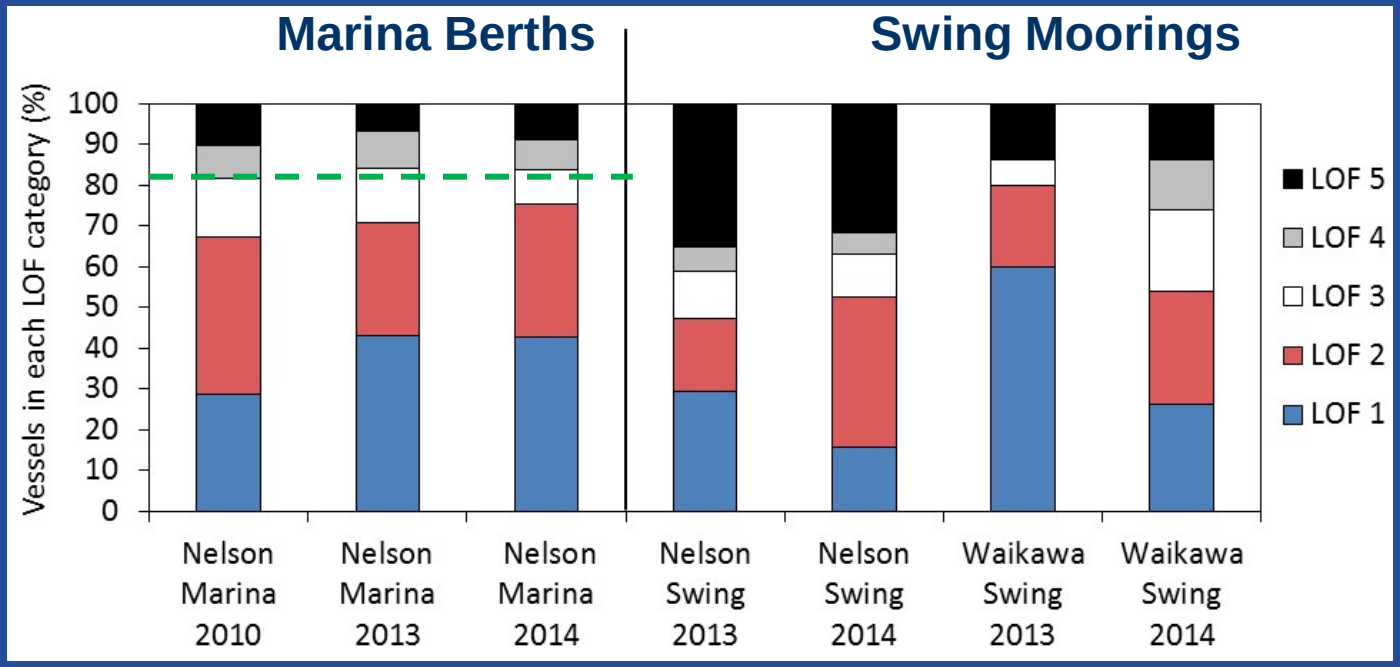
How do we measure success?

- Occurrence of pest incursions?
  - New incursions – too few to be reliable?
  - Incidence of human-mediated spread of established - requires regional surveys
- Extent of vessel risk reduction
  - Monitor change in vessel biofouling status and/or boater behavior? (knowledge, attitudes, practices)
  - Interception of high risk vessels pre-arrival in TOS

Vessel risk reduction

- **Data on TOS recreational vessel risk:** no change in fouling status on recreational boats

Occurrence of Level of Fouling scores 1 - 5



- **Eight potentially high risk vessels intercepted:** 2 “passed” and 6 responses

Conclusions and directions

- Have a good understanding of risk pathways
- Have a good toolbox for management (tools, resources, expertise)
- Can demonstrate that pathway management is worth the effort, although ‘risk reduction’ isn’t universally perceived as worthwhile
- Have methods for measuring the success of management efforts, and we’ve had at least some successes
- Challenge now is to identify and implement effective and acceptable management practices, ideally in a consistent and coordinated way nationally