Research update from down under

Dr Eugene Georgiades
Science and Risk
(Animals and Aquatic)
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  - Cawthron Institute
  - Biofouling Solutions Pty Ltd
  - Ramboll New Zealand Ltd
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- **MPI**
  - MPI Operational Research Team!
  - Facilities and Pathways Group,
  - Response Group & Surveillance and Incursion Investigation Team
  - Recovery and Pest Management Group
  - Border and Biosecurity Policy Team

Science advice: Testing in-water systems

- **Objectives**
  - Develop robust and repeatable testing procedures to evaluate the biosecurity risk of in-water cleaning systems
- **External hull and niche areas (Morrisey et al. 2015)**
  - Literature review (Morrisey and Woods 2015)

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ES Link Services
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- **Internal seawater systems (Growcott et al. 2017)**
  - Literature reviews (Growcott et al. 2016/2017)

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Background Image: NIWA Ltd

Science advice: Testing in-water systems

- General testing
  - Vessel testing using the full system
  - Simulation of intended use
  - Evaluation conducted by:
    - Approved
    - Independent
    - Scientist
      - Report all test failure**s**

Background Image: NIWA Ltd

Current research

In-water cleaning external hull – system testing (MPI)

In-water cleaning external hull – system testing (USA research - MPI Technical Input)

In-water treatment of internal seawater systems – reviews (Aus Govt – MPI Technical Input)

Fouling and disease (MPI)

Treatment of internal pipework of recreational vessels (MPI)

Background Image: NZ Diving and Salvage Ltd

Testing in-water cleaning systems (external hull & niche areas)

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- **Aim**
  - Suitably qualified and independent providers to test systems according to the science advice (Morrisey et al. 2015)*
- **Out of scope**
  - Development of systems
  - System developers testing their own systems
  - Development of new testing procedures
  - Testing of proactive systems (slime layer)

Background Image: DiveCo Ltd

Testing in-water cleaning systems (external hull & niche areas)

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- **Objectives**
  - Identify suitable systems (reactive)
    - large macro-fouled vessels
    - biocidal systems
  - Independently test efficacy of systems
    - performance criteria and procedures
    - assess utility of advice (Morrisey et al. 2015)*
  - Independently test and model potential for chemical contamination

Background Image: DiveCo Ltd

Tales from the C.R.Y.P.T.

Califont Recirculator for Yacht Pipework Treatment

Cawthron Institute
NIWA Ltd
Biofouling Solutions Pty Ltd
MPI

- Niche areas
  - Often overlooked
  - Knowledge gap regarding treatment
- Research objectives
  - Identify suitable treatment
  - Validate treatment
    - Laboratory testing (mock pipework)
    - Vessel testing
  - Deliver protocol for treatment

Background Image: Diving Services NZ Ltd

Treatment category	Treatment agent	Effective	Safe*	Biosecure	Consenting	Compatibile*	Feasibile	Quality control
Chemical treatment agents	Chlorine	?	✓	✓	✓	✓	✓	✓
	Chlorine dioxide	?	?	✓	✗	✓	✗	✗
	Bromine	?	✓	✓	✗	✓	✓	✓
	Hydrogen peroxide	?	✓	✓	✗	✓	✓	✓
	Ferrate	?	✓	✓	✗	✓	✗	✗
	Peracetic acid	?	✓	✓	✗	✓	✓	✓
	Acetic acid	?	✓	✓	✓	✓	✓	✓
	Descaler formulation – Rydlyme®	✓	?	✓	✗	✓	✓	?
	Quaternary ammonium compounds	?	✗	✓	✗	✓	✓	?
Non-chemical treatment agents	Physical removal	✗	✓	?	✓	✓	✗	✗
	Thermal stress	✓	✓	✓	✓	✓	✓	✓
	Deoxygenation	✗	✓	✓	✓	✓	✓	✓
	Osmotic shock	✗	✓	✓	✓	✓	✓	✓

– **Chlorine** **Acetic acid** **Heat**
60 °C / 60 min

More efficacy data required

Background Image: Diving Services NZ Ltd

Treatment of recreational vessel pipework

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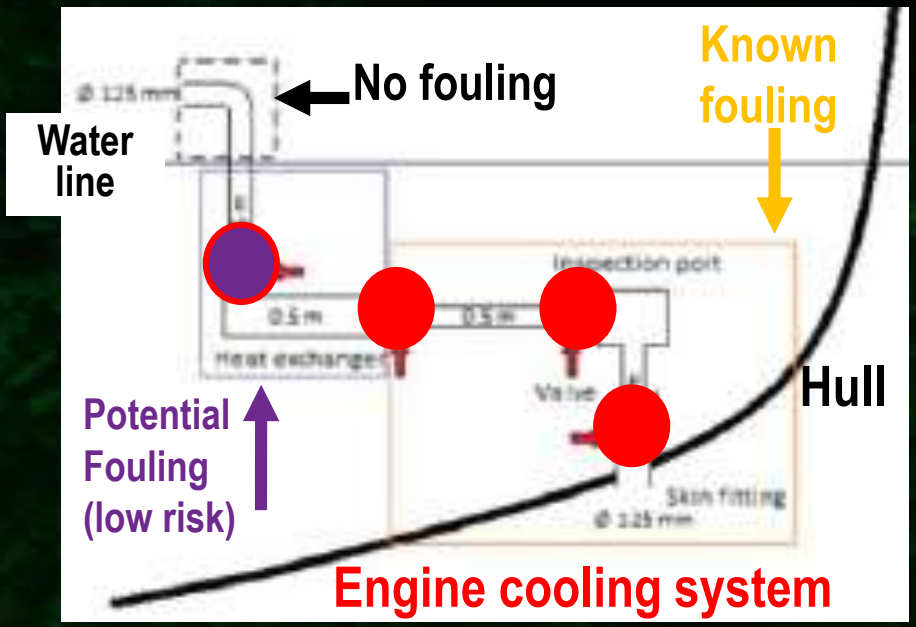
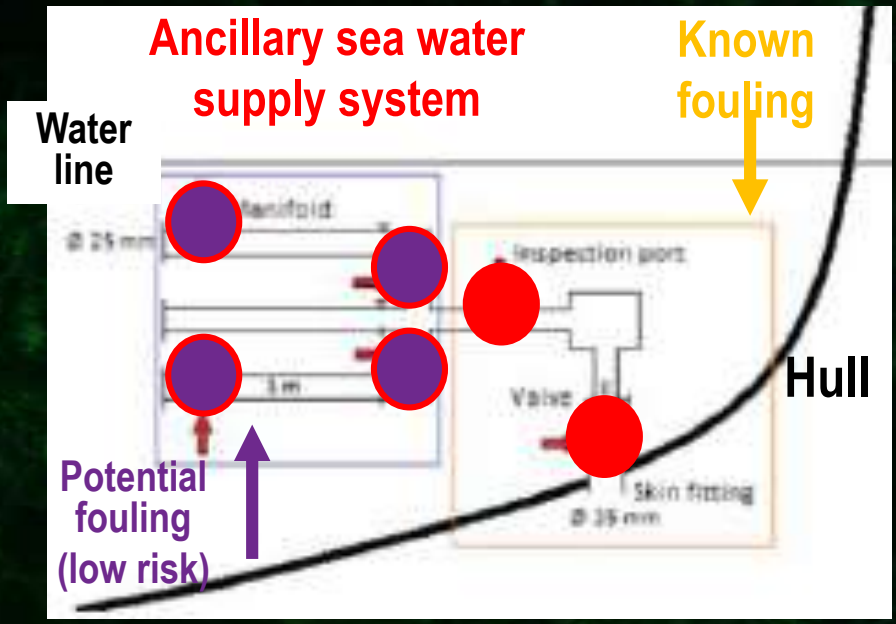
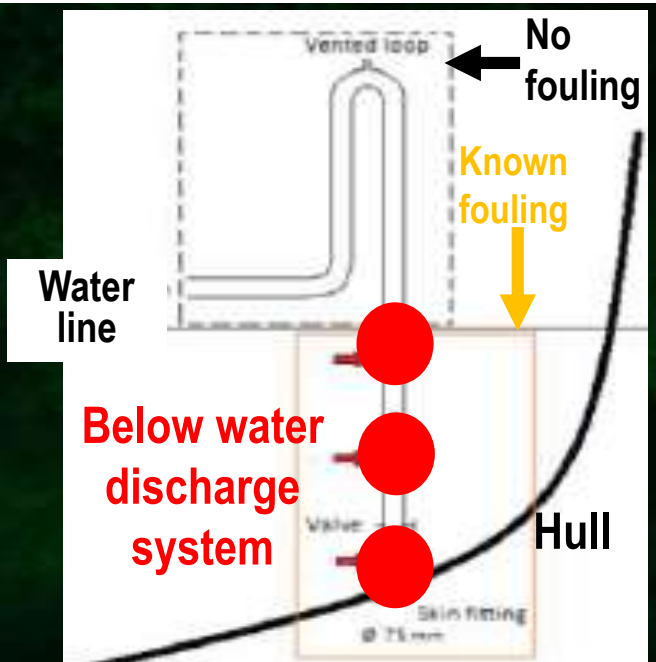
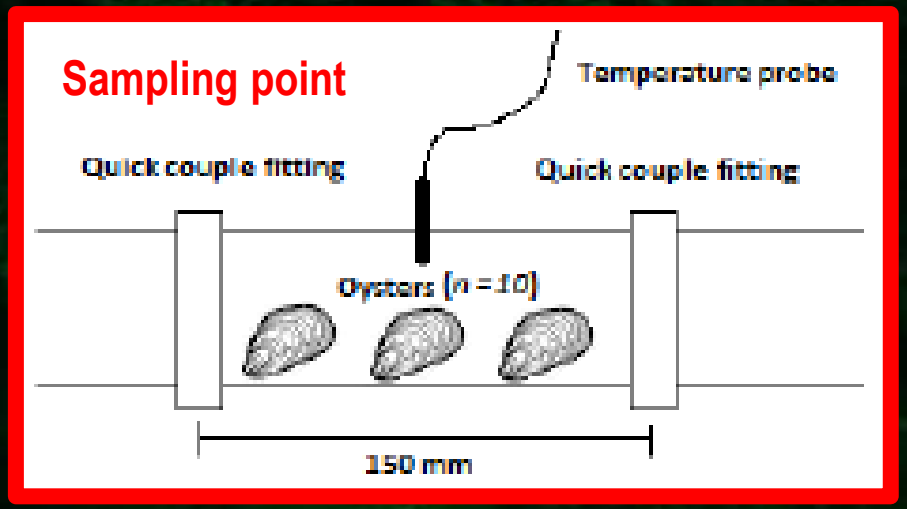
Treatment of recreational vessel pipework







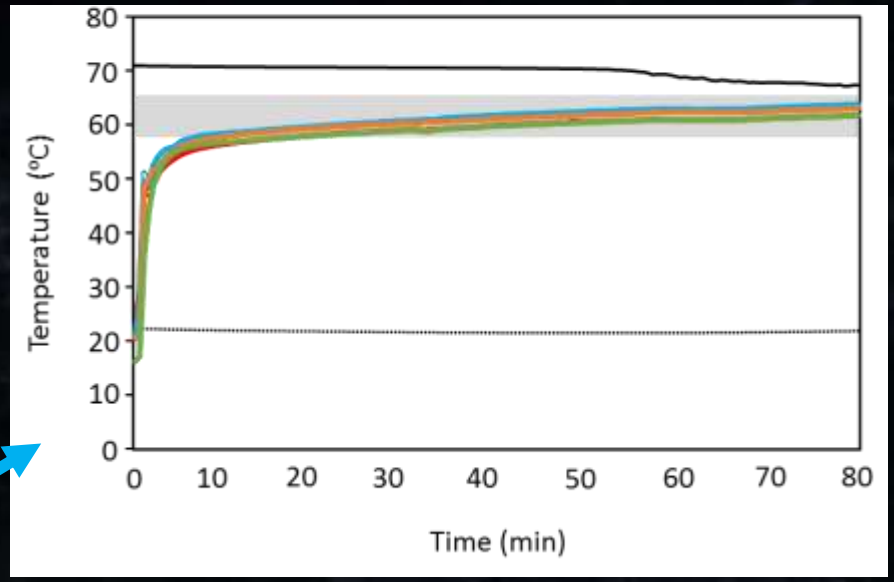


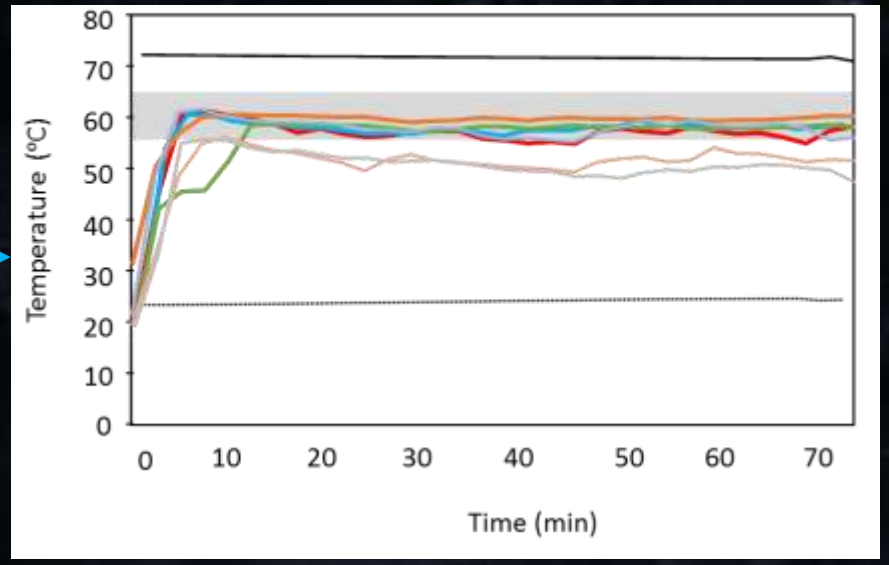
Images: Cawthron Institute

Background image: Diving Services NZ Ltd

Treatment of recreational vessel pipework

- **Laboratory testing**
  - Insertion to first bend
  - Cylinder at 72.5 °C
  - Flow rate at 20 L min^{-1}
  - No cooling step
- Worked perfect for below-water discharge system
- Ancillary seawater system – additional manual steps required, then worked





Final treatment 60 °C/ 60 min delivered 100 % mortality to oysters <u>in high risk areas</u>

Background Image: Diving Services NZ Ltd

Treatment of recreational vessel pipework

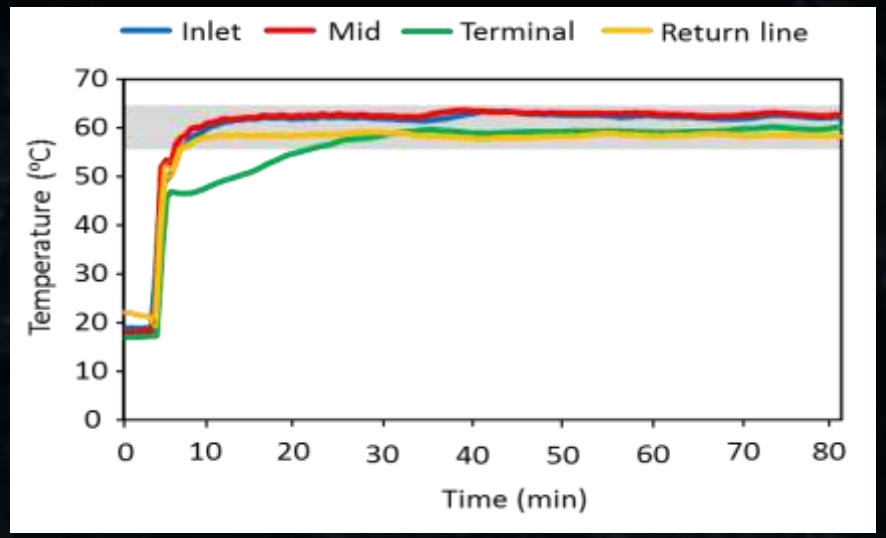
- **Field testing**
  - **Vessel A**
    - Length 23 m
    - Engine cooling system
      - Diameter: 50 – 125 mm
      - Length: 3 m
  - **Vessel B**
    - Length 7 m
    - Toilet water discharge system
      - Diameter: 12 mm
      - Length: 1.5 m

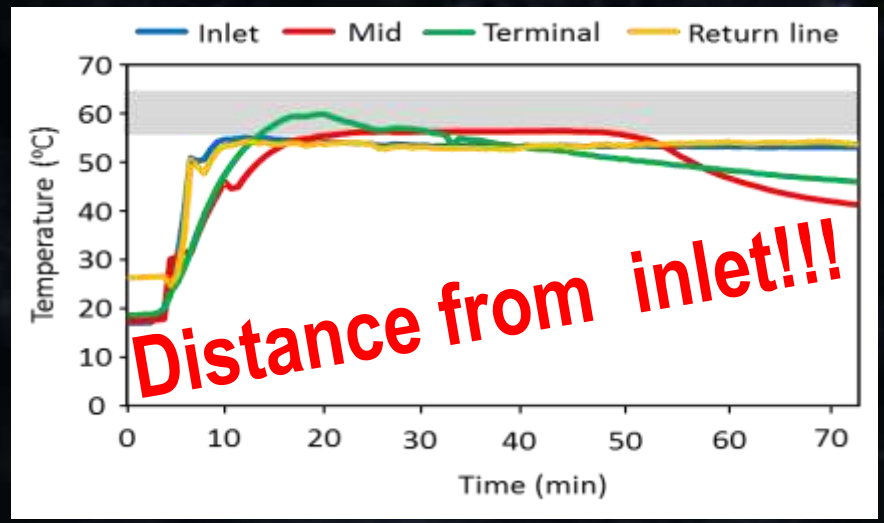
Background Image: Diving Services NZ Ltd

Images: Cawthron Institute

Treatment of recreational vessel pipework

- **Field testing**
  - **Vessel C**
    - Length: 10 m
    - Below water discharge system
      - Diameter: 25 – 32 mm
      - Length: 2.5 m
  - **Vessel D**
    - Length: 15 m
    - Below water discharge system
      - Diameter: 50 mm
      - Length: 2 m

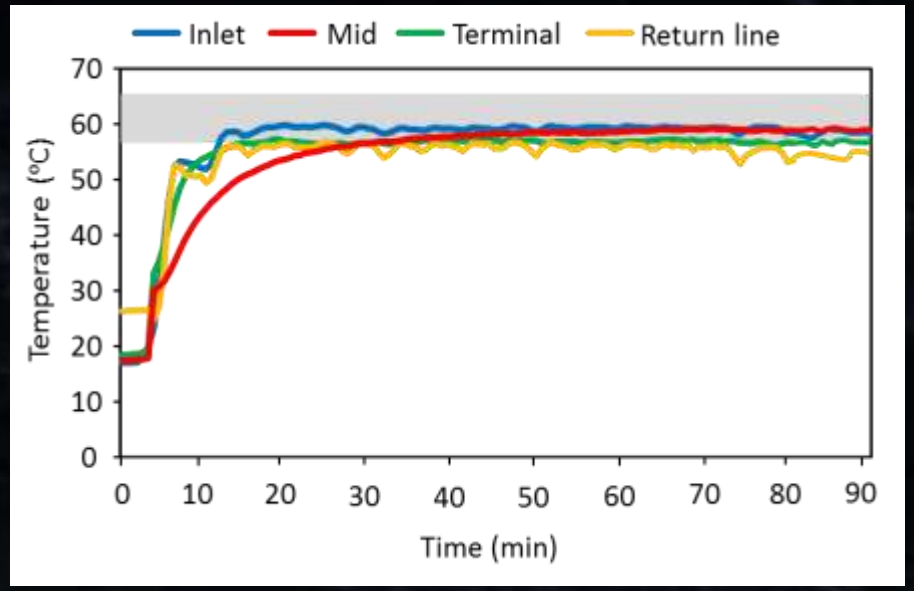


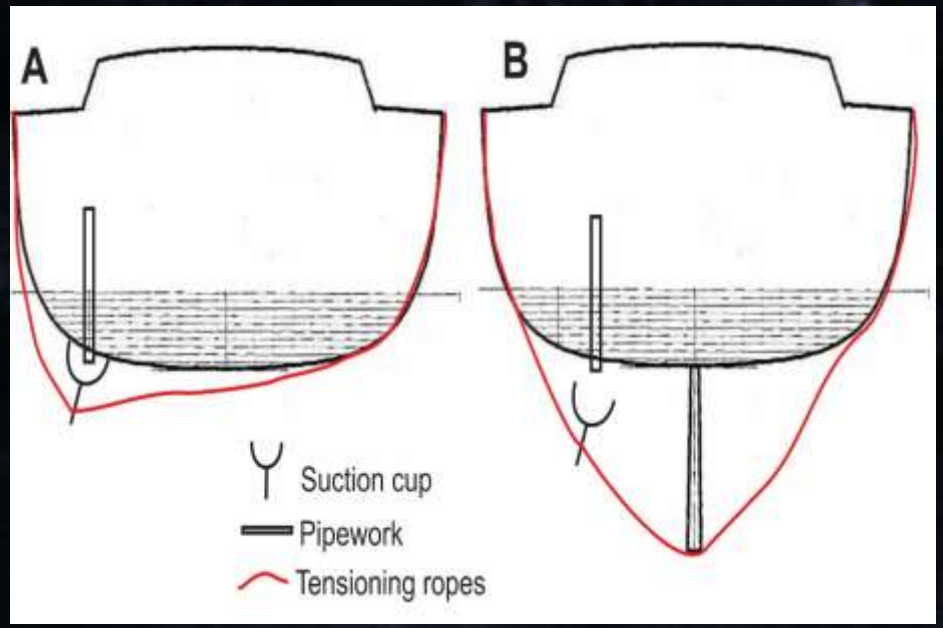


Background Image: Diving Services NZ Ltd

Treatment of recreational vessel pipework

- Field testing
  - Vessel E
    - Length: 9 m
    - Ancillary seawater supply
      - Diameter: 25 mm
      - Length: 0.75 m
  - Vessel F
    - Length: 9 m
    - Ancillary seawater supply
      - Diameter: 15 mm
      - Length: 3 m





Background Image: Diving Services NZ Ltd

Treatment of recreational vessel pipework

- The C.R.Y.P.T.:
  - *The Good*
    - Effective within 2 h, where seal can be achieved
  - *The Bad*
    - Instances where seal cannot be achieved
    - The smaller the pipework, the more difficult circulation is

    BUT
    - Engineering improvements can solve these problems
  - *The Ugly*
    - Robust in-water treatment is challenging
    - Unless all water is removed prior to treatment, it is likely a recirculation system would have to be used for any treatment

Field validation of lab testing on multiple systems is vital!

Background image: Diving Services NZ Ltd

Fouling and disease

University of Sydney
MPI

- Biofouling implicated in the spread of molluscan pathogens
  - *Bonamia ostreae, Ostreid Herpesvirus, Marteilioides chungmuensis*
- Proof of concept
  - Identify pathogen in biofouling species
  - Molecular methods
    - Optimise
    - Validate
  - Demonstrate pathogen viability

We are all connected

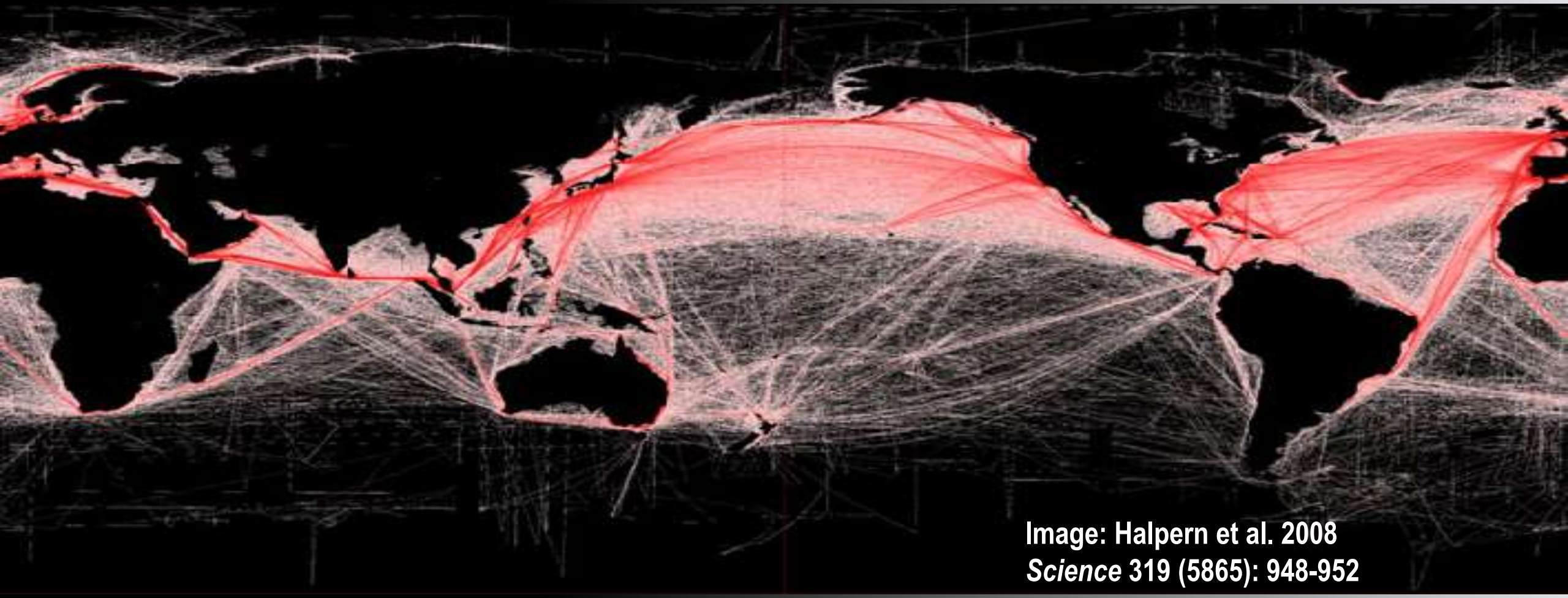


Image: Halpern et al. 2008
Science 319 (5865): 948-952

Thank you!