

Marine biosecurity in the Arctic: challenges and perspectives for effective management



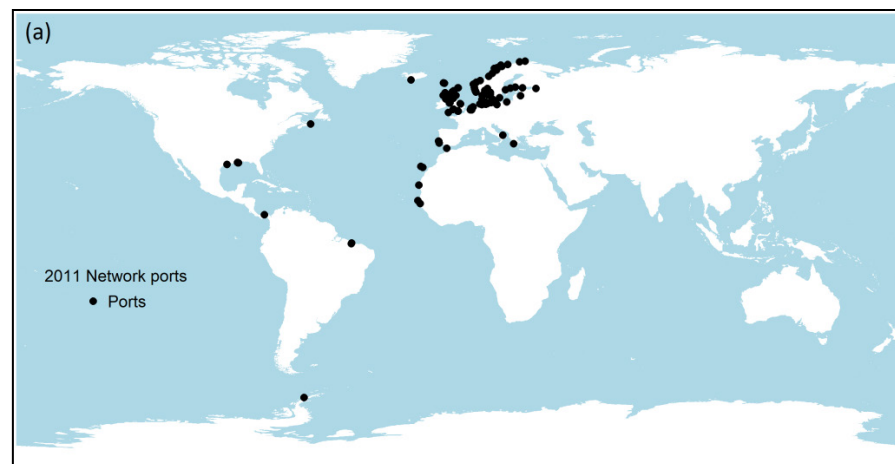
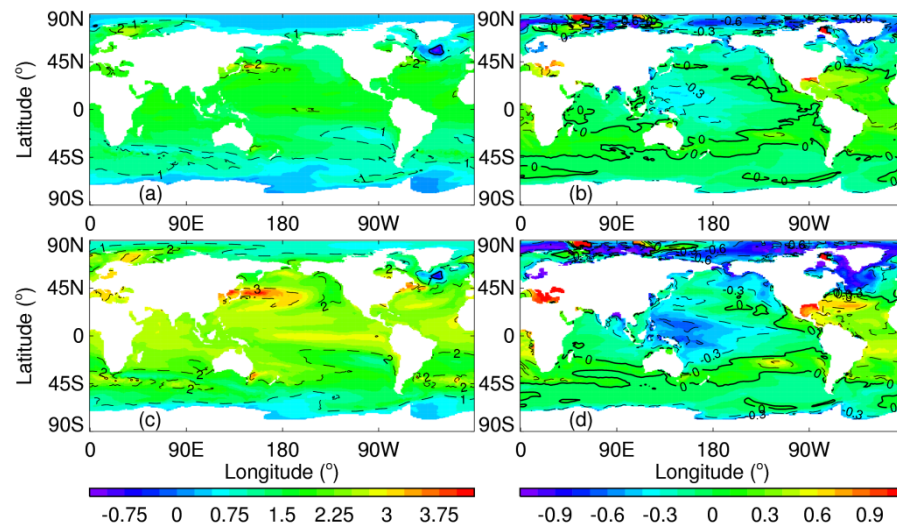
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On-going trends

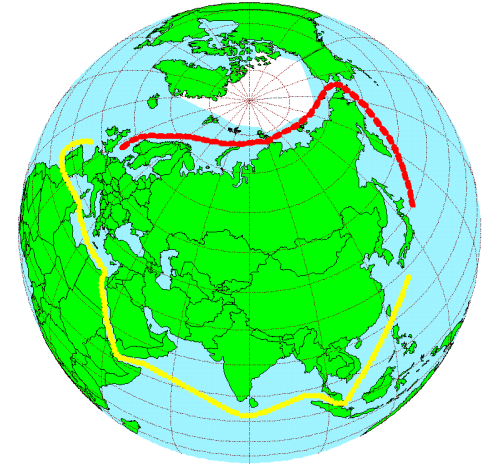
- Global climate is changing and environmental barriers are weakening
- Shipping and exploration in the Nordic region are increasing
- Aquaculture destined as a growth industry for the northern regions



Ware et al (2013)

On-going trends

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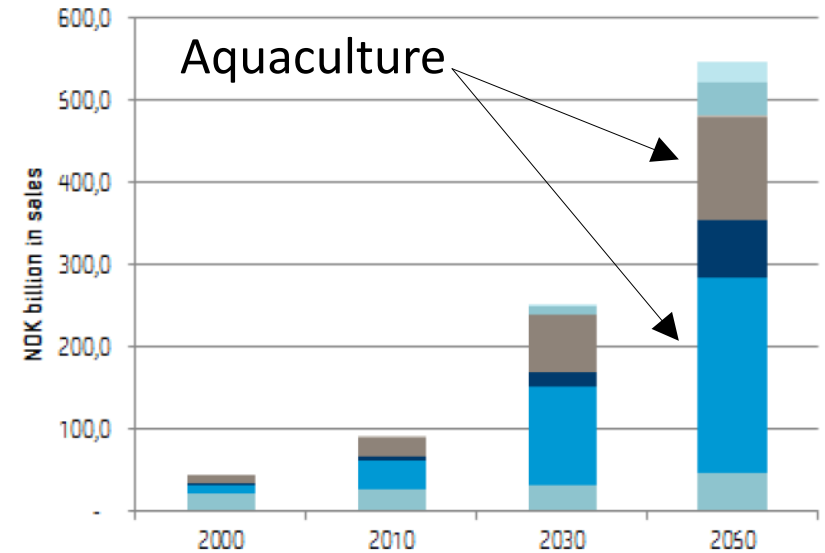
New discoveries are making the Barents Sea increasingly appealing for the oil industry (Photo: Det Norske Oljeselskap)

The petroleum industry rejoices over the discovery of two new major oil fields in the Barents Sea. A series of field centers are now in the making in Norwegian Arctic waters.

(Barents Observer, Sept. 2013)

On-going trends

- Global climate is changing and environmental barriers are weakening
- Shipping and exploration in the Nordic region are increasing
- Aquaculture destined as a strategic growth industry for the northern regions



Olafson et al (2012)

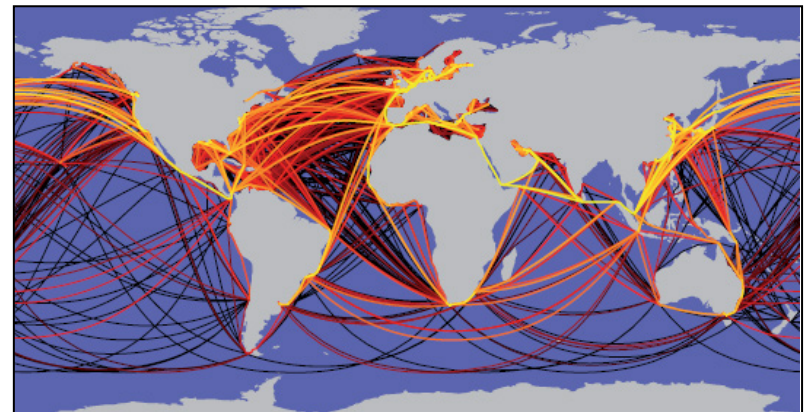


Biosecurity risks: Shipping and exploration

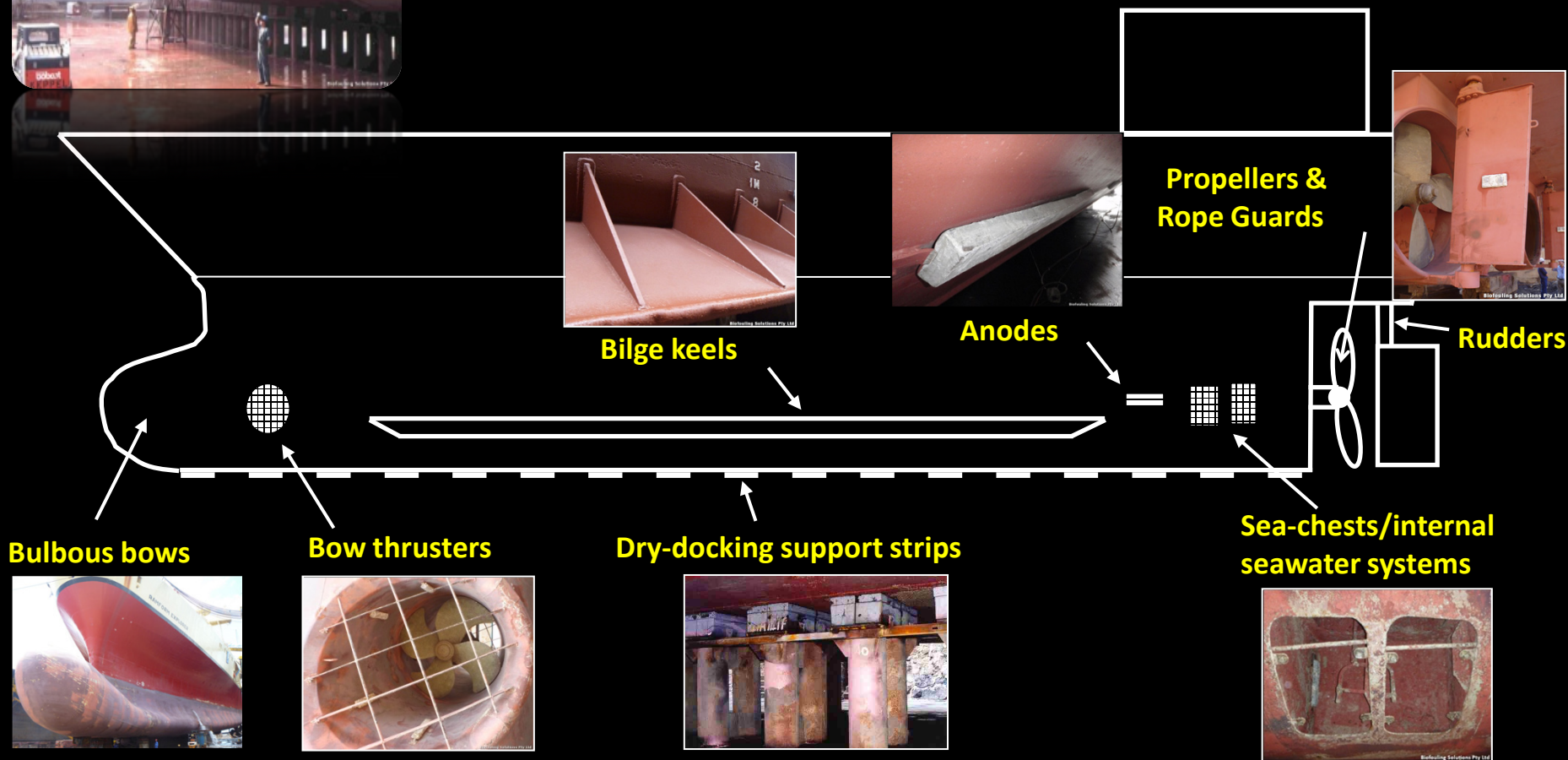
- Organisms transported as biofouling or in ballast water, > 2000 species recorded from biofouling alone
- Dominant species transport mechanism
- Merchant, passenger, recreational, exploration vessels, rigs – many types
- Global ports extremely well connected (52% by 2 steps)
- Management patchy, often missing

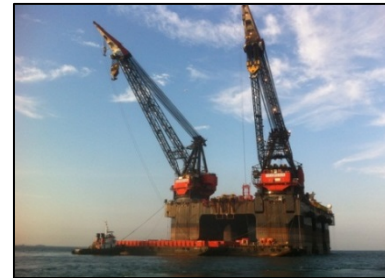
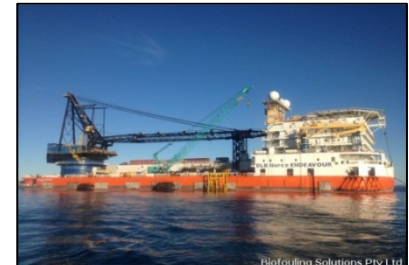


Image: Biofouling Solutions



Kaluza et al (2010)





Images: Biofouling Solutions Pty Ltd

Operation of large oil/gas fields: Seismic Survey Vessels, Chaser Vessels, Mobile Offshore Drilling Units, Anchor-handling Tug Supply Vessels, Launch Barges, Dumb Barges, Spike/pin Positioning Vessels, Heavy-Lift Barges, Semi-submersible Crane Barges, Dive/ROV Support Vessels. **Wide geographic mobilisation range**

Shipping and exploration

- Individual ships and oil rigs can harbour many tons of biofouling and mobile organisms, plus ballast water
- Large proportion carry non-indigenous species



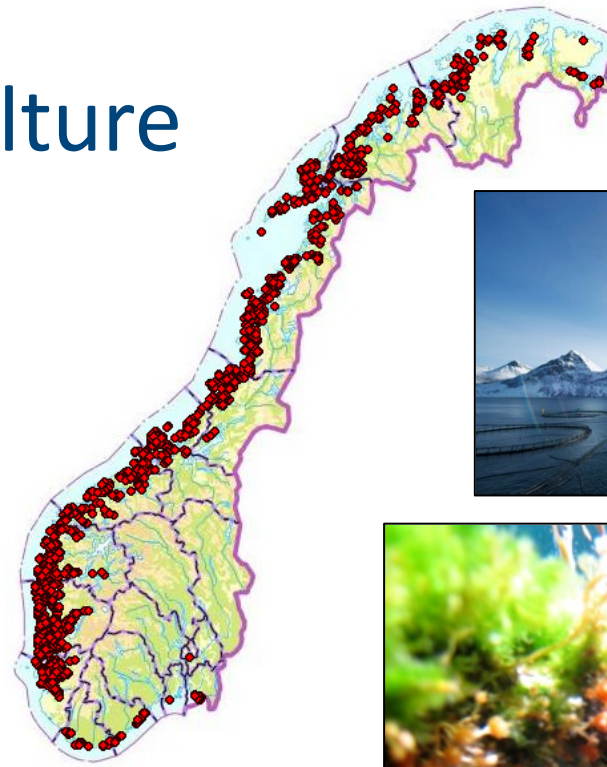
Coutts & Dodgshun (2007)



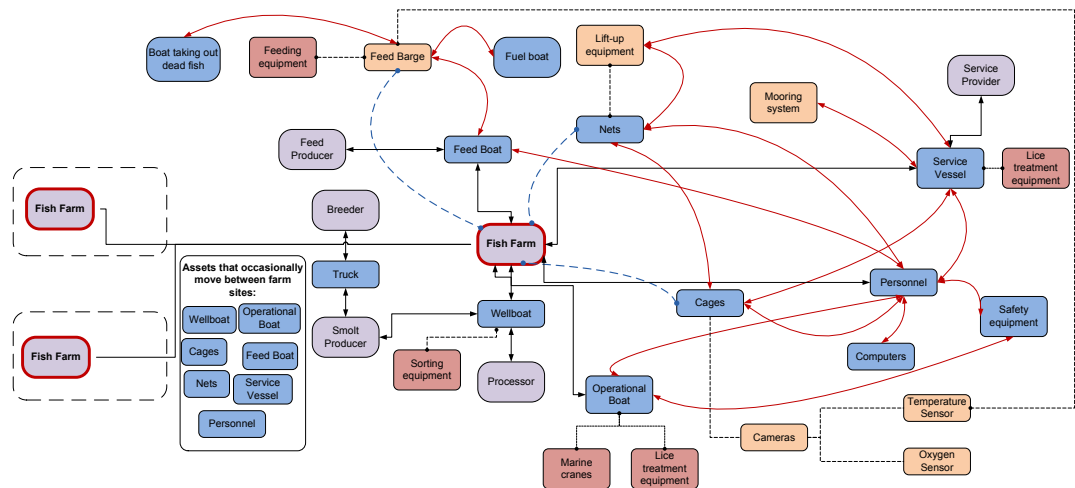
Hopkins (2010)

Biosecurity risks: Aquaculture

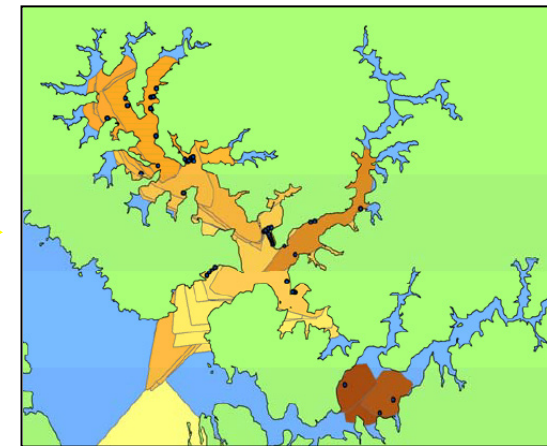
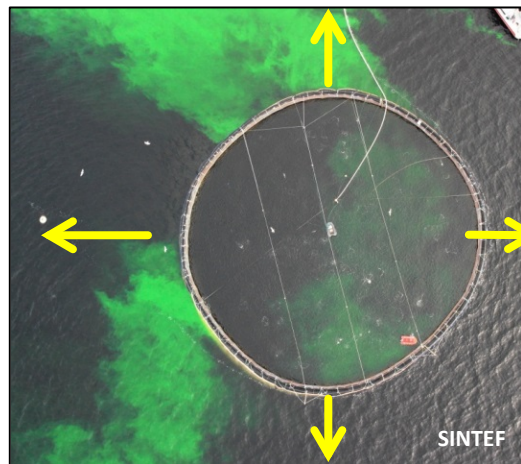
- Norway: 1,300 salmon farms
- 20,000 – 60,000 m² of artificial habitat per farm
- Up to 6.7 tons biofouling per cage (4-15 cages), 90 sp.
- Range of diseases



- Non-indigenous species and disease reservoirs
- Complex network: vessels and equipment
- Norway: **30,000 – 130,000 tons** of biofouling 'dumped' annually
- 'Contact zones' assist spread, compromise management



Thakur & Floerl in prep.



Morrissey et al 2011b

Biosecurity management in New Zealand and Australia

- Founded on **legislation** (e.g. Quarantine Act 1906, FRMA 1995, Biosecurity Act 1993, Hazardous Substances and New Organisms Act 1996)
- Government departments **dedicated** to biosecurity management
- State (Australia) and regional (New Zealand) governments have specific **responsibilities**



Requirements for effective biosecurity management

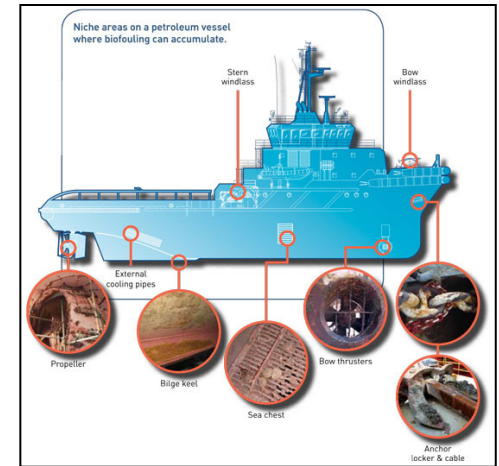
1. Clear **statements** of desired outcomes or level of protection
2. Knowledge and **understanding** of all major pathways and vectors – and the risks they pose
3. Tools for **managing risk**
 - i. Prevention/mitigation
 - ii. Monitoring
 - iii. Response

1. Clear statements of desired outcomes



2. Understanding of main pathways

- Nationwide port baseline surveys (NZ & AUS)
- International vessel surveys (NZ)
- Domestic shipping network (NZ)
- Aquarium trade analysis (AUS)
- Marine pathways analysis (NZ)



Biosecurity risk based on risk assessment

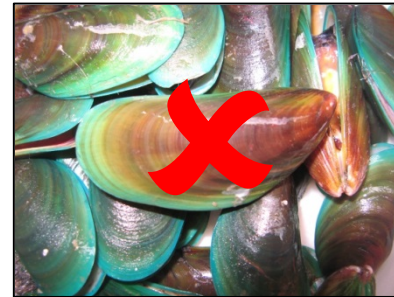
Likelihood and consequence of undesired events

- Transport pathways and vectors
- Species of concern ('next pest')
- High-risk entry locations

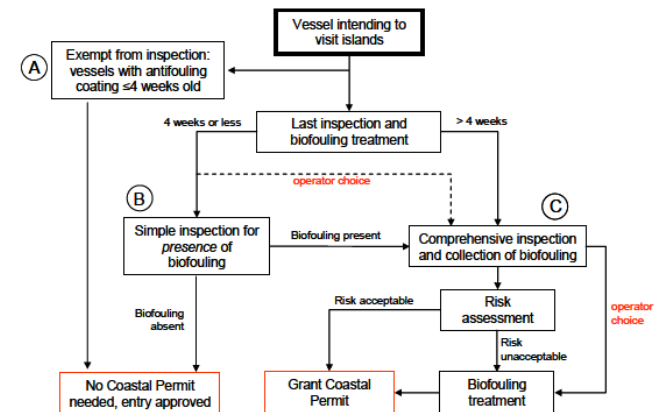


3. Tools for managing risk

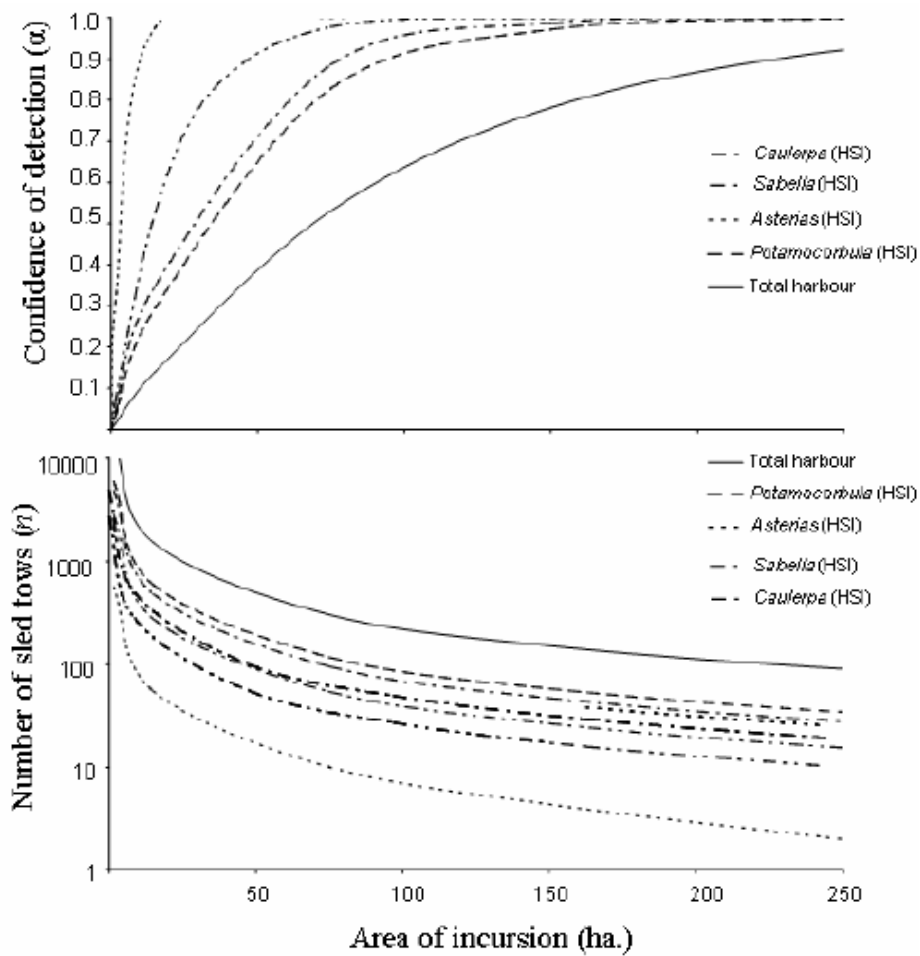
- Import Health Standard (NZ)
- Species of Concern (AUS)
- Industry Codes of Practice and guidelines
- Decision Support Tools
- National target surveillance (NZ)



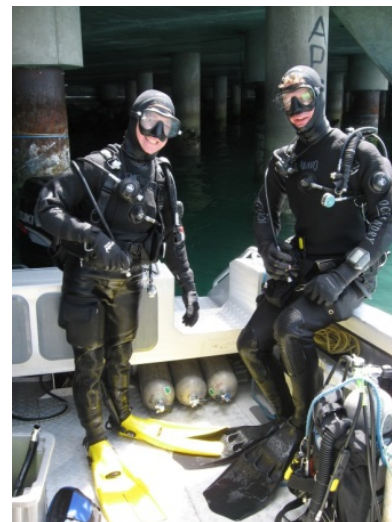
Coutts 2013



Floerl et al 2010

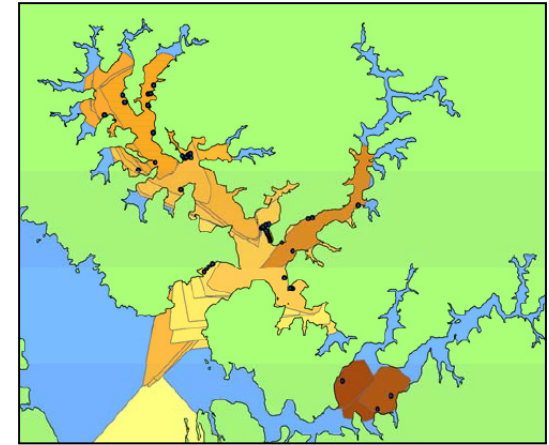


Inglis et al 2006



3. Tools for managing risk

- R&D into treatment tools
- Population control trials
- Rapid response plans (AUS)
- 'Aquaculture Readiness'
- Pre-border inspections for mitigating high-risk



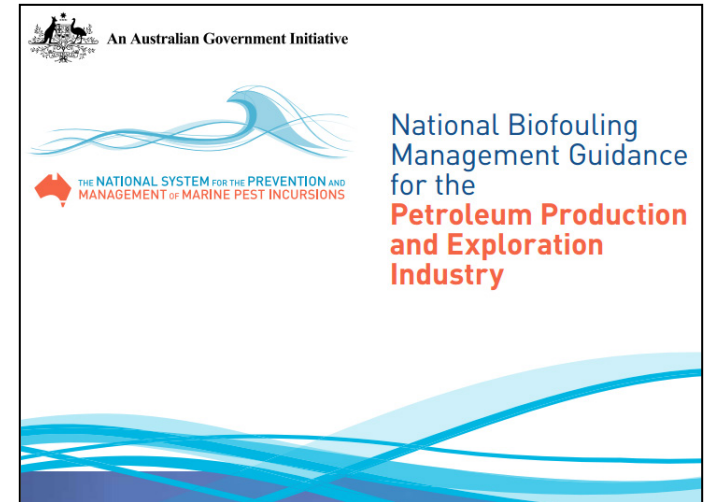
Morrisey et al 2011



Biofouling Solutions

Results and insights

- Creates 'biosecurity awareness'
- Builds capability
- Highlights need for monitoring and adaptation
- Highlights shortcomings (post-border management tools)
- Industry pro-active (to avoid losses and seize opportunities)



Recommendations for effective marine biosecurity (esp. in international context)

- Clear and agreed goals and strategy
- Effective governance structure
- Dedicated, on-going political commitment, guaranteed strategic resources
- Science to underpin management
- Engage with industry and public
- Monitoring, review, adaptation

Acknowledgements

- National Institute of Water and Atmospheric Research
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- New Zealand Department of Conservation
- Australia Department of Agriculture, Forestry and Fisheries
- Western Australia Department of Fisheries

