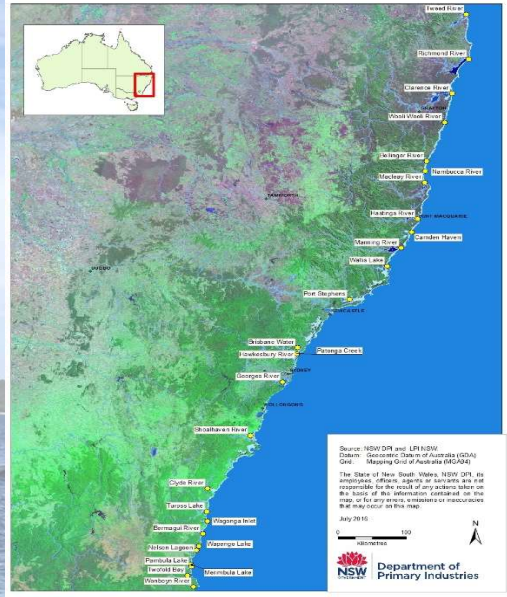
Prof Shauna Murray, Dr Penny Ajani, Dr Hazel Farrell, Anthony Zammit, Prof Wayne O'Connor, Dr Mike Dove, Matthew Tesoreiro, Dr Arjun Verma, Mary Goodacre and Shaye Carman (Deb Gardner)

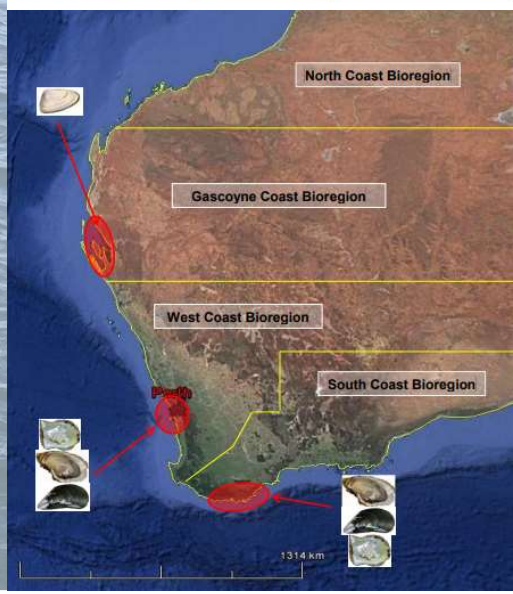
Project Lead – University of Technology Sydney, Project Partners – NSW Dept Primary Industries, NSW Farmers, WA Dept of Primary Industries and Regional Development, Food Agility CRC

Industry Background

NSW Shellfish Industry ~$55 million p.a. farm gate. State's largest fishery by value. Farmed commercially for ~150 years.

WA Shellfish Industry currently expanding, with 3 aquaculture development zones established.



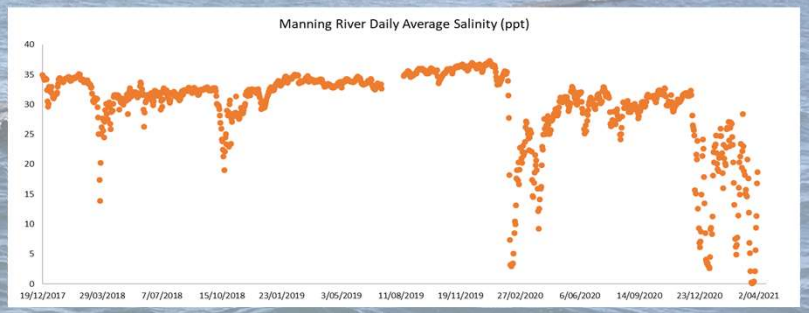


Transforming Australian Shellfish Production

- How can we improve and innovate the existing food safety programs and farm operations to benefit industry?
- Collaboration between industry, government and researchers.
- Increase days available for oyster harvesting (real time sensing and molecular methods).
- Develop models for risk prediction.
- Better informed and responsive management.

https://www.foodagility.com/research/transforming-australian-shellfish-production

Phase 1. 2017-2021 – NSW Oysters Transformation Project



https://www.foodagility.com/research/food-safety-in-the-oyster-industry

Transforming Australian Shellfish Production

Phase 2. 2021-2024

1. Using environmental data and biological sample results, tailored reports and models are being delivered on an estuary by estuary basis.

2. Two new NSW estuaries – Macleay River and Merimbula Lake, and Oyster Harbour, Albany, Western Australia.

3. Output of models embedded into oyster management apps and all data available online via eResearch @UTS.

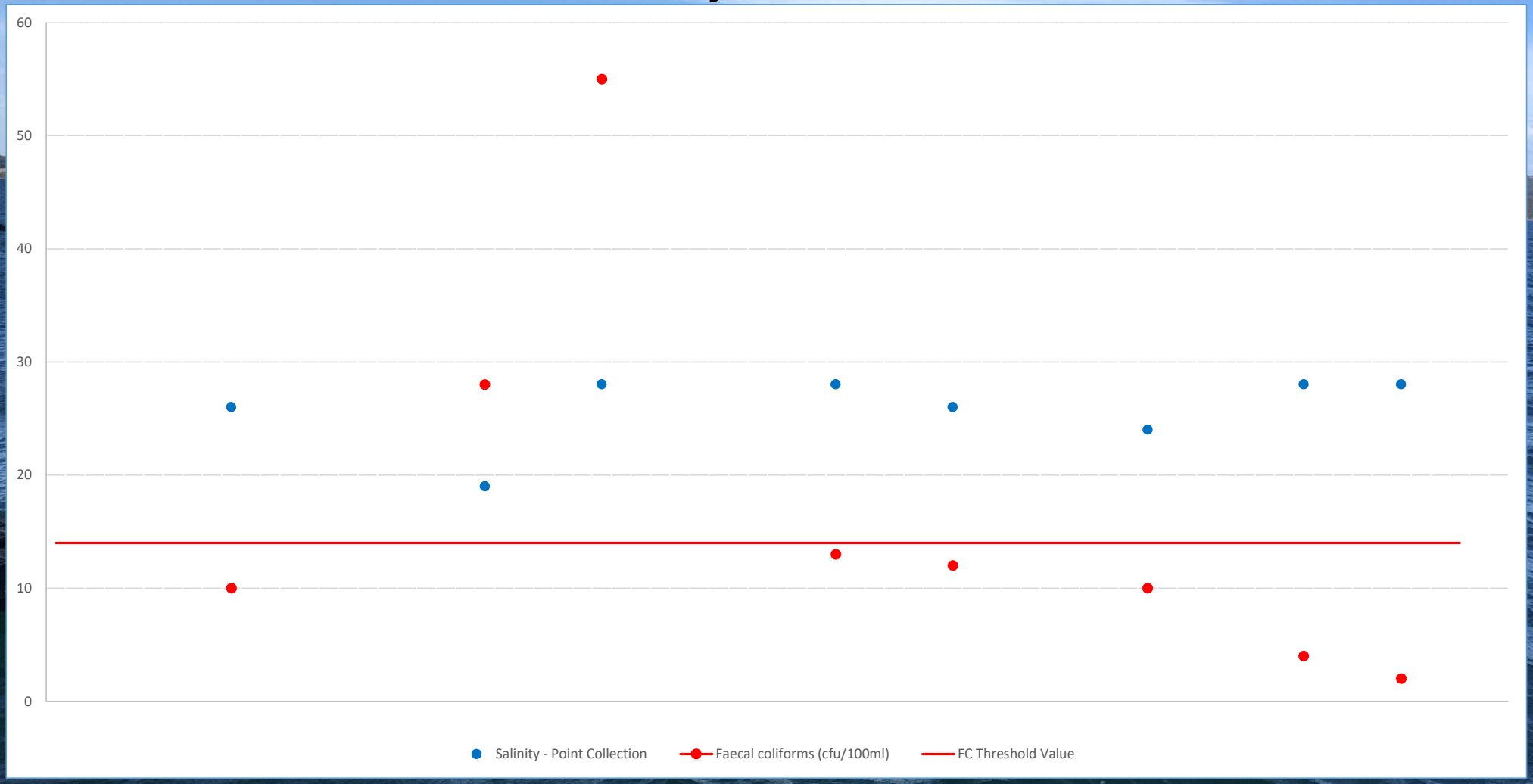
Transforming Australian Shellfish Production

Results so far….

- 15 estuaries engaged in project (NSW and WA).
- 17 management plans based on real time sensor data offered in NSW; six taken up and rest under consideration.
- Estimate ~$3 million p.a. additional farm gate value in NSW if taken up state-wide.
- qPCR assays designed for *E.coli* (bird, cow, human) and harmful algae (*Alexandrium, Pseudo-nitzschia, Dinophysis, Prorocentrum*).

https://www.foodagility.com/research/transforming-australian-shellfish-production

Previous Salinity Data



Previous rainfall

Overlay Real-time Salinity Data

TRANSFORMING AUSTRALIAN SHELLFISH PRODUCTION

Pelican Point Harvest Area - Manning River

Report on Stage 1, December 2017-March 2021

A Food Agility CRC collaboration project partnering with the University of Technology Sydney and the New South Wales government.

Penelope Ajani, Mike Dove, Hazel Farrell, Wayne O'Connor, Matt Tesoriero, Arjun Verma, Anthony Zammit, Brian Hughes and Shauna Murray

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TRANSFORMING AUSTRALIAN SHELLFISH PRODUCTION

Lower Honeymoon Bay Harvest Area - Wagonga Inlet

Report on Stage 1, December 2017-March 2021

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TRANSFORMING AUSTRALIAN SHELLFISH PRODUCTION

Pelican Point Harvest Area - Manning River

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MAJOR FINDINGS

8 Available data indicated that eight harvest area closures could have potentially been avoided between December 2017 and August 2021

75% Salinity was a more reliable predictor than rainfall of faecal bacteria (3 out of 4 indicators tested), showing changed harvest area management would be safer and more discriminatory

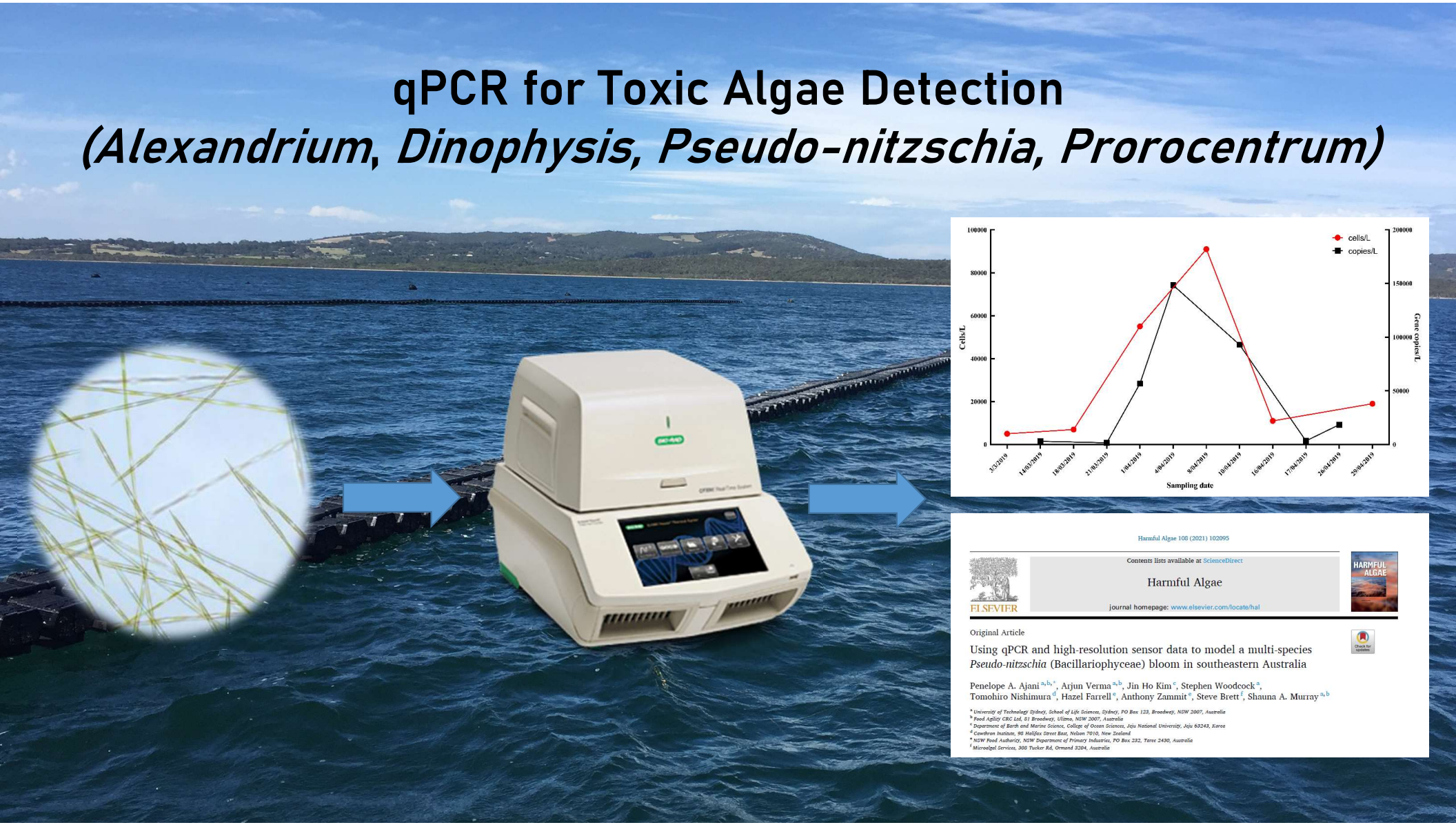
E. coli and cow faecal bacteria increased with rainfall, and generally dissipated after three days

Human bacteria were very low across sampling period

0 No oyster mortality events that exceed background farming mortality occurred over the study period

https://www.foodagility.com/research/transforming-australian-shellfish-production

qPCR for Toxic Algae Detection
(Alexandrium, Dinophysis, Pseudo-nitzschia, Prorocentrum)



Harmful Algae 108 (2021) 102095

Contents lists available at ScienceDirect

Harmful Algae

journal homepage: www.elsevier.com/locate/hal

Original Article

Using qPCR and high-resolution sensor data to model a multi-species *Pseudo-nitzschia* (Bacillariophyceae) bloom in southeastern Australia

Penelope A. Ajani [a,b,*], Arjun Verma [a,b], Jin Ho Kim [c], Stephen Woodcock [a], Tomohiro Nishimura [d], Hazel Farrell [e], Anthony Zammit [e], Steve Brett [f], Shauna A. Murray [a,b]

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[c] Department of Earth and Marine Science, College of Ocean Sciences, Jeju National University, Jeju 63243, Korea
[d] Cawthron Institute, 98 Halifax Street East, Nelson 7010, New Zealand
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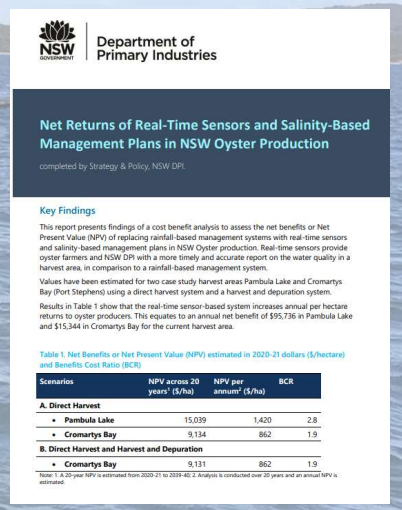
[f] Microalgal Services, 308 Tucker Rd, Ormond 3204, Australia

Transforming Australian Shellfish Production

Conclusions so far….

- Real time salinity sensing shows considerable promise allowing rapid harvest area opening and closure decisions.
- Economic assessment showed net improvement to business profit from implementing real-time salinity management in the pilot estuaries. If widely taken up, will increase profitability and allow for growth of the industry.

https://www.foodauthority.nsw.gov.au/about-us/science/science-in-focus/real-time-sensors-shellfish-harvest-area-management



NSW GOVERNMENT | Department of Primary Industries

Net Returns of Real-Time Sensors and Salinity-Based Management Plans in NSW Oyster Production

completed by Strategy & Policy, NSW DPI

Key Findings

This report presents findings of a cost benefit analysis to assess the net benefits or Net Present Value (NPV) of replacing rainfall-based management systems with real-time sensors and salinity-based management plans in NSW Oyster production. Real-time sensors provide oyster farmers and NSW DPI with a more timely and accurate report on the water quality in a harvest area, in comparison to a rainfall-based management system.

Values have been estimated for two case study harvest areas Pambula Lake and Cromartys Bay (Port Stephens) using a direct harvest system and a harvest and depuration system.

Results in Table 1 show that the real-time sensor-based system increases annual per hectare returns to oyster producers. This equates to an annual net benefit of $95,736 in Pambula Lake and $15,344 in Cromartys Bay for the current harvest area.

Table 1. Net Benefits or Net Present Value (NPV) estimated in 2020-21 dollars ($/hectare) and Benefits Cost Ratio (BCR)

Scenarios	NPV across 20 years[1] ($/ha)	NPV per annum[2] ($/ha)	BCR
A. Direct Harvest			
• **Pambula Lake**	15,039	1,420	2.8
• **Cromartys Bay**	9,134	862	1.9
B. Direct Harvest and Harvest and Depuration			
• **Cromartys Bay**	9,131	862	1.9

Note: 1. A 20-year NPV is estimated from 2020-21 to 2039-40. 2. Analysis is conducted over 20 years and an annual NPV is estimated.

- Considerable scope for co-benefits, i.e. modelling and prediction of harmful algal blooms, oyster growth, on farm monitoring, ecosystem health.

https://www.foodagility.com/research/transforming-australian-shellfish-production

Acknowledgements

- DPI Biosecurity and Food Safety– Dr Hazel Farrell, Anthony Zammit
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- DPIRD – Deb Gardner, Shaye Carman
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- ANU – Prof Bill Maher
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- Food Agility CRC team
- Sensor Providers – The Yield, ICT, In Situ Marine Optics
- Hunter Local Land Services – Brian Hughes
- Oyster farmer samplers (many! 1300+ hours of sampling)