



Oyster research in Queensland, and the potential of two endemic tropical oyster species



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Presentation outline



- Queensland oyster research and funding pathways
- Oyster farming in Queensland
- Challenges currently facing Sydney Rock Oyster farmers
- The Blacklip Oyster and the Queensland Sunshine Oyster
- QX resistance trials and strain/ species results and comparisons
- *Advances in TRO hatchery production and epinephrine free settlement*
- How this relates to NSW oyster farmers.

Oyster RD&E in Queensland

The Qld Gov has recognised the many benefits of oyster farming and the industry's great potential for expansion.

- **A decision was made for DAF to support the Qld oyster industry through targeted RD&E** as part of the current *Aquaculture Transformation Initiative* (started late 2021 and is to continue to end of 2026).

This funding allowed DAF to begin working on oysters in 2021, while preparing a dedicated FRDC research proposal.

- The proposal was supported by FRDC and started in October 2022.



FRDC Project 2021-047: *Harnessing the Aquaculture Potential of Queensland's Native Rock Oysters*



This project is supported by funding from the Fisheries Research and Development Corporation on behalf of the Australian Government

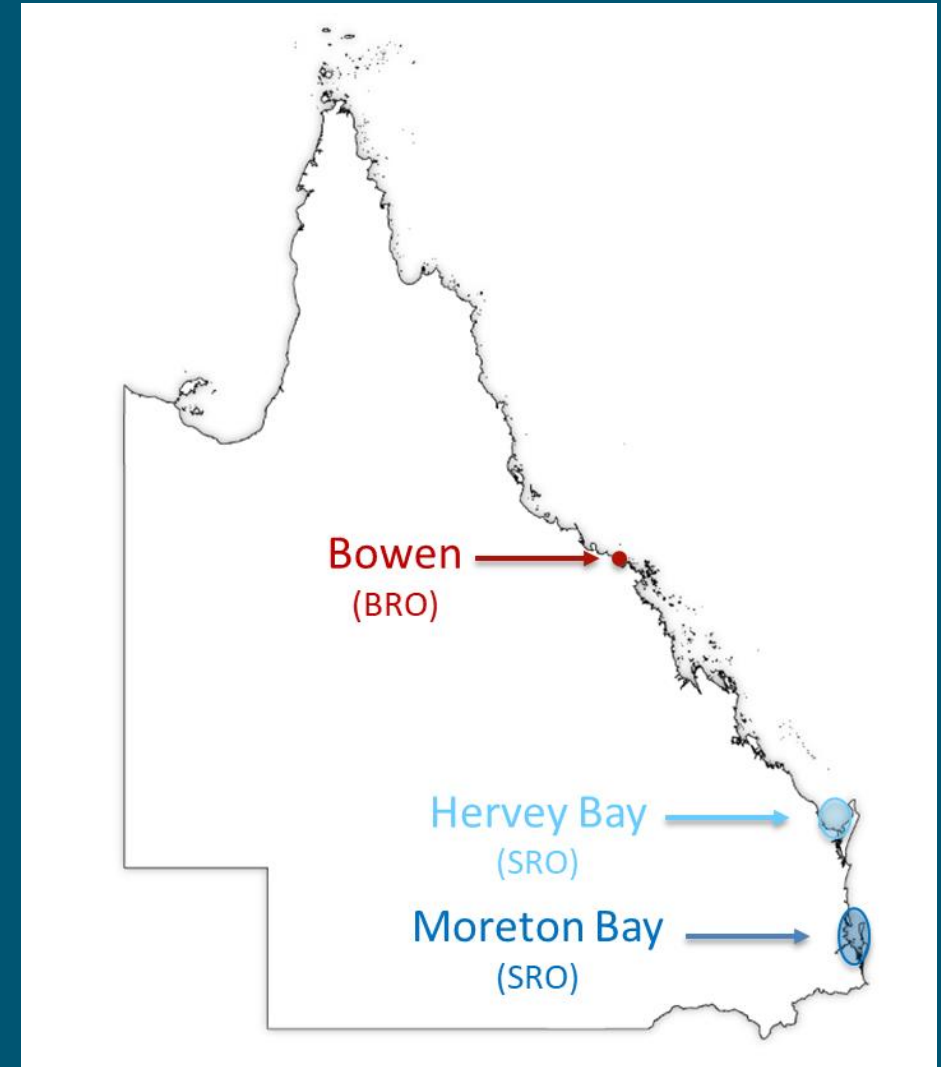
Project details:

- Lead by DAF and based at BIRC
- 4 year duration
- Big project with 6 diverse Subprojects
 - All of which relate to QX response, new Tropical Rock Oyster (TRO) assessments, farming options and hatchery production.



Oyster farming in Queensland

- The Queensland oyster farming industry is currently almost exclusively based on Sydney Rock Oysters (SRO) *Saccostrea glomerata* in Southeast Qld.
- With one exception:
 - the Collisons, growing Blacklip Rock Oysters (BRO) *Saccostrea echinata/ spathulata*, at Bowen.
- And very recent trial stockings of the Queensland Sunshine Oyster (QSO) *Saccostrea lineage G* in Moreton Bay



The challenges for SRO farming in Queensland

Queensland oyster farmers face all the same challenges as NSW.....

However:

- We are already at the extreme northern limit of the SRO distribution
 - This also precludes northern expansion of SRO farming
- Pacific oysters are not a diversification option for Qld
- Improved strains of SROs show potential, but these strains have still experienced unacceptably high rates of summer mortality when exposed to QX

Although SRO selective breeding is very relevant

- We believe that we also need to explore a different approach for addressing these challenges.....



The Queensland approach:

A major focus to identify **suitable native tropical oyster species** and develop appropriate hatchery and farming procedures, and capacity around these species.

We aim to improve the productivity, resilience and profitability of the existing oyster farming industry and enable northern expansion

The two species that we initially identified as strong aquaculture candidates are the **Blacklip Rock Oyster** and the **Queensland Sunshine Oyster**



The Blacklip Rock Oyster (*Saccostrea echinata/spathulata*)

Why is Queensland interested in BRO?

- Endemic to Northern Australia, including most of Qld's coast. Potentially opening vast new areas to oyster farming.
 - The Sydney Rock Oyster is currently farmed in Southeast Qld, but only 15% of the Qld coast is suitable for SRO
- We now know **with certainty** that the species has excellent aquaculture attributes & enormous potential in tropical locations.
 - Still assessing whether BRO is suitable, or permissible, for SEQ.



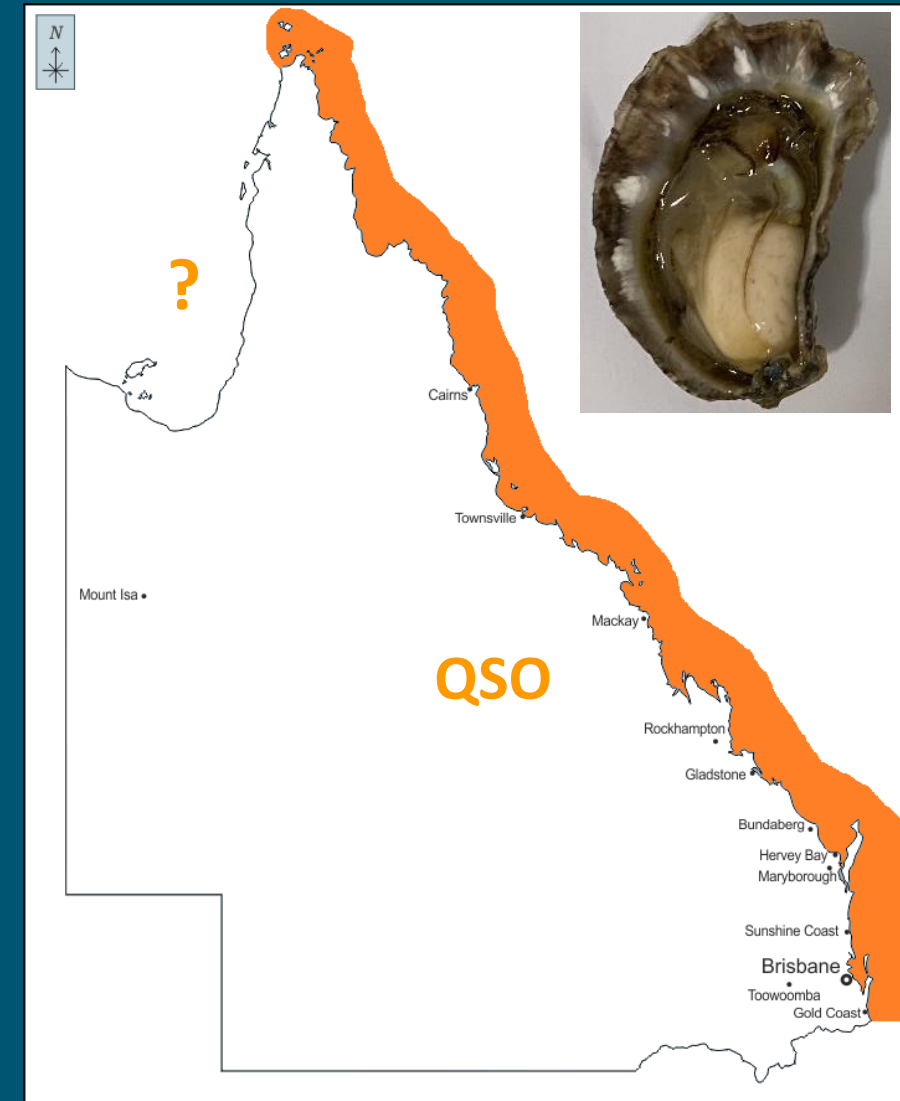
BRO are a large, heavy shelled, attractive and robust oyster.



The Queensland Sunshine Oyster (*Saccostrea* Lineage G)

Why is Queensland interested in QSO?

- 1) The QSO is endemic to the entire east coast of Queensland
- 2) The species was only identified in Qld in 2019 by Griffith Uni and still has no recognised scientific name
- 3) The wild oyster looks exactly like SROs and the two species grow alongside each other in many SEQ locations and can only be differentiated through genetic analysis



Queensland Sunshine Oysters

- Based on the initial information and observations it seemed possible that the QSO could provide a warmwater, climate change, alternative for SEQ farmers
- Very little else was known about the QSO as they had never been intentionally farmed or tried in a hatchery.



- *Hatchery produced QSO have a gold to light brown colour with a well-proportioned deeply cupped shell*

SRO QX strain comparison trial

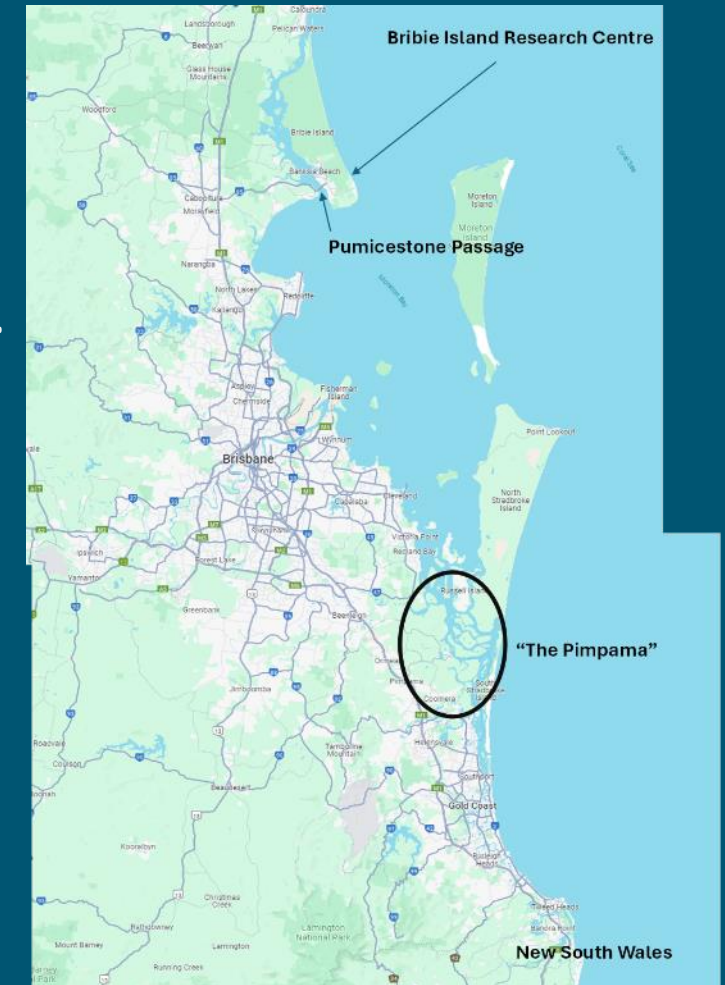
- Started in early March 2023
- The trial is to assess the relative growth, survival, condition and QX response of three varieties of SRO over 2-years
- Replicate experimental stockings were undertaken at eight sites with differing environmental conditions and expected levels of QX, - 4 replicate treatments of each variety at each site.
- This trial does not intend to provide definitive outcomes about the overall performance and suitability of the 3 strains.
- Our trial aims to obtain a comparative assessment of how the strains perform under SEQ conditions.

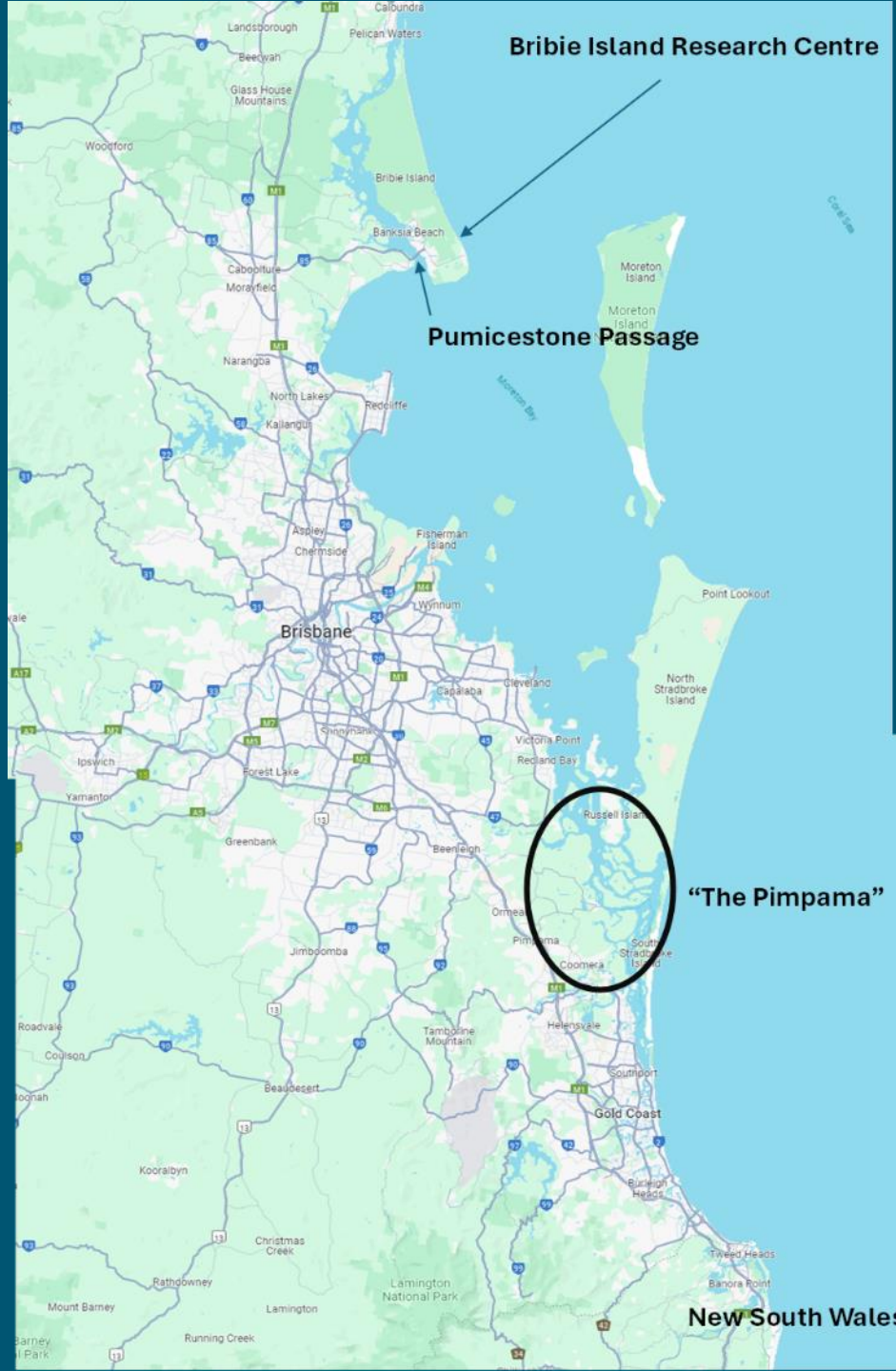


- * *Moreton Bay Wild*
- * *NSW DPI Selected*
- * *Richmond River*

SRO QX strain comparison trial

- Today I want to focus on the one aspect where we already have significant outcomes:
 - **Survival rates from the 3 trial sites that have been impacted by QX over the recent summer/ autumn**
- Two of these sites were oyster farms in the Pimpama River mouth and one was a research pontoon adjacent to Pumicestone Passage.





Bribie Island Research Centre

Pumicestone Passage

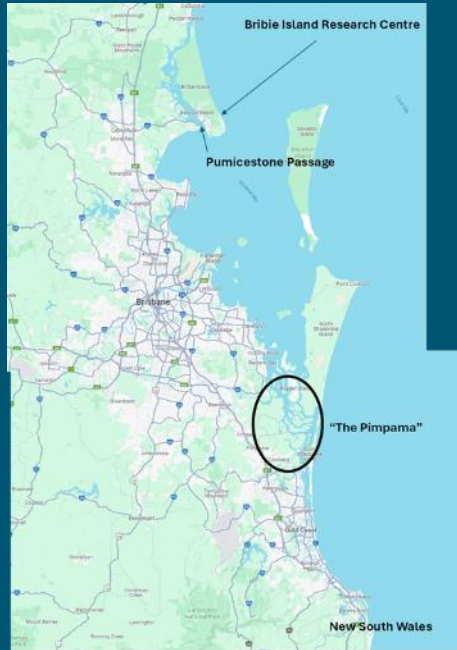
"The Pimpama"

New South Wales



SRO QX strain comparison trial

Over the recent summer months all 3 of these sites experienced very high water temperatures and heavy rainfall – which was followed by major QX outbreaks, and high mortalities.



Over 30 °C



SRO QX strain comparison trial

- Although all strains experienced heavy mortality there were significant differences in survival



- * *Moreton Bay Wild*
- * *NSW DPI Selected*
- * *Richmond River*

Sydney Rock Oyster strain survival

Site	Moreton Bay Wild	NSW DPI Selected	Richmond River
Pimpama 1	12%	28%	23%
Pimpama 2	24%	31%	41%
Pumicestone	11%	25%	36%
<i>Average</i>	<i>16%</i>	<i>28%</i>	<i>33%</i>

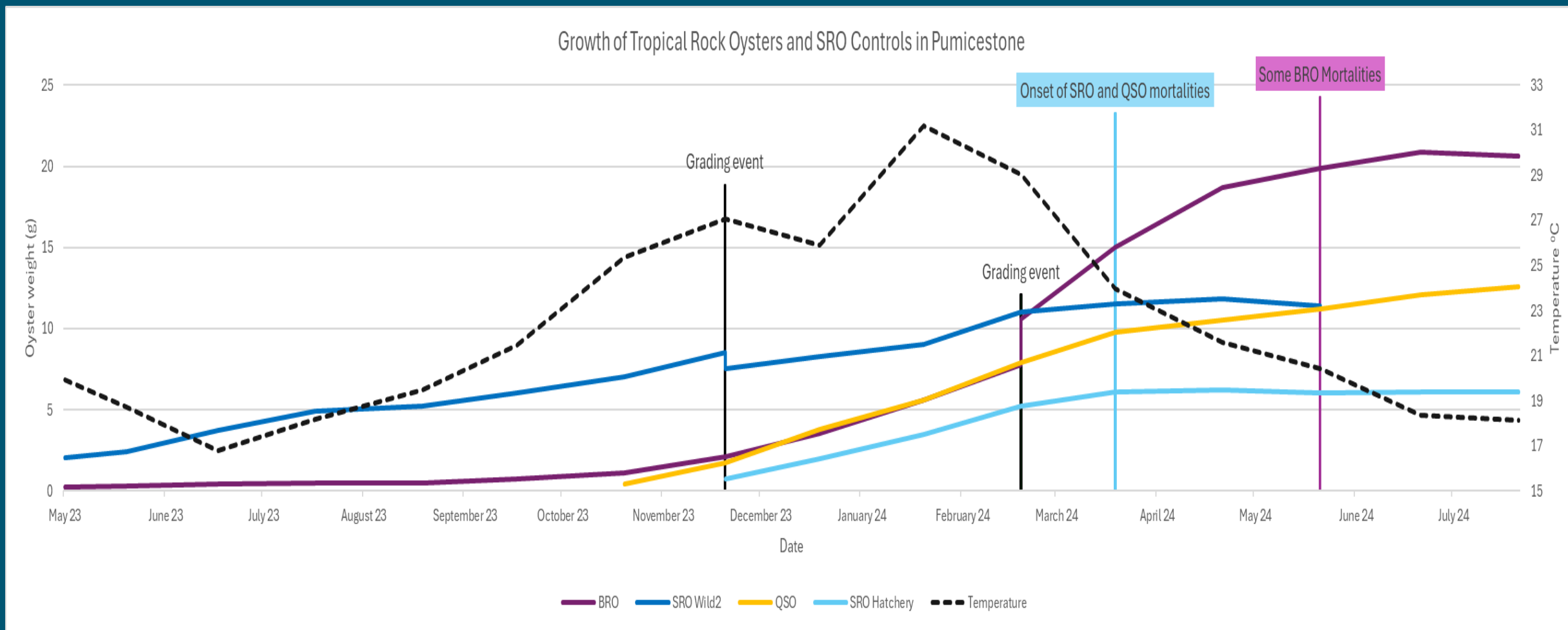
- The native *Moreton Bay Wild* oysters consistently had the lowest survival.

Growth and survival of all oyster species at QX impacted sites

- After starting the SRO Strain Comparison Trial (*early March 2023*)
 - We then obtained approval to stock BRO (*research permits*) at Pumicestone (*late April*), and later at one of the Pimpama sites (*early January*)
 - When QSO spat became available they were also stocked at these sites (*being endemic to SEQ no special approvals required*) (*October*)
- This provided an opportunity to make initial comparisons between the 3 species



Growth and survival of Tropical Rock Oysters at QX impacted sites



Survival of Tropical Rock Oysters at QX impacted sites



	Tropical Rock Oyster survival		
Site	Sydney Rock Spat Control (small hatchery)	Queensland Sunshine Oysters	Blacklip Rock Oyster
Pimpama 1	0%	56%	70%
Pumicestone	20%	72%	96%
<i>Average</i>	<i>(10%)</i>	64%	83%

Growth and survival at Pumicestone

The outcome of growth and survival of 100 oysters from the 3 oyster species



SRO 20% survival (x = 6.1 g)

QSO 72% (12.6 g)

BRO 96% (17.8 g)

Growth and survival at Pumicestone

The outcome of growth and survival of 100 oysters from the 3 oyster species



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BRO 96% (17.8 g)

QX infection status

PCR testing was undertaken to determine if QX was present

August 2023 – all specimens tested negative



April 2024:

- SRO - All SRO strains at both Pimpama and Pumicestone were **QX positive (95+%)**
- QSO - All specimens (100%) tested from both Pimpama and Pumicestone were **QX Negative**
- BRO - All BRO specimens tested from Pumicestone (100%) were QX Negative, but some (33%) from Pimpama were QX positive.

Site	Sydney Rock Oyster strain survival			Tropical Rock Oyster survival		
	Moreton Bay Wild	NSW DPI Selected	Richmond River	Sydney Rock Spat Control (small hatchery)	Queensland Sunshine Oysters	Blacklip Rock Oyster
Pimpama 1	12%	28%	23%	0%	56%	70%
Pimpama 2	24%	31%	41%			
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Average	16%	28%	33%	10%	64%	83%

Advances in TRO Hatchery Production and Settlement

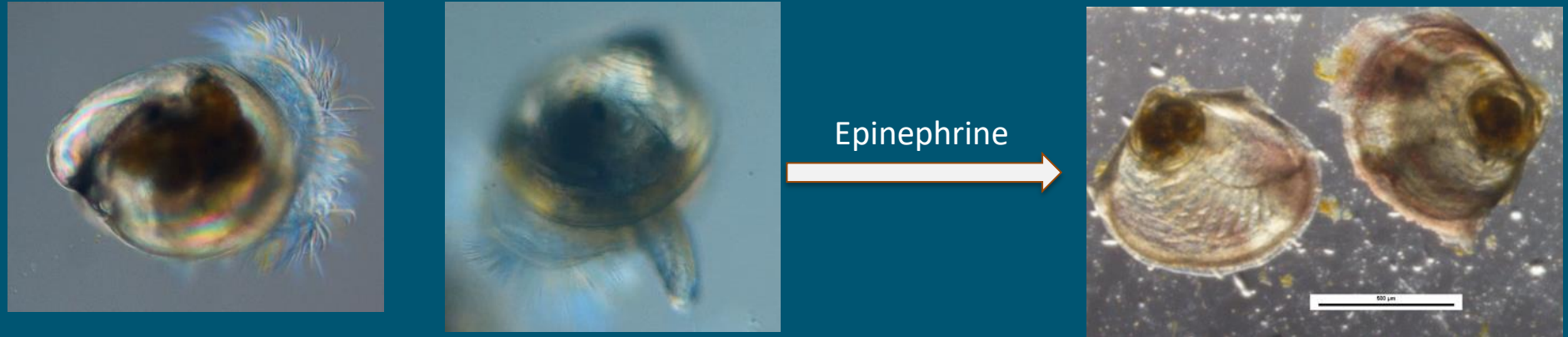
Some acknowledgements:

- The DAF Oyster team:
 - Karl Reiher, Aiden Mellor, and Trevor Borchert
- The proceeding body of research has allowed us to quickly achieve success with TRO hatchery production and focus on what we believe is the major current BRO hatchery bottleneck..... settlement and early post-settlement survival.
 - DPI NSW Oyster Team
 - NT Darwin Aquaculture Centre Team



Settlement and the use of epinephrine

The use of epinephrine (adrenaline) to induce settlement is standard practice in Australian oyster hatcheries and usually results in a highly successful, efficient process, with settlement rates above 80%, and excellent survival.



Unfortunately, **this has not been the case for BRO....**

Even after years of dedicated BRO hatchery work and ongoing refinements to the epi process, settlement rates remain low – usually well below 30%.

It is probable that repeated exposure to epinephrine may cause considerable stress to BRO, potentially making the spat more prone to post-settlement mortality.

Epinephrine BRO settlement observations

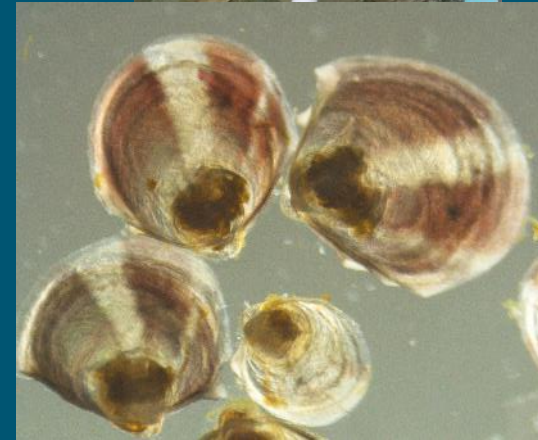
1st Queensland BRO hatchery run (January 2022)

Produced 6M settlement ready larvae, and with repeated epi treatments managed to settle 480,000 spat (8%).

However, over the next 4-weeks **85% of these spat died**. The cause of the mortality was complicated, but post-epi stress is likely to be a major contributor.

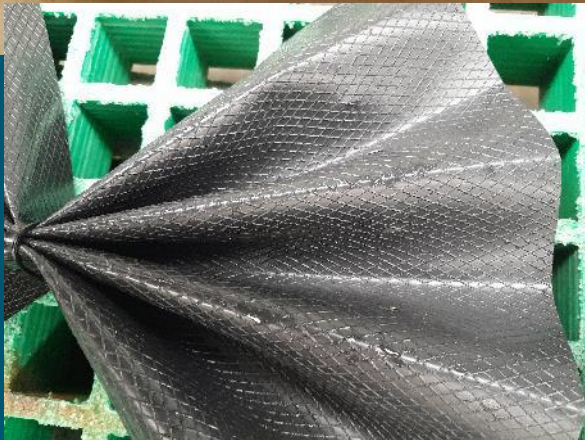
We noticed that the few BRO larvae that settled naturally as “epi-free spat” did not show the same post-settlement mortality as those treated with epi.

We then focussed our efforts on developing an effective epi-free settlement processes.



Epi-free BRO settlement outcomes

Over the last 2½ years we have refined our hatchery procedures, particularly the epi-free settlement process. We tested and assessed various settlement structures and now routinely use a “black bat”.



Epi-free BRO settlement outcomes

In addition to “Bats”, the other essential component to epi-free settlement is “Oyster water”

When not using epi, we wanted to maximise potential natural settlement cues.

- Including the regular addition of water from the broodstock tank (filtered to 1 μ m) to all settlement tanks.
- Replicated experiments confirmed that the addition of **oyster water increased spat production by more than 10 times**
- Oyster water *may* also enrich the internal microbiome of the spat and potentially make them more resilient and resistant to post settlement mortality

The epi-free spat have been successfully held in a variety of nursery systems for many months with no post-settlement mortality (in contrast to substantial ongoing post set mortality being experienced in the NT with epi-set-spat)



Epi-free settlement outcomes

We *believe* that the daily use of a commercial probiotic (Sanolife MIC) further contributes to hatchery health

- *Not experimentally demonstrated but we are convinced that it helps.*



Epi-free settlement outcomes

With the use of Bats, oyster water and probiotics and many additional refinements, we have increased BRO hatchery output:

From ~100,000 farm ready spat per hatchery run..... **To** 2.9 million (February 2024)

From 2% of final stage larvae surviving as spat..... **To** 50+% (February 2024)

It is amazing to think that a single 30 x 30 cm piece of black plastic can produce over 50,000 spat



Recent result **confirm the viability of the epi-free approach to BRO settlement.**

With a larva to spat settlement rate of 50% (higher for the fastest developing larvae), this also **proves the suitability of the species for commercial scale hatchery production.**

Epi-free BRO settlement outcomes

The BRO spat were distributed to farms for stocking and production trials in March/ April



Epi-free settlement outcomes

It is possible that our successful BRO hatchery run in January/ February was a “fluke”
This seems much less likely when considering that it was immediately followed by a more successful **QSO hatchery run** (using the same procedures) resulting in **3.3 million** farm ready spat.



These were distributed to SEQ farms in July/August for farmer assessment and commercial scale production trials.



What do these results mean for NSW growers?

- **QX susceptibility of SRO strains**
- The results of this trial are most relevant to Queensland
- As the response QX disease appears to differ substantially between estuaries and local conditions, these results are unlikely to be directly applicable to NSW. They provide additional information to help to better understand this very complex disease.
- **BRO** are unlikely to be suitable or permissible for farming in NSW
- It is important to be aware of this species, as it is a new product will be produced in increasing quantities from Qld, NT and WA.

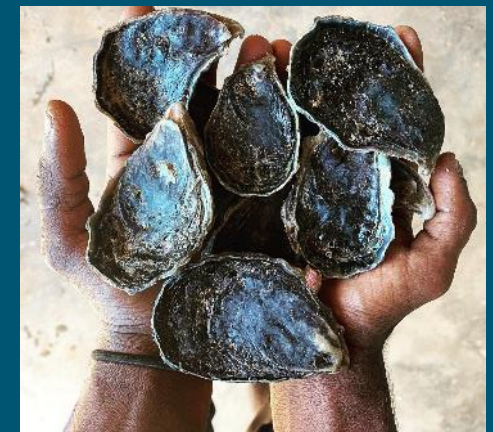


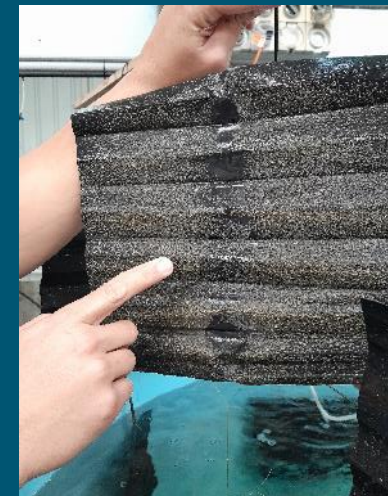
Photo from DAC NT

What these results mean for NSW growers

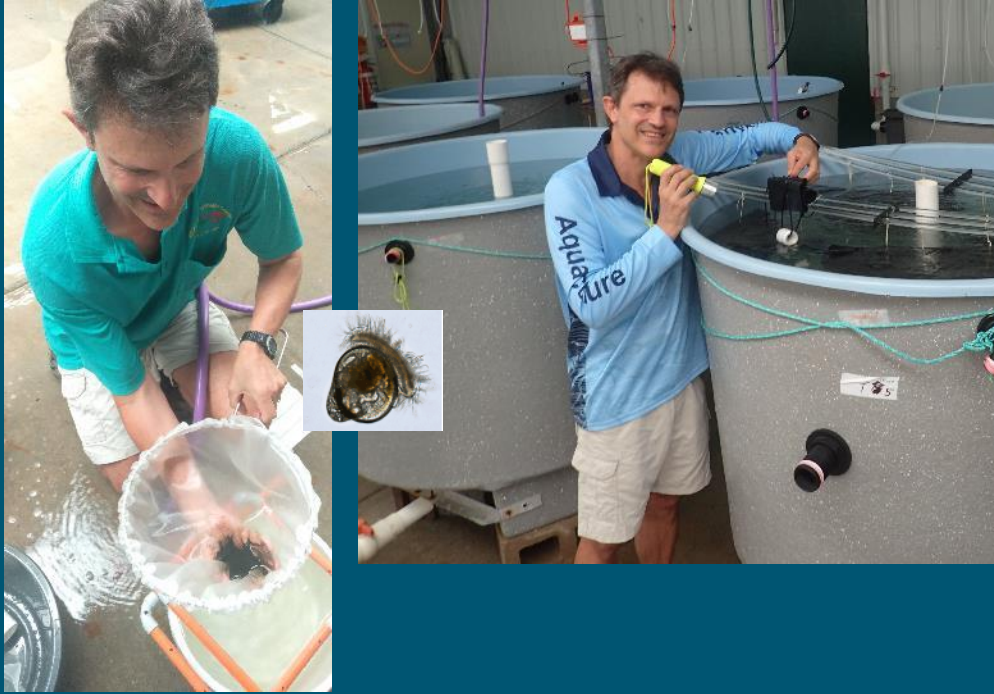
- **Queensland Sunshine Oysters**
- As QSO are endemic even in SEQ, it is probable that they are also be endemic to northern NSW
- At some stage the species *may* therefore be a potential option for some NSW farmers??
- **Epi-free hatchery production**
- The newly developed settlement process is particularly important for BRO but also works for other species
- The current SRO and PO hatchery processes appear to be efficient and effective
- The new process is presented largely for interest – although it **may provide an additional settlement option that could readily be implemented, by any hatchery, if ever required.**



QSO
and
paired
SRO



Questions?



I look forward to sharing thoughts and ideas and discussing any aspect of interest in more detail over the next few days.