



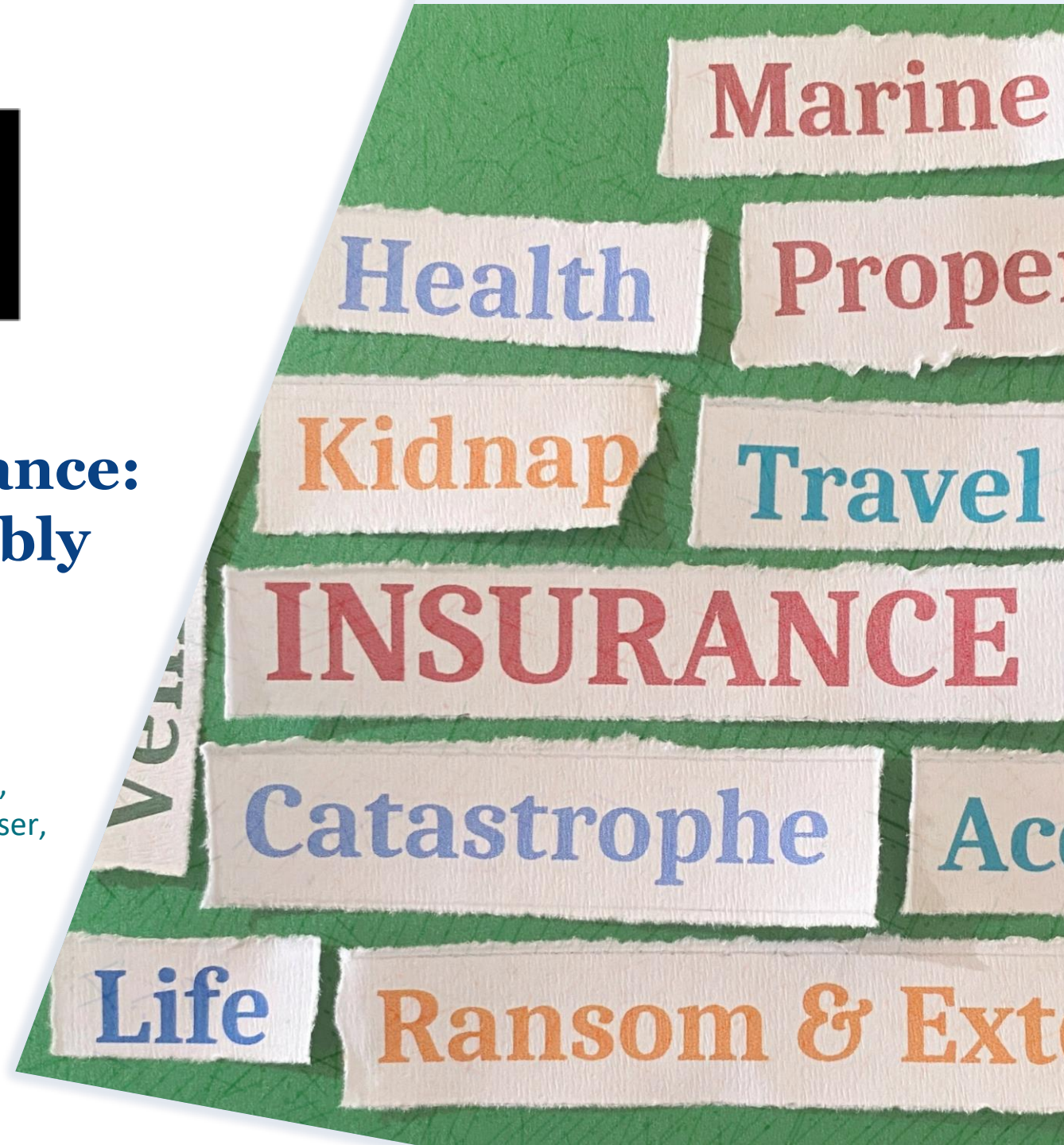
# Inventing biosecurity insurance: Using incentives to sustainably fund biosecurity

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**CEBRA**

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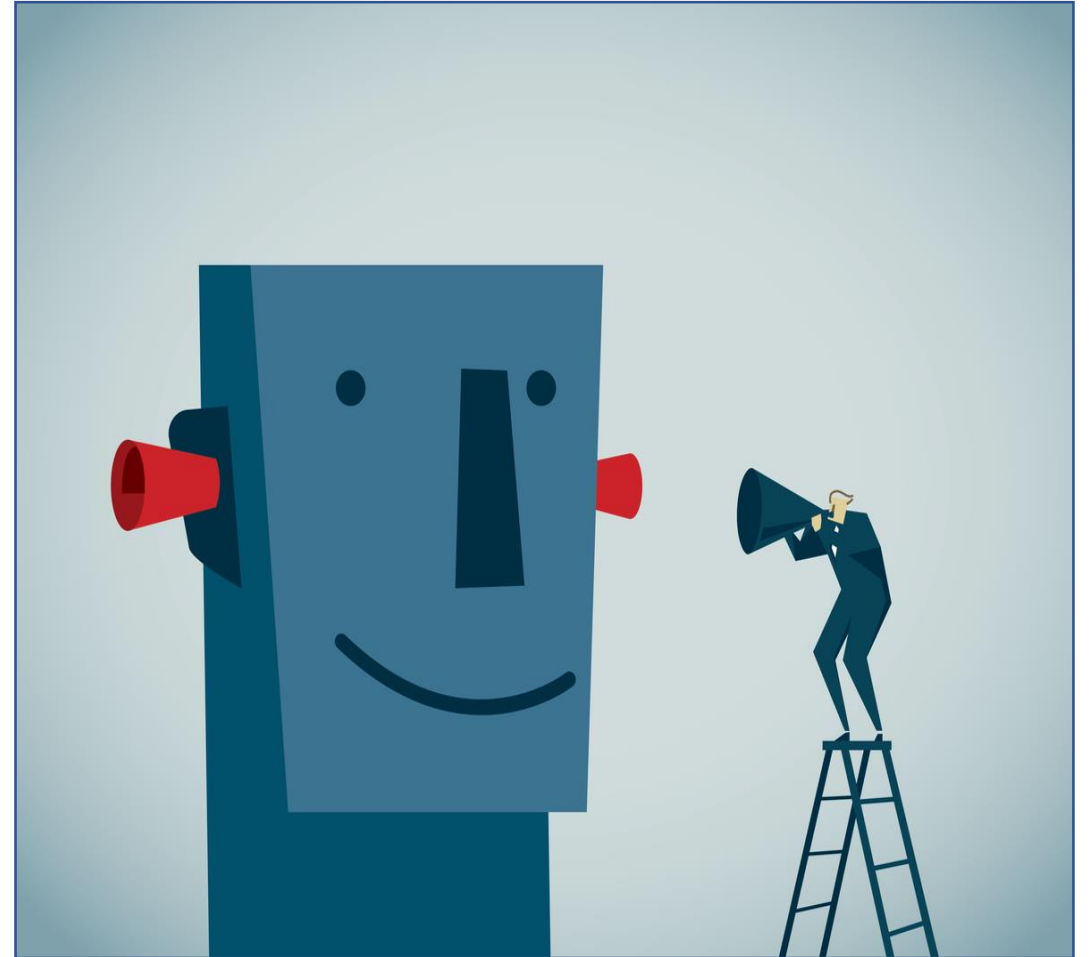


# Outline

- Context
- What can economics offer?
- CEBRA 21C
  - Incentive-compatible policy design
  - The framework
    - Diagnosis
    - Addressing the problem
    - Demonstration (biofouling, cut flowers)
    - Embedding in policy-design process
- Conclusion

# Context

- Humans are largely responsible for pest and disease spread
- The current biosecurity system:
  - Science focused
  - Risks assessed and interventions developed
    - human behaviour and incentive effects are not explicitly considered
  - Regulations are used to manage human behaviour
    - Effective in preventing catastrophic outcomes
    - Not effective when aim is to modify behaviour
- What can economics offer?



# What can economics offer?

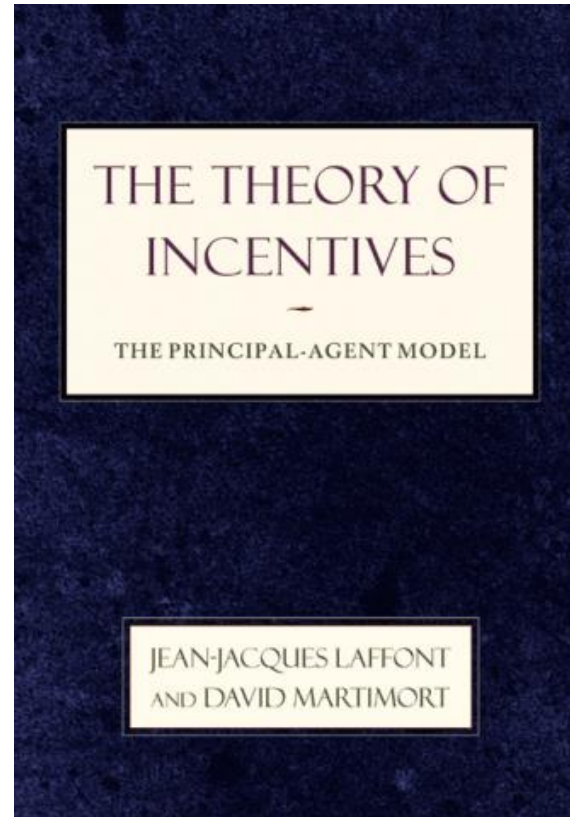
- **An objective:** right level and type of protection from biosecurity threats
- A way to frame biosecurity system problems:
  1. Delegation creates risks
  2. Divergent motives of stakeholders
  3. Information is unevenly distributed
  4. Stakeholder actions aren't always observable
- Solutions that will improve efficiency
  - Science-based interventions are not enough to deal with 1-4
  - link science, economics and technology



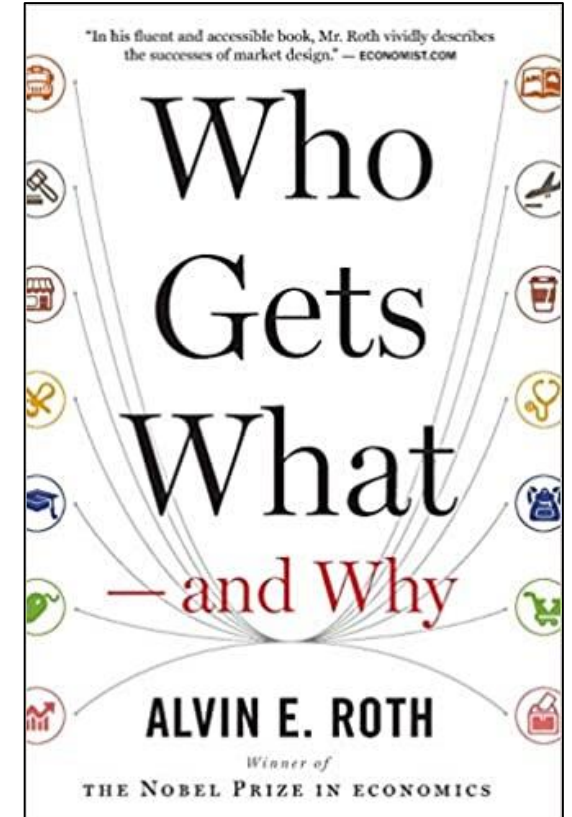


# What can economics offer?

- Assistance with incentives!
  - Biosecurity regulations create incentives
- A framework for incorporating incentives into the biosecurity system:
  - i. Economic theory (e.g. market design, principle-agent theory)
  - ii. A process for trialling and refining interventions in a controlled way (economic experiments)



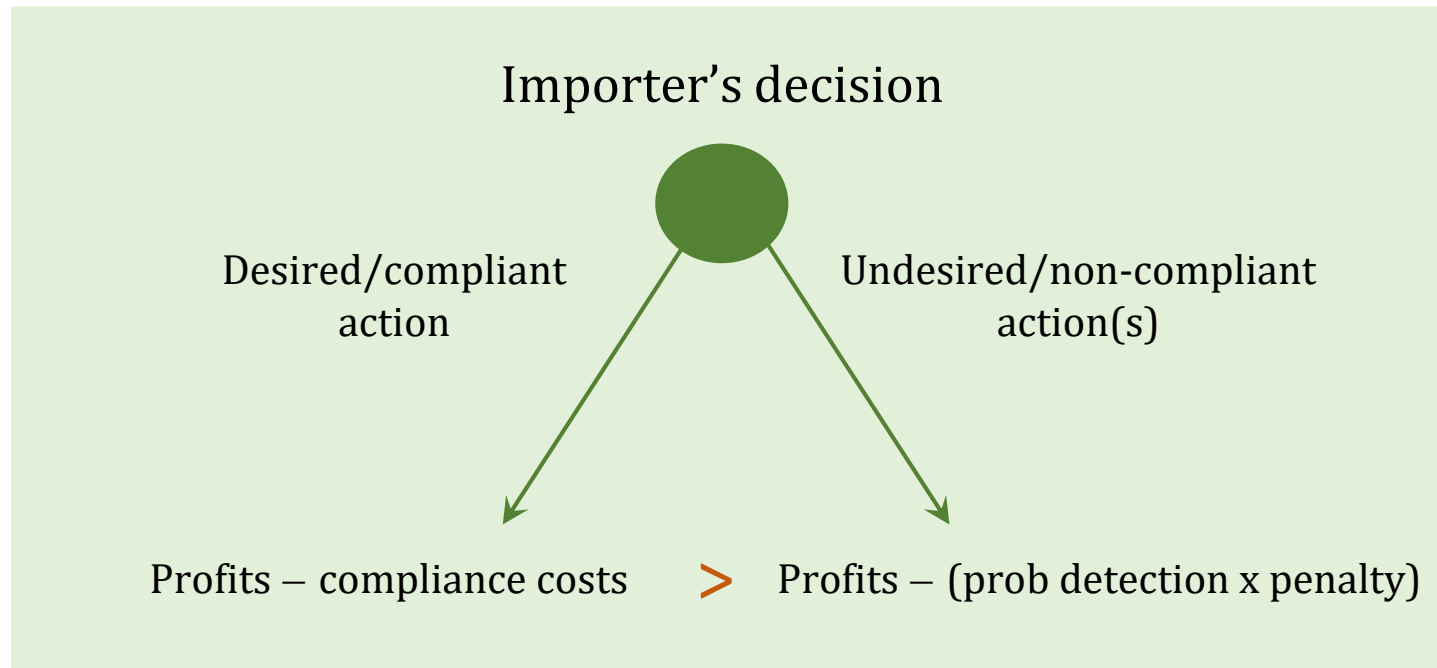
Laffont & Martimort (2002). In *The Theory of Incentives: The Principal-Agent Model*



Roth (2016) Who Gets What — and Why:  
The New Economics of Matchmaking and  
Market Design.

# CEBRA 21C: incentive-compatible policy design

- Create 'incentive compatible' rules:
  - where taking the desired actions (good biosecurity behaviour) will be better than outcomes from other available choices.
  - 'Best' decision for stakeholder is the desired one from DAFF's standpoint



# CEBRA 21C: incentive-compatible policy design

## Risk creators:

Importers, vessel operators, passengers

- Actions expose Australia to financial losses
- Can't attribute loss exposure to specific risk creators (externality)
- Self-interested
- Hold information relevant to the objective
- Behave strategically
- Can't always observe actions

**What interventions align the actions of risk creators with the biosecurity objective?**

## Regulator

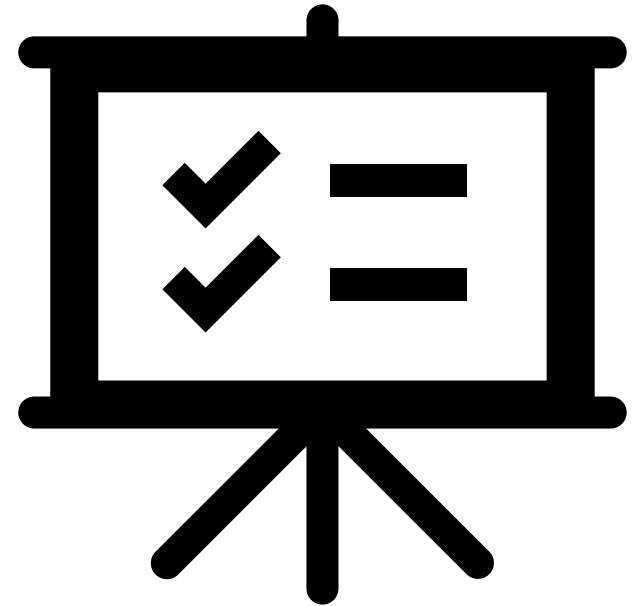
Biosecurity authority – DAFF

- Acting in the national interest
- Implements the *Biosecurity Act 2015*
- Intervenes in the economy to regulate



# CEBRA 21C: incentive-compatible policy design

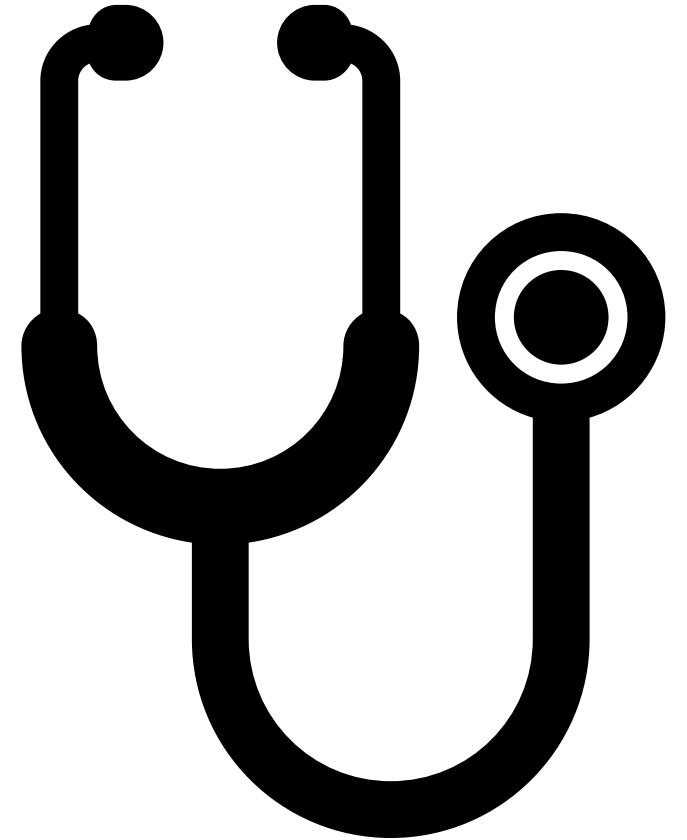
- The framework:
  - i. Diagnosis
  - ii. Solution
- Demonstrate framework using case studies:
  - Biofouling
  - Cut flowers
  - And?
- Embed the framework into DAFF policy design process





# CEBRA 21C: the framework – diagnosis

- Key Questions:
  - Is non-compliance deliberate, despite the policy?
  - what are the potential consequences to entity?
- Resolve whether the non-compliant behaviour:
  - Results in significant non/monetary benefits to entity
  - Is likely to be detected or, biosecurity risks identified and attributable to the risk creator
  - Results in consequences to the entity or individual
- Determine the scale of the problem



# CEBRA 21C: the framework – addressing the problem

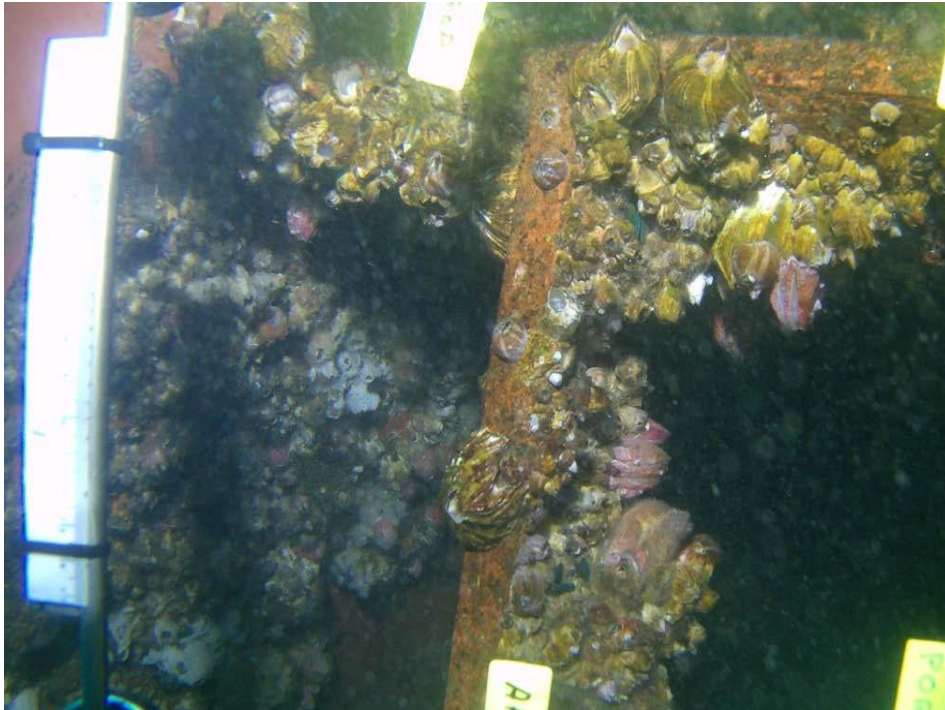
- Key steps:
  - understanding the current driver/s of non-compliant behaviour
  - connecting this information to outcomes that the individuals or organisations care about
- Two approaches to implementing incentive design:
  1. Pathway ‘overhaul’ — rethink or redesign a pathway using biosecurity risk insurance
  2. Pathway ‘fine-tuning’ — identify potential vulnerabilities and modify/design policies to be ‘strategy proof’
- Limits – perceived or actual – to possible changes



# CEBRA 21C: the framework — demonstration

## Case study 1:

Biofouling — pathway overhaul



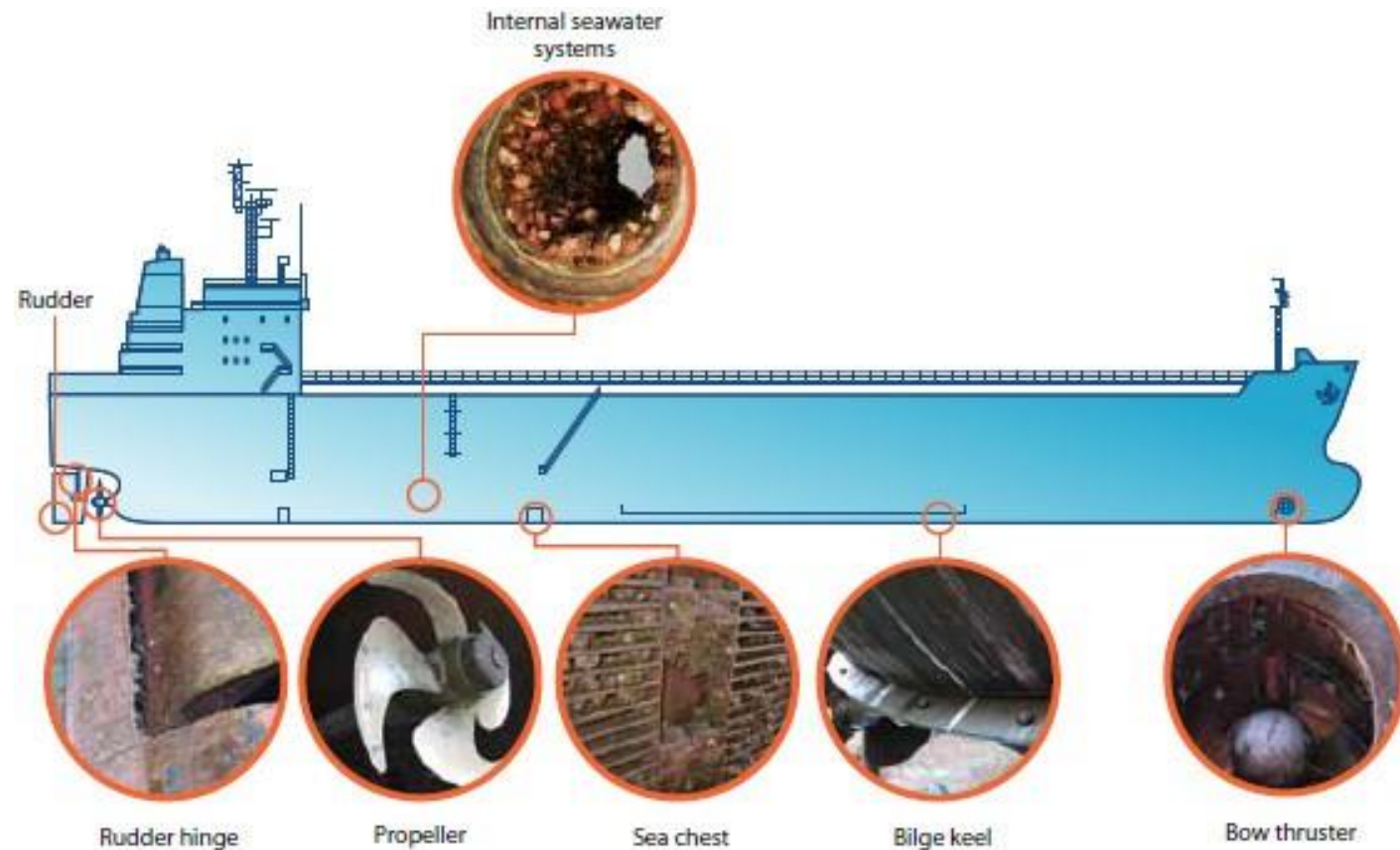
## Case study 2:

Cut flowers — pathway fine-tuning



# CEBRA 21C: framework demonstration – biofouling

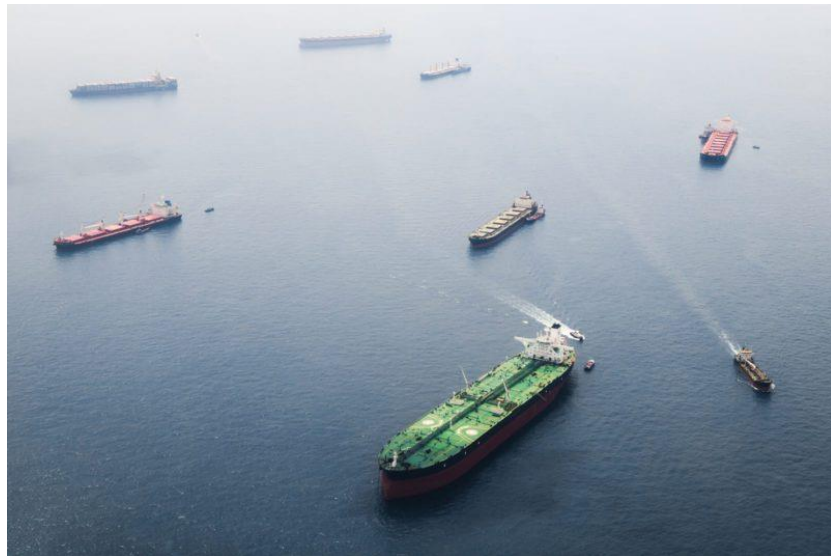
- Without intervention by DAFF there would be no incentive for vessel owners to remove biofouling in niche areas





# CEBRA 21C: framework demonstration – biofouling

- DAFF is reviewing policies around biofouling
- Diagnosis phase: is there an incentive problem?
  - Non-compliance results in significant benefits
  - Resource pressures in DAFF impact on ability to detect non-compliance
  - Penalties for non-compliance are large but seldom applied



# CEBRA 21C: framework demonstration – biofouling

- Addressing the incentive problem
  - Biofouling is a class of risk (Stoneham et al. 2021)
  - Risks are managed through insurance
  - Diagnose why biosecurity insurance is absent
  - Design an insurance mechanism
- Solution mechanism: biosecurity insurance
  - Apply actuarial principles to biofouling risk
  - Apply incentive theory
  - A new type of insurance





# CEBRA 21C: framework demonstration – biofouling

## Biosecurity insurance mechanism:

- Vessel operators required to purchase biofouling risk insurance
  - Premiums calculated by actuaries based on biofouling risk posed by vessels
- Link risk-rating to verifiable BMPs
  - No verifiable BMPs = high risk, high premiums
  - Incentives to reduce biofouling risk
- Insurance pool (accumulated premium payments)
  - Funds biosecurity agency costs
  - Funds response effort
  - Financially sustainable model



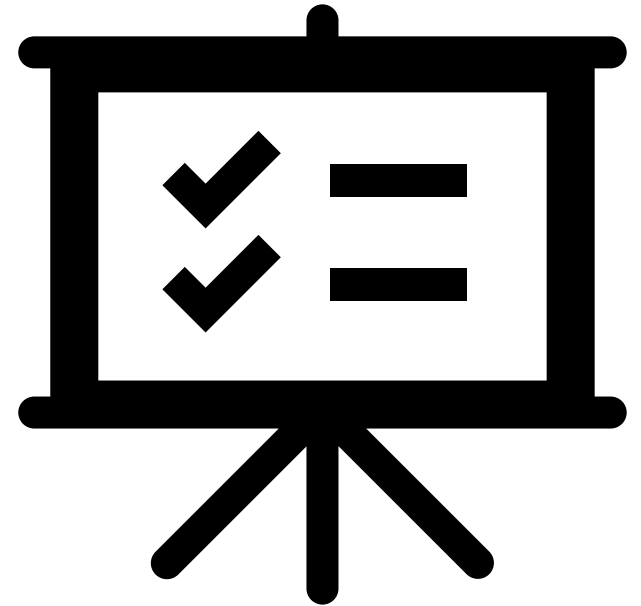
# CEBRA 21C: framework demonstration – cut flowers

- Context
  - History of relatively high non-compliance
  - Recent policy changes appear to have significantly improved compliance
- Diagnosis phase: Disentangle policy changes:
  - Understand how/if elements of policy change affected incentives
- Addressing problems
  - Design/fine-tune elements of policies to improve incentives
  - Test and refine policy (economics laboratory)
  - Evaluate through a field pilot



# CEBRA 21C: incentive-compatible policy design

- The framework:
  - i. Diagnosis
  - ii. Solution
- Demonstrate framework using case studies:
  - Biofouling
  - Cut flowers
  - And?
- **Embed the framework into DAFF policy design process**
  - Insert Q: “is the policy incentive-compatible?”
  - Limits – perceived or actual – to possible changes
  - Use of in-house vs external expertise



# Conclusion

- This project offers an opportunity to bring science and economics together to future-proof the biosecurity system.
- Explicit consideration of incentives will:
  - Improve efficiency and effectiveness of biosecurity interventions
  - Build on science knowledge and skills of DAFF staff
  - Require new skills: actuaries, (market design) economists, tech. specialists
- Biosecurity insurance is:
  - A new type of insurance
  - Potentially applicable across the biosecurity system
  - A financially sustainable funding model



# Acknowledgements



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