



## APRIL 2024

The Sydney Rock Oyster breeding program started in the 1990s to increase industry productivity, provide management options to industry in times of oyster diseases, and establish a platform to respond to future needs and threats such as climate change. Over the past 30 years the program has changed in terms of breeding goals and methods used to achieve them.

The current industry goal is to produce commercial oysters with greater than 70% survival through one QX disease outbreak and 30% faster growth, without changing meat condition when compared to a wild oyster.

The DPI pair mated families produced in the 2022-year class were assessed in March 2024 and show that we are close to meeting these goals, with an average estimated breeding value (EBV) of 80% for spat survival through one QX outbreak, 25% faster growth, and no change in meat condition compared to wild Sydney Rock Oysters (Figure 3). It is these traits that are used in the overall selection index. Adult survival following one QX outbreak is on the same upward trajectory as spat survival and is sitting at 65%.

Other traits are also measured. For example, in response to the needs of farmers in Port Stephens, the survival of the 2022-year class families following dual exposure to two seasons of QX disease, including spat and

adult survival, is currently being assessed in the Karuah River and Georges River. The final data for this dual QX exposure trial will be collected in July 2024. Additionally, at industry's request was the incorporation of Richmond River Sydney Rock Oyster genetics.

The elite families of the 2022-year class will be distributed to commercial hatcheries in April 2024.

DPI completed its 2023-year class run in January 2024, with 37 families produced. Richmond River broodstock were also used, increasing representation of the Richmond River genetic group. DPI will collect data on the survival of spat from the 2023-year class families, following one QX outbreak, in July 2024. Survival of adults following one QX outbreak as well as survival following dual exposure to QX, from spat to adults, will be collected in July 2025.



*Figure 1: Family broodstock in Wallis Lake. These families are from year class 2016. They were grown on the same lease, using the same cultivation techniques, presented side by side to illustrate the influence genetics has on their growth and general appearance.*



*Figure 2: Sydney rock oyster family lines being surveyed. Each section of a tray holds one family line.*

### **How the breeding program works**

Oysters used to establish the Sydney Rock Oyster breeding program were collected from across NSW.

There are now close to 450 pedigreed families that have had tens of thousands of survival and performance records collected on them through the breeding population, which forms the foundation of the ongoing genetic evaluation of current and future families.

Annual family breeding runs are done at DPI Port Stephens Fisheries Institute during spring and summer.

The goal for each breeding run is to produce 30-50 new families for each year class. The year class denotes the year that families were produced. The year runs from July 1 through to June 30.

Examples of Sydney Rock Oyster families and their gains are shown in Figure 3.

Representatives from each family undergo performance trials to assess growth, QX disease survival and meat condition.

The top performing families are identified based on the selection index (referred to on page 1) which has a weighting of 2 for QX spat survival through a single QX outbreak, 1 for growth and 1 for condition.

These top performing families, which rank higher in the selection index, are used to create the next generation. Additionally, these families are more likely to be chosen for use in commercial hatchery runs than lower ranking families.

DPI works with geneticists at CSIRO to formulate breeding strategies based on industry advice.

All data for the breeding program is housed in a customised data management system designed by CSIRO.





### Genetic Gains Trend of the SRO Breeding Program

EBV Date: 27 January 2024

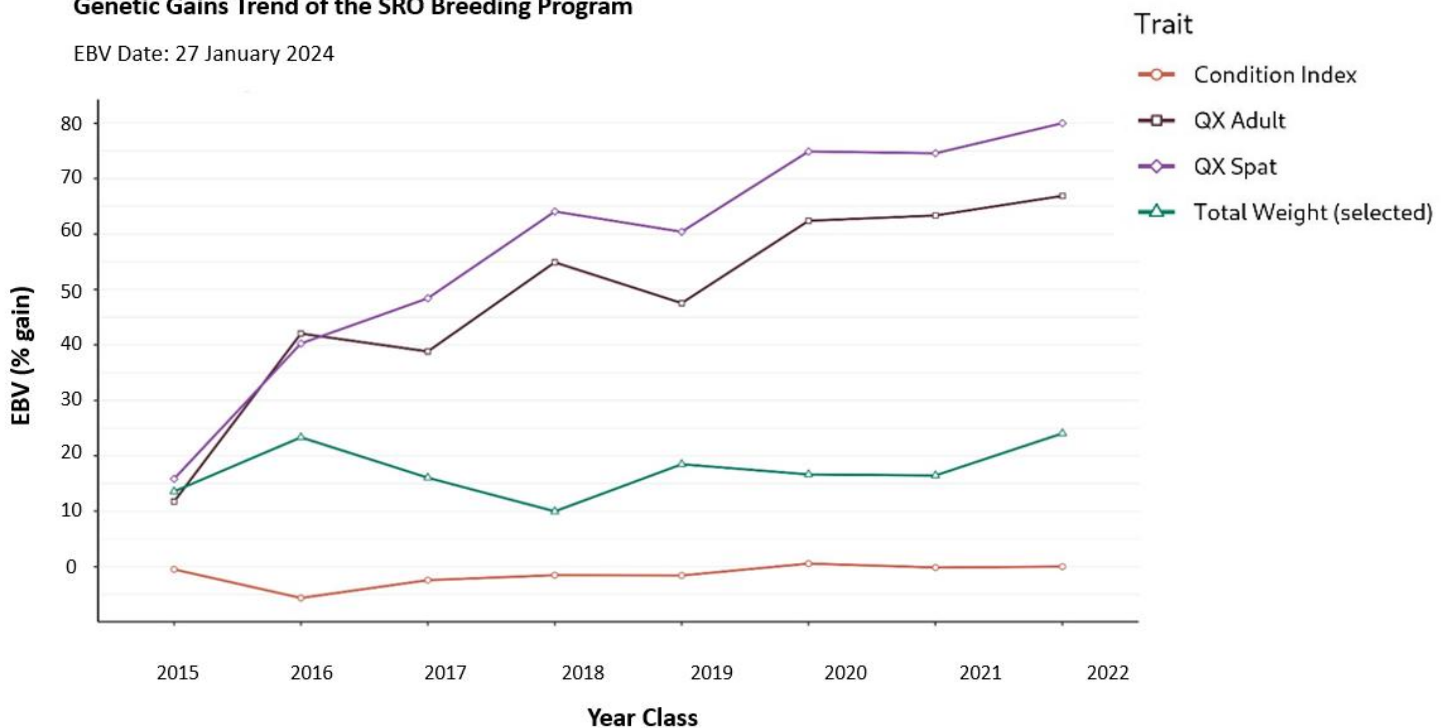


Figure 3. Genetic gains trend of each year class in the Sydney Rock Oyster breeding program for the traits QX Spat survival (single exposure), QX Adult survival (single exposure), Total Weight selected (growth), and Condition Index (meat condition) from year class 2015 to 2022.

### Latest performance results for QX resistant Sydney Rock Oysters

Estimated breeding values (EBVs) are calculated for each family in the breeding program and represent a family's genetic potential for the traits under selection. EBVs take into account the pedigree and performance data of a family in relation to QX survival, growth and meat condition. The EBV is expressed as a percentage and represents the difference between the family's genetics and the genetic base it is compared to. In the Sydney Rock Oyster Breeding Program EBVs are compared to non-selected, or wild, Sydney Rock Oysters. Growth and condition EBVs are presented as percentage gain over a wild oyster. QX EBVs are presented as the expected survival after a single QX hit on spat or adults. The expected survival following a QX hit does not take into

consideration background mortality that can occur due to routine farming operations.

To minimise losses attributable to QX disease it is recommended to nursery-rear spat in estuaries not impacted by QX disease and transfer spat to estuaries affected by QX disease when infections of the disease-causing agent *Marteilia sydneyi* have ceased.

### Families for industry use

DPI provides broodstock families to hatcheries after the families they wish to use have been selected from the CSIRO data management system. The QX disease biosecurity closure has restricted some hatcheries accessing Port Stephens broodstock. As a result of this, broodstock is now held in Port Stephens and a NSW



estuary not impacted by QX (currently Wallis Lake). A commercial hatchery run requires a minimum of two families. Pedigree data allows inbreeding levels to be calculated and managed.

DPI is currently trialing a new model to supply broodstock families to hatcheries. Hatcheries will now nominate a broodstock holder that they would like their broodstock families to be sent to.

The broodstock holder must have a Class A permit and is required to sign a broodstock holder Material Transfer Agreement (MTA) supplied by DPI prior to receiving broodstock. Please note, this is separate to the Hatchery MTA that is signed by hatcheries. Once the broodstock is available it will then be transfer to the nominated broodstock holder.



*Figure 4: Sydney Rock Oyster family lines being surveyed. Image NSW DPI.*

There are several private sector hatcheries that can produce, and supply Sydney Rock Oyster spat spawned from selected families. Scan this QR code for details:



There is a \$3/1000 spat service fee charged at the point of exit from a hatchery for producing selected lines of spat.

This system is currently under review by the Sustainable Sydney Rock Oyster Breeding Program Reference Group.

For access to details of families for commercial hatchery production either through an online CSIRO site or from DPI contact Laura Parker, Senior Fisheries Scientist NSW DPI (email: [Laura.parker@dpi.nsw.gov.au](mailto:Laura.parker@dpi.nsw.gov.au))



## **Richmond River oysters are incorporated into the breeding program**

DPI are continuing to incorporate Richmond River genetics into the Sydney Rock Oyster breeding program. Richmond River Sydney Rock Oyster broodstock were crossed with our high performing DPI families in the 2022 and 2023-year class run. This is in addition to the families created in 2020. Current interim field data show that these families are ranking highly in their selection index assessment (2:1:1 for QX spat survival: growth: meat condition). Families from the 2022-year class are available for industry to use for commercial hatchery production. The 2023-year class will be available following their assessments in 2025.

## **Climate change**

DPI continue to test families in the breeding program for climate change resilience. A subset of families from the 2022-year class were deployed in the warmer waters of Bribie Canal and the Pimpama River in Southern Queensland and their growth and survival will be assessed over a period of 6-months. Pimpama River is a site known to experience recurrent QX disease outbreaks.

DPI is also beginning a large long-term experiment, aimed at determining whether conditioning broodstock under climate change conditions will enhance offspring resilience to climate change over their lifecycle. Over the coming breeding seasons, DPI will be exploring ways to incorporate climate change resilience into the breeding program on a larger scale. The current climate change stressors of focus are ocean warming, marine heatwaves and ocean acidification.

## **Funding the program**

Ongoing funding for the Sydney Rock Oyster breeding program has been discussed with the Shellfish Committee, DPI and the SRO Breeding Program Reference Group.

It has come to a point in time where the industry contribution to the breeding program must increase in order for the program to continue.

The NSW Shellfish Committee established the Reference Group in 2021 which consists of 14 oyster farmers, DPI representatives, and CSIRO geneticists. Led by an independent Chair, the Reference Group is tasked with informing DPI of industry needs and goals for the breeding program and a business plan to support the sustainable growth of the breeding program. A Technical Committee has also been established which is a sub-group including members of the Reference Group, DPI and CSIRO. The Technical Committee is focussed on technical aspects of the program, for example making decisions about family broodstock distribution locations and coordination.

The current cost of the breeding program is about \$400,000 per year. Approximately \$15,000 - \$20,000 is being recovered under the current business model which is the service fee of \$3 per 1000 spat, charged to the grower on the point of spat leaving the hatchery.

A series of business model options have been considered over the past year by the Reference Group, including increasing the current service fee, charging for the use of broodstock, charging industry a flat levy, selling the breeding program or





components of the breeding program, and combinations of these different options.

The model option that the Reference Group agreed to pursue and raise with industry, with endorsement by the Shellfish Committee, is a hybrid fee model. This hybrid model may entail an industry-wide set levy (for example charged on a per hectare basis) combined with an increased service fee paid on purchase of breeding program spat.

DPI have committed to \$500,000 over the next two years for the program but advised that without an industry commitment, DPI would find it difficult to continue funding. An options paper will be sent to industry shortly for consultation.

Contact Emma Wilkie 0428 764 310 or [emma.wilkie@dpi.nsw.gov.au](mailto:emma.wilkie@dpi.nsw.gov.au) for information about the Reference Group and Technical Committee, and to provide input.

### **NSW Farmers Association support**

NSW Farmers are overseeing the recruitment and administration of an extension officer to extend the outputs of the breeding program and liaise with producers and hatcheries. The Oyster Committee, in consultation with the Reference Group, will guide the operations of the extension officer.

### **QX Monitoring**

DPI are continuing annual autumn QX surveillance in Port Stephens until June 2025, thanks to funding from DPI. Ten sites across Port Stephens were recently surveyed (March 2024) to determine the geospatial distribution of QX at a time when the disease most active.

At each site, cultivated and wild Sydney Rock Oysters were collected and assessed for the presence of QX-causing agent *Martelia sydneyi*.

In 2022 detections of sporulating QX disease were confirmed in 7 of the 10 sampling zones however some positive detections were due to sampled oysters having been moved from other locations also testing positive. It was therefore unknown where the oysters became infected. In 2023 detections were confined to the inner estuary in Karuah River and Tilligerry Creek. Sampling for 2024 has been undertaken and results will be available shortly. Results as they become available are published on the DPI website.



DPI are also continuing a QX window of infection trial. Naïve oysters are being deployed fortnightly in Tilligerry Creek, Karuah and Cromarty Bay and are being regularly tested via qPCR and cytology. In addition, sentinel QX-R, Richmond River and Wallis Lake wild caught oysters are being monitored for survival at the same locations. NSW DPI are also working with farmers to monitor stock performance. This is a continuation of work that has been underway since May 2022. The window of infection is currently open at the Karuah River site only. In prior years, the window of infection has coincided with the minimum water temperature exceeding 21.5 °C and



following a significant rainfall event. Investigations into alternate hosts for the disease are ongoing, with investigations targeting plankton and polychaete worms.

An FRDC-funded project is also underway which aims to determine whether differences in *Marteilia* strains in oysters could account for expression of QX disease in high but not low risk estuaries. One aim of this study is to use previously generated genome sequence data to develop a molecular typing scheme for *M. sydneyi* and will include sampling and testing of oysters from low risk estuaries where disease does not occur (Wallis Lake, Wagonga Inlet, Tuross Lake) over the coming months for comparison to archived materials from high risk estuaries. At the same time, the survival of families from the Sydney Rock Oyster Breeding program following exposure to QX disease is being compared in the Georges River and Karuah River to determine whether the QX resistance of the families is similar across both estuaries.

QX disease risk status is determined for all estuaries in NSW.

High risk estuaries are Richmond River, Clarence River, Balinger/Kalang River, Macleay River, Port Stephens, Hawkesbury River and Georges River, while medium risk are Tweed River and Brunswick River. All other estuaries are currently classified as low risk. The risk status has implications for movement of oysters and gear. Risk status of each estuary and what the status means is on the DPI website.



The ongoing work into the potential causes and risk factors for disease outbreaks, combined with the breeding program are important management strategies for the disease which has devastating impacts for the industry.

#### MORE INFORMATION



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- [DPI Aquatic Biosecurity](#)
- [DPI Aquaculture Permit Holder Website](#)
- [DPI QX Disease](#)
- [NSW Oysters](#)