



Overcoming technical constraints to Sydney Rock Oyster hatchery production

Hatchery Hub training program

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15 June 2016

FRDC Project No 2015-706



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ISBN 978-0-646-95789-0

[Overcoming technical constraints to Sydney Rock Oyster hatchery production]
[2015-706]

[2016]

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Acknowledgments

We wish to thank The NSW Department of Primary Industries Port Stephens Fisheries Institute (PSFI), for the use of their conference room, bivalve hatchery tour and the display of family breeding lines. We thank Anthony Sciacca, Verdich and Sons, XL Oysters, and Ritchies Oysters for supplying broodstock and selected lines of stock for demonstrations at the workshops. We thank the consultant Jonathan Bilton who continues to provide additional support to hatchery managers on request, remotely. We thank Victorian Shellfish Hatchery, Camden Haven Oyster Supply and AquaFarms QLD for participating and supporting the Hatchery Hub program. We thank attendees of the workshops, particularly hatchery managers and people from interstate who contributed to the discussions at workshops. We thank the FRDC for funding, and the Seafood CRC for support and input into the design and application of the project.

Abbreviations

SOCo - Select Oyster Company Pty Ltd

PSFI - NSW DPI Fisheries Port Stephens Fisheries Institute

SRO - Sydney Rock Oyster

VSH - Victorian Shellfish Hatchery

CHOS - Camden Haven Oyster Supply

Hatchery Manual - O'Connor, W., Dove, M., Finn, B., O'Connor, S. (2008). NSW DPI Fisheries Manual for Hatchery Production of Sydney Rock Oysters *Saccostrea glomerata*. NSW Department of Primary Industries – Fisheries Research Report Series: 20.

The Hub - The Sydney Rock Oyster Hatchery Hub program

Executive Summary

The Sydney Rock Oyster Hatchery Hub (The Hub) program, and this report, have been managed and facilitated by Select Oyster Company (SOCo).

The Hub was created for two key reasons: 1) increase spat supply of selected lines of SRO to industry and; 2) improve knowledge transfer about hatchery production and the breeding program. Spat supply is in deficit of demand by about 50% due to a combination of technical challenges, environmental conditions, and access to conditioned broodstock. Commercial hatchery managers have reported to SOCo that while operational and R&D improvements established by the NSW DPI Fisheries are proven effective ways of producing commercial quantities of SRO spat at the PSFI hatchery, production challenges persist. Knowledge transfer between hatcheries and the importance of communication within the industry about selected spat development and supply have also been raised.

The Hub was therefore designed by SOCo, in consultation with commercial hatchery managers and the Seafood CRC to address six key objectives, listed here with a summary of actions and outcomes from each:

1) Develop technical capacity among commercial hatchery operators and their staff where possible in the production of SRO spat: On-site hatchery consultations, and remote assistance on demand including after the program, were provided by an expert consultant Jonathan Bilton Athair Aquaculture. Two hatcheries chose to participate in consultations: Camden Haven Oyster Supply, Laurieton NSW and Victorian Shellfish Hatchery, Queenscliff VIC. They received a four day on-site consultation and remote advice on request. After the consultation, a confidential recommendations report by the consultant was provided, and each are currently writing and applying their own set of standard operation protocols. A third hatchery, AquaFarms QLD received advice remotely through phone and email communications. Each of the hatcheries provided a report to SOCo based on their consultation experience including the changes they made to their operations, their increase in production (if any) and general satisfaction with The Hub, available on request. Prior to on-site visits, communication between Jonathan, SOCo and participating hatchery managers set the foundations for the consultation strategy, assessed hatchery records and targeted hatchery priorities to ensure effective use of time for on-site visits. Some of the key challenges in SRO production that were identified included water supply and quality, algal quantity and quality, record keeping, hygiene and structural modifications. The challenges however were not insurmountable and each hatchery therefore applied and continues to apply changes to their operations based on advice from the consultant. More complex changes to equipment could not be made due to immediate costs, but hatcheries intend on pursuing these recommendations in the future.

2) Identify reasons for technical constraints in production and why currently available protocols are not transferable to emerging hatcheries: Throughout The Hub project, currently

available protocols in the NSW DPI [Manual for hatchery production of Sydney rock oysters \(*Saccostrea glomerata*\)](#) were considered and applied, in order to identify if and where such protocols are and are not transferable to commercial hatchery operations.

Hatcheries reported that the Hatchery Manual has been very beneficial in the set up of their operations, and in developing a base line understanding of SRO hatchery production requirements. However, intrinsic circumstances to each hatchery's environment, infrastructure and capacity were compared to NSW DPI hatchery, and noted as important factors in the outcomes of their runs.

3) Develop a Hatchery Hub program for future hatchery capacity building projects: Compliment and contribute to R&D of the SRO breeding program: After hatchery consultations, we ran two industry workshops. The wider industry was given access to knowledge about SRO hatchery operations including technical issues and its management associated with environmental conditions and hatchery set up and operations. Hatchery operators (NSW and interstate inclusive), industry, member groups, government departments and students were invited to participate in a round-table discussion and networking opportunity which has formed the foundations for a SRO Hatchery Hub and will be an important network in all future initiatives that fall under The Hub banner.

4) An increase in production of SRO selected lines of spat for industry in the 2015-2016 production season, and consistent production in subsequent years to perpetuate the genetic gains achieved from the family breeding program: Consultations were purposefully scheduled during hatchery runs and at peak production times. This meant that hatcheries and the consultant could aim to foresee, and change where necessary, operational procedures that might have been contributing to lower than desired yields. Production of SRO seed increased at AquaFarms QLD. The hatchery manager believes that this is largely attributable to the advice he and his staff received from the consultant, and from NSW DPI Fisheries staff. VSH and CHOS did not increase their immediate production capacity during The Hub consultation period, however they believe that the changes they've implemented as a result of the program will increase their production in future seasons.

5) Introduce the concept of a hatchery training standard for the production of SRO, which can be certified through tertiary institutions: In building this project, SOCo have expanded the hatchery training concept in a new project proposal which includes collaboration with RTOs in the development of a certified hatchery production course. We've made progress in communications with Natfish, North Coast TAFE NSW including drafting a budget, strategy, and resource requirements for the design of a certified course. TAFE also assisted in advertising the The Hub workshops. At the workshops, at some industry meetings, and in communications with hatchery managers and the consultant, SOCo has advertised the fact that this is the direction we are pursuing. SOCo has also secured additional funding from the Local Land Services on behalf of the NSW Minister for Primary Industries Niall Blair to further develop training and capacity building projects for the SRO selective breeding program.

6) *Develop a peer network for future hatchery support and capacity building*: A network for future support has been established through two workshops; Port Stephens Fisheries Institute (including a hatchery tour) and in Narooma NSW. Workshops facilitated an open dialogue and a network among hatchery managers, government departments and industry from QLD, NSW, TAS and WA. This approach not only addressed technical issues, but offered a platform to share information about spat production with the wider industry and interested groups. Workshops also provided a platform for industry to know who is in the hatchery business and how to get support, either from commercial or government hatchery operators if they were interested in developing their own hatchery. Contact details were distributed of all hatchery operators and the consultant on request. Combined with the industry workshops, the consultations also set the foundations for future Hatchery Hub projects including training and on-site advice, while linking hatchery operators to each other and to external expertise. Each hatchery reported that the consultation was extremely useful to them for both the technical and networking aspects it brings. They encourage follow up programs, and programs that facilitate on-site consultation throughout the duration of an entire run where possible.

Keywords

Saccostrea glomerata, Hatchery Hub, selective breeding, industry, broodstock, algae, consultation, commercialisation.

Introduction

Hatchery training and capacity building in the production of Sydney Rock Oyster (SRO) seed is essential for the NSW oyster industry and the SRO breeding program. The demand for selected lines of SRO seed exceeds supply. At present about 20% of the spat estimated to secure future production and market supply annually is sourced from selectively bred stock, with capacity for at least twice this proportion as records indicate that supply is in deficit of demand by approximately 50%. This shortfall is due to the combination of technical and environmental conditions intrinsic to hatcheries, and access to conditioned broodstock.

Select Oyster Company P/L (SOCo) is the industry owned company that manages the commercialisation of the SRO breeding program. SOCo is tasked with organising the production and distribution of broodstock from the improved breeding lines and to ultimately take control of the management and future development of the breeding lines. With the establishment of SOCo, and funding support from the industry, the Seafood CRC, and Fisheries Research & Development Corporation (FRDC), the breeding lines, developed by NSW DPI Fisheries have now been made commercially available to the oyster industry.

Hatchery-produced oyster spat continues to become more readily accessible in NSW, particularly for the SRO industry which, prior to 2003, had been largely unavailable to the majority of the rock oyster industry. Over the years, hatchery technologies and access to selectively bred broodstock have significantly improved. The NSW DPI Fisheries published the 'Manual for hatchery production of Sydney rock oysters (*Saccostrea glomerata*) in 2008 which successfully demonstrated how hatchery production of commercial quantities of SRO seed could be achieved, and to this day the manual is followed by several commercial hatcheries.

However, annual supply from commercial hatcheries is inconsistent and generally does not meet demand. There are currently five commercial hatcheries which are permitted to produce SRO seed for the NSW industry, however only one has a production record that could be considered commercially viable. This in turn creates a challenge for SOCo and the perpetuation of the breeding program in that the levy for selectively bred spat is inadequate at current sales levels to fully fund management of broodstock.

SOCo therefore saw an important opportunity to assist in facilitating perpetual, regular and increased production among commercial hatcheries. Regular communications with hatchery managers indicated that the technical challenges in the hatcheries and in broodstock conditioning are both impacting production and supply. As such, the SRO Hatchery Hub, herein The Hub, was created.

The Hub's primary purpose has been to increase spat supply of selected lines of SRO to industry. This involved a holistic approach which included; on-site hatchery consultation services with an independent external consultant, creation of support networks by linking hatchery managers with each other and with the expert consultant, and increased communication channels within the

industry to drive awareness about hatchery production procedures, accessibility of spat and support networks, and the breeding program.

At the onset, it was important to note that commercial scale production of SRO has been achieved and guidelines published by the NSW DPI in the Sydney Rock Oyster Hatchery Manual. Hatcheries report that the Hatchery Manual has been very beneficial in the set up of their operations, and in developing a base line understanding of SRO hatchery production requirements. However, intrinsic circumstances to each hatchery's environment are influencing factors in the production, and such circumstances could not be addressed as thoroughly as they were through consultation by application of the Manual alone.

Consolidating on-site training and workshops, as opposed to applying only one component of the program (i.e. training only) was considered an effective method of addressing issues in technical capacity, communication difficulties, and paving the way for future initiatives that will build from this initial Hub. In particular, The Hub has demonstrated the effectiveness of on-site consultation in identifying otherwise potentially overlooked operational aspects, and applying this consultative approach in developing a certified training course through registered training organisations such as NSW TAFE. All future initiatives therefore build from the Hub; including the networks it created, the effectiveness of its consultative approach, access to commercial hatcheries for future training, and dialogue among the industry and policy makers.

Objectives

Here we state the objectives of the program, as they are stated in the Agreement, and which have not changed during the program.

1) Develop technical capacity among commercial hatchery operators and their staff where possible in the production of SRO spat.

2) Identify reasons for technical constraints in production and why currently available protocols are not transferable to emerging hatcheries.

3) Develop a Hatchery Hub program for future hatchery capacity building projects.

4) An increase in production of SRO selected lines of spat for industry in the 2015-2016 production season, and consistent production in subsequent years to perpetuate the genetic gains achieved from the family breeding program.

5) Introduce the concept of a hatchery training standard for the production of SRO, which can be certified through tertiary institutions.

6) Develop a peer network for future hatchery support and capacity building.

Method

To address each of the six objectives, a combination of on-site hatchery consultations followed by industry workshops was undertaken to address technical production aspects from within each hatchery, through to sharing the knowledge gained to a broader network for Hub development and peer networking.

The consultations served as a means to provide technical advice to each participating hatchery, primarily addressing Objectives 1,2,4,5. The industry workshops were focussed on extension and peer networking opportunities, and primarily served to address Objectives 3 and 6. That said; both components worked hand-in-hand to address all six objectives.

ON-SITE HATCHERY CONSULTATIONS

SOCo, in consultation with hatchery managers from five commercial hatcheries, and the Seafood CRC sought a consultant, Jonathan Bilton, Athair Aquaculture SA with expertise in SRO hatchery production.

Jonathan spent four days at VSH, Queenscliff VIC and CHOS, Laurieton NSW. During consultations, not all aspects of hatchery production could be addressed in 'live-time' during their runs as a typical run of SRO takes 6 weeks. Therefore, the timing of his visits were scheduled as effectively as possible around the hatchery's run schedule and based on the stage of the run the hatchery needed assistance with most. For example, Jonathan was able to provide advice on any stage of a SRO run including broodstock conditioning, algal production, spawning, fertilization, larval rearing, spat rearing and nursing, hygiene, aeration, water storage, pump capacity and more. The hatcheries liaised with Jonathan to determine when his visit would be of most benefit to them. He also provided remote assistance and advice whenever required. A key objective was to increase the production of SRO selected lines of spat for the industry in the 2015-2016 production season, therefore visits were scheduled at a time to maximise the chances of Jonathan's advice coinciding with production times.

Prior to each consultation, Jonathan assessed hatchery records and protocols to maximise his time on-site. Jonathan also reviewed the NSW DPI Hatchery Manual in order to place it in the context of each hatchery's specific operations and identify ways to optimise the use of these known methods given the hatchery's environmental circumstances and resources.

Originally it was just these two hatcheries that were participating in the consultation program, however since initiation a third hatchery; AquaFarms QLD started production of selected lines of SRO. While AquaFarms QLD did not participate in on-site consultations, it did receive regular advice from Jonathan over the phone, whenever needed.

Consultations included pre-visit assessment of hatchery records, and regular communication and remote advice to hatcheries whenever needed. Both participating hatcheries provided a report on their experience of the consultation period (available on request) and Jonathan provided each

with a confidential set of recommendations. Hatchery protocols written by each hatchery are being created in order to develop a set of standard, effective operating procedures that are effective in their circumstances.

This is the first time on-site hatchery consultations in several hatcheries have been undertaken for the SRO industry. Through the combination of on-site visits, consolidation of records and reports from each hatchery, and networking opportunities, we aim to lay the foundations for a certified hatchery training course which will be developed and delivered through tertiary institutions. To ensure we continue in this direction, the Hub is being advertised to state training organisations and universities, as well as the wider industry.

INDUSTRY WORKSHOPS

Following on from the consultation period, SOCo hosted two workshops, at PSFI (Monday 4th April 2016) and Narooma Fishing Club (Wednesday 6th April 2016). At these workshops the industry was invited to learn about the outcomes from the on-site consultations (confidentiality of certain aspects was managed, and at the hatcheries' discretion) and the SRO production processes including specific aspects of hatchery production.

At the PSFI workshop, DPI staff provided a bivalve hatchery tour, and several of the SRO families from the newly adopted multi-trait single pair mated breeding program were on display for industry to see the outcomes from the breeding program to date. Three growers also brought samples of selected lines of SRO at different life stages to demonstrate to industry the experience with the product. At Narooma there was no hatchery tour, but instead more photos were used to explain the hatchery process in depth. A local SOCo broodstock carer brought two lines of mass selected broodstock, and some of his own selected younger spat to display.

The workshops were an open discussion format (i.e. not a seminar) and provided a networking opportunity for industry members to link with hatchery expertise, a means to boost awareness about the SRO hatchery production processes within industry, and among those interested in extending their business to hatchery or nursery operations. Workshops were advertised to industry via SOCo communications, email, social media and our website.

Results

ON-SITE HATCHERY CONSULTATIONS

VSH and CHOS provided detailed accounts of their on-site experiences with Jonathan, and the key elements of particular significance to them, which are summarised here. These technical outcomes from the program have addressed Objectives 1, 2, 4 and 5 predominantly. However, while the Hub aimed to provide consultation during hatcheries busiest production times, and hence increase supply of selected lines of SRO for the 2015-2016 season (Objective 4), the increase in supply was not an immediate outcome. Some hatcheries continue to do runs out of season, into winter of 2016 at the time of writing this report. While they did not have significant

increases in supply during the consultation, the advice they received from Jonathan on-site, and they continue to receive remotely, benefits their production capacity and is expected to have long term benefits.

VSH: The SRO being non endemic to Victoria creates challenges for this hatchery's operations. Biosecurity protocols and standards are imposed on VSH by local government, before being able to attempt production and sale of SROs in NSW. This causes challenges on broodstock logistics as operations occur interstate and the ability to efficiently assess broodstock quality and oversee its movement prior to a spawning event are severely hindered. Also in relation to biosecurity protocols it is difficult to manage and oversee the adequate implementation of specific broodstock requirements remotely. This situation unfortunately cannot be resolved in the short term.

Prior to undertaking the most recent SRO production run, modifications to feeding densities and algal species percentages were made during initial consultations with Jonathan. An audit of the system was then made with minor adjustments to tank management and cleaning techniques suggested. New cleaning chemicals were introduced to replace existing chemicals, being better suited to the intended use, specifically chlorfoam® is now being used in place of sodium chlorite.

To manage problems associated with larval overfeeding, target residual algal levels were reduced, and it was suggested to double the dose of vitamins, and transition into a Conway media (rather than current hybrid f/2 mix). A Conway media formula was provided. It was also recommended that fresh starter cultures that were free of contamination (i.e. other algae species) of all four algal species were sourced from CSIRO, Hobart but only after the new media formula was decided on. An audit of the algal system was then made with minor adjustments to tank management and cleaning procedures.

To remove any unknown/unidentified toxins, installation of inline activated carbon filters was implemented as a precautionary measure. Research into the use of activated carbon in bivalve hatcheries has shown some promise in other facilities. Replacement of some small brass fittings from the pumping system was also recommended and implemented. Leaching of copper and zinc from these fittings was considered to be a possible cause of mortalities and poor growth among larvae, in conjunction with other factors.

Intensive review of algal growth media identified some differences in nutrient, trace metals, phosphates, metasilicate, vitamins and tris buffer solution quantities from other documented medias. Modifications to this have been made and will continue to be made slowly over several months so as not to shock algae system. But, differences in algal quality have already been noted since implementation of changes. For instance the algae system in general appears to be better performing, and bag life expectancy has increased by over a month since implementing these changes. Furthermore, the bag density of algal cells increased by about 5% - 10%.

Paper based larval note taking rather than direct to computer documentation was also suggested. This was a simple but effective way to reduce the time it takes to record data while in the hatchery because there was no need to move to and from the computer or accommodate for

software specifications. A new format has been devised and will be implemented during the next scheduled production cycle.

Modifications to the seawater intake system were recommended to create a simpler system and provide further control on water parameters i.e. residence time. However, this recommendation could not be achieved due to the immediate cost, logistics, and restrictions imposed by the site. Relocation of filters and the UV sterilising unit was also recommended. This is still being looked into and there is no action expected in the short term due to similar constraints as with the seawater tanks.

With regards to the NSW DPI Manual, it has been used as a resource for SRO production at VSH. The manual gave insight into production techniques and protocols. In particular, growth curves, grading, and feeding protocols were of great benefit during production, and relied upon as comparative reference.

Water storage systems differ greatly between VSH and the DPI Port Stephens hatchery. At VSH the salinity is kept constant at 35ppt. Water arrives on site and is filtered through a 45 micron rotary drum filter and stored in either of two 100,000L storage tanks. Water is then filtered further to 10 micron using a pleated cartridge before being temperature manipulated to the required set point. This water is then further filtered to 1 micron and UV sterilized. Water is continuously moving and being replenished on site.

Broodstock conditioning systems described in the Manual were not applicable to VSH due to biosecurity and relative time constraints imposed for production as already mentioned. What's more, unlike at Port Stephens, salinity was not used as a spawning inducement method. Although this method was used in 2014, it was shown to be unnecessary in the inducement of spawning in more recent production runs.

The Hatchery Manual is written from the perspective of static larval culture. This imposed some difficulties as VSH operates as a flow through system, therefore larval tank sizes were scaled and modified to suit flow through system and the limited floor space available to VSH. Several of the calculations had to be re-done to suit the flow through system, and techniques also adjusted. For instance, manual, daily counting of algal cells using a haemocytometer was recommended as general good practice while the coulter counter can be used for residual counts.

Issues with larval mortality and stunted growth occurred during production. The cause of this was looked at in great depth and detail however with no conclusive cause or treatments were determined. Several hypotheses and issues were discussed and minor modifications made to technique and system in an attempt to rectify the problem. It is possible that a combination of several minor factors is imposing pressure on the larvae.

In general, VSH and its staff greatly appreciated the consultation. Jonathan's knowledge and experience highlighted several operational areas that benefited from being tightened and refined. It was also highly beneficial to have him as a sounding board for future changes and developments to the hatchery. Some suggestions were difficult to implement in the short term, but work is being done to progress such changes in medium and long term plans.

VSH suggested that SRO workshops would be of benefit to hatcheries and subsequent staff allowing for networking and the distribution of knowledge/skills. VSH also believes that published broodstock condition reports to hatcheries would be of use, along with follow up reports on larval health and development post deployment to nurseries. These tasks would be carried out by SOCo and nursery managers respectively.

If there was more time for Jonathan to spend at VSH, they would seek further discussions in comparative techniques to allow for more development of operational protocols. Perhaps the option to allow for staff training / workshops in specialised skills unfamiliar to some. VSH has had a long standing relationship with Jonathan Bilton through other endeavours and consultation with him will continue into the future.

CHOS:

The main challenges faced by CHOS were predominantly trouble with growing some algae spp, mostly *Chaetoceros calcitrans*. Their algal production system relied on autoclaved carboy production which was limiting their capacity to produce enough algae in the later stages of larvae and spat development. Also, reoccurring mortalities throughout the larval stages has resulted in low numbers of oysters going to set.

Jonathan rectified the algae issues by adding more vitamins, and this has resulted in all species of algae performing well. The hatchery is also in the process of constructing a continuous flow bag system of algae production to augment carboy production.

Changes have also been made to:

- Intake lines upgraded to food grade standard lines
- Increased and centred (rather the tank periphery) air flow into the larvae tanks to provide a more even water movement pattern in the larvae tanks
- Add cartridge filtration into larvae tanks to 1 micron
- Trial the use of EDTA to 5g/5000L larvae tanks at each tank fill. This is a chelating agent which can help bind metal ions in excessive concentrations
- Lower larval stocking densities from 10 to 8 oysters/ml at the start of a run, and then further reduced densities during the run by increased grading frequency (see next point)
- Increase the frequency of larvae grading as necessary, generally every one to two days, to remove slow growing larvae from the system
- Increasing the range of grading screen sizes at each grading to separate different larval sizes more robustly, thereby allowing for the cohorts of larvae to be managed separately depending on their stage of development
- Improve the record keeping system to improve accuracy of algal cell counts, facilitate more consistent and accurate feed rates and implementation of spreadsheets to calculate and record feed rates
- Change the makeup of the algae diet so that a higher percentage of diatoms is now being used

Based on advice from Jonathan, it was recommended to set up a flow through algae-bag growing system. Although during the course of this consultation there wasn't enough time to set this up, the hatchery has been given all the information needed to set up this system and has been offered more advice if needed.

While the DPI Hatchery Manual has formed the basis of this hatchery's operation to date, the only deviation from this Manual the hatchery has applied is in larval diet. Jonathan's advice has been more extensive than the information set out in the manual. However, CHOS would have liked to have had the consultation available for a complete hatchery run cycle, particularly during the set and post set phases. The hatchery will reach out to Jonathan in the future for advice via phone and email, and also intends on visiting Jonathan in his hatchery in WA in the near future.

Overall, Jonathan's service to the hatchery was highly valuable. Hatchery feedback states that Jonathan was very knowledgeable, able to assess the hatchery operations and find more effective and simpler ways to improve production. He was able to identify where the problems may lie and suggest modifications to overcome these problems. His manner was easy going and his communication skills were excellent. In the broader sense of the Hub, CHOS encourages Hatchery Hub development in the longer term, including ongoing annual meetings for operators to discuss issues and new technology. CHOS found the Hub to be highly useful and the owner Tony Troup passes on his appreciation to SOCo, the FRDC and the Seafood CRC for providing the opportunity to participate.

AquaFarms QLD:

At the initiation of this program, AquaFarms QLD were not in a position to receive on the ground consultations from Jonathan. This is because during the Hub concept design, their hatchery was not yet in operation for the production of SROs, and without staff. However, during the time of consultation and workshops period, they did indeed become operational as staff, equipment and broodstock became available. Therefore they were undergoing a SRO run and were able to receive advice from Jonathan remotely via phone and email, regularly, and on a needs basis.

Specific changes that the hatchery made in response to Jonathan's advice included reductions in larval density to half what it was prior, which is believed to have reduced larval mortality as compared to previous runs, and improved the health of the larvae. Larval feed quantities for each algae species were altered to better respond to larval needs at different stages through to run day 20; a change which is believed to have positively influenced growth rates and better quality larvae going to set.

Hatchery hygiene procedures and equipment were changed; previously this hatchery used non-food grade filling tank hoses which had potential for contamination and toxicity, and now they use food grade plastics and follow daily standard operating procedures for maintaining hygiene. Their water quality was discussed, and this helped in overcoming water quality issues. Algae production was analysed to assess the potential high risk areas for bacterial contamination and to mitigate risks of such contamination.

Overall, the hatchery was extremely satisfied with the level of attention and support they got from Jonathan, and stated: “We have been very lucky to have had this advice and thank the FRDC for their support that has on-going benefits from the farmer to consumer”.

INDUSTRY WORKSHOPS:

PSFI, 4th April 2-6pm has 31 attendees, of these, 20 were NSW growers and the rest were DPI staff, SOCo Board, an interstate industry member and representatives from industry bodies. Growers from Port Stephens, Wallis Lake, Hawkesbury River, and Shoalhaven were present. There were five hatchery managers present, one being a commercial operator from NSW. The workshop started with a 30 minute hatchery tour whereby guests were shown all the facilities within the PSFI bivalve hatchery, lead by Steve O’Connor Hatchery Manager. There were four YC2014 SRO families from the breeding program on display, and three growers brought a sample of selected lines of SRO to show and share their experiences of growing selected lines of SRO.

Narooma, 6th April 10am-1pm had 16 attendees, 13 of which were growers from Merimbula, Wapengo, Tathra, Narooma and Clyde Rivers. Three hatchery operators were present, including Steve O’Connor Hatchery Manager from DPI, Jonathan Bilton and one previously commercially operating manager from the region. Another grower who is attempting to start their own hatchery on the south coast of NSW was also present.

At each workshop, Jonathan led an open discussion and the audience contributed when they wished. Below is a summary from each, which incorporates input from all guests.

Jonathan first introduced himself and his background with SRO and other species’ hatchery production, including mussels, flat oysters, and pearl oysters. He talked about a hatchery he built in NZ and its evolution of algae culture using carboys and autoclave systems to produce better quality algae. The importance of hygiene and sterilization were emphasised here.

He discussed the set up of a hatchery, with reference to the NSW DPI Manual. Key points that were discussed included access to a site with good, consistent water quality (for example, with minimal turbidity or fresh water input), the different characteristics of estuarine and oceanic sites, the approaches to risk management and estimating production yields, essential equipment you need in a hatchery including microscopes, a good data logging system, and hygiene standards.

Algal production was discussed in more detail including differences in flow through versus batch culture, and whether it’s continuous or semi-continuous depending on the number of staff you have. Hygiene of carboys and bacterial risk mitigation was a key point discussed.

Hatchery challenges and some solutions were discussed. It was noted that SRO are a relatively hard species to spawn and rear into the larval stage. Comparisons were made to other species’ spawning habits and larval rearing. SRO sometimes suffers larvae anorexia, which is thought to be seasonal but we don't know what is driving the anorexia, and there are no known links with bacteria levels. Bacteria in the system can also be problematic, and the impacts of this were discussed.

Protocols on how to grow spat in hatcheries and nurseries were discussed, and questions were raised as to what hatchery and nursery rearing techniques might result in different shaped spat. It's known that the shape of oysters have a strong genetic component, and a farm component as well but generally the spat performance improves as soon as it is moved from any land-based nursery to the estuary and therefore the timing of spat delivery to the farm is important for growers to achieve good performance from their spat. Several growers agreed with this point, from personal experiences.

Comparisons were made between the Tasmanian and NSW situations. In Tasmania they produce Pacific Oysters *Crassostrea gigas*. In Tasmania, there are more commercial hatcheries than in NSW, and they sell from the hatchery at 6mm spat not at 1mm as has been the norm in NSW. As such, Tasmania uses a vertically integrated model unlike in NSW where nurseries have historically been separate to hatcheries. SRO can also have high mortality rates during the nursery stage, ~500micron to 2mm so nurseries may also suffer losses.

The topic of biosecurity was discussed, and the protocols for movement of stock into and out of NSW from other states were raised, however we did not address this in detail as it was out of the remit of the workshop and would have required significantly more time.

Steve O'Connor DPI Fisheries gave an update of the SRO family breeding Program. The program is moving from mass selection to multi-trait breeding program. The latest data from performance trials for QX disease resistance were discussed, including those from mass selected lines in the Georges River, and results from family lines in the Clarence River. This was an important topic of conversation for industry as it was the first time these results have been openly discussed. Discussing the results indicated to industry that SOCo and the DPI support transparency with industry in regards to performance of selected lines, and also show that the family breeding program is making gains in resistance, and other desirable traits including condition and shape as priorities for the industry. Furthermore, it was reiterated that SOCo serves as the conduit of information between DPI and industry in terms of selection decisions for the family breeding program.

The tools that have been used to improve the families were discussed, such as SOCo-contracted geneticists at CSIRO, development of EBVs, and research in molecular mechanisms behind resistance were discussed. In terms of commercial availability of the new family lines for industry, further results from performance trials are needed before this stage, but we're currently on target to have the first available generation of family lines commercially available in 2017. The unknowns were also discussed and how they are being addressed by the DPI, SOCo and research institutions in line with industry priorities. A SOCo update was presented at the Narooma workshop, whereas at the Port Stephens workshops due to time constraints this was not possible.

In terms of grower involvement in the discussions, there was a difference between the audiences of the two workshops, probably attributable to the fact that in Port Stephens there was a greater presence of hatchery and nursery managers than in Narooma. In Port Stephens open dialogue between hatcheries and nurseries openly identified problems in the current supply chain and how it impacts their businesses. Furthermore, with a larger presence of hatchery operators in Port

Stephens, there was a more active contrast in view points between some aspects of hatchery production as each operator will produce spat differently from another.

In Narooma, the audience were engaged in hearing about the technical aspects of hatchery production which were fairly new to them, and they were more actively involved in discussions about the outcome from family breeding such as heritable traits in condition and winter mortality which are key priorities for growers on the NSW south coast.

SUMMARY

The Hub was a first of its kind for the SRO industry, and was designed in a way to identify circumstances unique to each hatchery that can be used as effectively as possible in SRO production. For the first time, the diversity of operational procedures and environmental circumstances that are currently available to the SRO industry hatchery network have been assessed and consolidated on-site. The Hub brought people together, including current and future operators and industry groups. SOCo, through the Hub, have connected with NSW TAFE and drafted a budget and work plan for the development of a certification in aquaculture and hatchery production, and funds have been secured as a result to begin development in 2016. Funds have also been secured by SOCo from the NSW Local Land Services on behalf of the Minister of Primary Industries Niall Blair, which we intend to use to extend the Hub from four days to several weeks consultation period at participating hatcheries, seeing them through the duration of a run and development additional certified training. SOCo have alerted the hatcheries of this, and plan to work closely with them to meet their needs in this next program. SOCo have also connected with new entrants into the hatchery business and we are collaborating with them in hatchery development programs in NSW.

Discussion and Conclusion

The broad aim of this project was to increase a regular and generate a perpetual supply of selected lines of SRO spat to industry through hatchery production training and networking initiatives. While the production of spat did not increase during the few weeks that this program was undertaken, it has made important developments in identifying and improving operations within commercial hatcheries, set foundations for more rigorous and structured training programs, and built networks of hatchery managers, staff, government and research partners, and industry that continue to be utilized in ongoing communications. Importantly, the Hub will continue. Additional funding has been secured, and will ensure that the gains made in this program benefit future initiatives.

On-site hatchery consultation delivered here has been the first of its kind for the SRO industry. Two commercial hatcheries, VSH and CHOS that each produce selected lines of SRO spat to the NSW industry received four days of on-the-ground assessment and guidance from Jonathan Bilton. Jonathan was selected by SOCo, with input from the Seafood CRC and hatcheries for his services as an external, independent consultant who has experience in SRO, and other species hatchery production for over 25 years.

The approach Jonathan took was thorough; he maintained regular contact with the hatcheries prior to and after their consultation periods and provided advice remotely, regularly and on demand. He assessed their records before visits, familiarising himself with their needs to maximise the time efficiency, and with maximum effectiveness while on-site. A confidential hatchery report was written for CHOS and VSH, with key recommendations and changes that they could each make, and unique to their operations.

Each hatchery had unique circumstances and challenges to be addressed, including but not limited to: challenges with biosecurity protocols that slowed broodstock movements, hygiene, food grade plastic materials, record keeping and live-time note taking, algae compositions and feeding densities, vitamin media, and larval stocking densities and grading frequency. Each hatchery made changes accordingly during the course of the visit, while larger changes that required more structurally complex and costly changes were not implemented immediately but have been implemented in stages after the consultation, and continue to be addressed with remote assistance from Jonathan. Overall, the hatchery feedback was positive; they notice small and large changes to their operations have improved their operations and they are pleased with the attentiveness and expertise provided by Jonathan and appreciate the long term benefits of a Hub program.

The workshops provided a platform for industry and hatchery managers to come together to have an open dialogue about the challenges of SRO production, and formed a means to identify solutions to such challenges. In Port Stephens, the hatchery tour gave industry the chance to be inside a hatchery and for most of the attendees for the first time. The hatchery managers were able to express their views about SRO production openly, and in instances where they disagreed or had very different experiences from the others this was openly discussed. The workshops also provided the opportunity to discuss the latest results and direction for the future of the SRO family breeding program; including the progress made to date and in particular the technical aspects, including hatchery production, of producing broodstock at each generation and commercial quantities of selected lines of SRO spat. SOCo have received positive feedback from growers about the workshops, in particular were pleased with the chance to be informed of the latest performance results from the breeding program, and the change to speak openly about their business needs and spat requirements.

With regards to the DPI Manual, its application within each of the hatcheries was assessed and referred to throughout the consultation program. While the manual has not been changed in response to the Hub, differences between each of the hatchery's procedures and the Manual have been identified, and this knowledge helps the hatchery managers where they may not be able to adopt specific protocols as outlined in the manual. Furthermore, through the Hub, these differences have been documented and made known to the PSFI, and therefore available for their use if a revised edition of the Manual is published.

Implications

Broadly speaking, this project has set the foundations and demonstrated a strategic approach for the development of a SRO Hatchery Hub. More specifically, it has:

- provided a platform for open dialogue between industry and hatchery managers about the supply of SRO seed, including production challenges, management options (from a hatchery and grower point of view), sourcing spat, developments in the breeding program, and realistic outputs in production.
- directly benefited three hatchery managers from NSW, QLD and VIC in the operational side of SRO hatchery production. Two of these hatcheries were undergoing SRO production during the consultation and believe it will boost their capacity at future runs. All three agree that the consultation and networking opportunity have improved their standard operations.
- formed a link among commercial hatchery managers from NSW (participating and non-participating in the consultation process), QLD, VIC, TAS and WA, and departmental hatchery staff from NSW Fisheries to discuss their experiences and preferences in operations in SRO hatchery production.
- identified common and unique challenges to each hatchery in SRO production, including broodstock condition, water quality, food quality, biosecurity standards, production capacity and ways to increase capacity, and meeting industry expectations.
- identified differences in environmental and operational circumstances unique to each hatchery, with particular focus on challenges and advantages of applying the current Hatchery Manual protocols.
- linked several operators with SRO hatchery expertise to each other and to a new entrant who wishes to build a hatchery; such connections have been highly beneficial to potential hatchery operators.
- formed a network and training foundation that has identified resources at hand, laid the foundations for future training standards, and in doing so secured funding for additional Hatchery Hub on-site consultations and training initiatives.
- formed a network of hatchery operators, for hatchery operators to feel confident and comfortable in reaching out to each other now and into the future to provide support on a regular, and needs basis.
- provided the latest performance results on the SRO selected lines of families, and what these results mean for industry in the short and longer term.
- provided the SRO industry the opportunity to tour a working hatchery and gain insight into what's involved in hatchery production.
- has provided SOCo, as a third party and industry body, to have access to SRO hatchery expertise and resources, improved communication with the hatcheries, communication about hatchery production to the industry, and set the stage for future projects in hatchery capacity development as managed by SOCo.

- while the project did not increase spat supply in the 2015-2016 season, it did instigate several operational changes at three currently producing hatcheries. AquaFarms QLD has increased its production since, all hatchery managers report they are already seeing the benefits in their most recent runs following on from the consultation. They're confident that their production will increase in the 2016-2017 season. They acknowledge that having ongoing access to remote assistance when required is of great benefit to them.

Recommendations

Based on feedback from hatchery managers and industry we recommend the following:

- The network of hatchery managers that was formed during the Hub program is maintained. It will be up to SOCo, commercial hatchery managers, and the consultant to maintain this contact in the short term. But, in the longer term we would encourage involvement and support from the FRDC, through the Oysters Australia IPA, for follow-up workshops and networking opportunities whereby hatchery managers can reflect on the benefits of the consultation, particularly as they have implemented changes since the consultation period.

- In the case of on-site consultations, where funding permits, the consultant can spend the duration of an entire SRO run on the ground with hatchery operators. A program whereby hatchery operators are given the chance to contribute or match the funds in order to extend the duration of the consultation period might be an effective approach.

- That consultation is structured in terms of specific areas of hatchery production: for instance, a separate component which addresses only algae production or only water quality, etc... This would require more time and funding than the current approach, and potentially involve a broader range of expertise not necessarily from Australia, but also from overseas.

- That support is provided to hatchery managers to travel to the PSFI hatchery when it suits their run schedules to have on-site training. Supporting the costs of travel would help hatchery managers get certain training networking opportunities during times when they have runs underway and therefore cannot afford to leave their hatcheries during scheduled workshops and training sessions such as the one we facilitated here whereby unfortunately operators and staff from QLD and CHOS could not attend.

- That the hatchery managers can maintain a network and regular communication via annual meetings, telelinks, and phone hooks ups on a needs basis, managed by a third party such as SOCo, and that SOCo assist in making this process more systematic than it is currently. This could be done for instance by means of a scheduled meeting time and place, and regular follow ups with each of the hatchery managers.

- That hatchery managers continue to call the consultant when required, which is something the consultant has urged us to pursue. This encouragement and regular communication should be managed by SOCo.

- That managers and departments from other states are encouraged to participate in the Hub to facilitate discussion about possible options for production of SROs in other states including TAS,

SA and WA. The Hub may also expand into other species, for instance emerging Native Angasi oysters.

Further development

The most consistent feedback we received during this project from the hatchery managers was that while the on-site consultation period was of huge benefit, they strongly support the idea of having a consultation period that lasts the duration of a run in its entirety. The current project had a consultant on-site for four days at two participating hatcheries. Hatchery managers have reported that this period of time was beneficial because it allowed for an external review their operations and an assessment of their records and facilities. But, a consultant to be on the ground throughout an entire run, or at the very least, in separate blocks is required to capture the critical phases of a SRO run (i.e. spawning and setting). Extending this time period clearly comes down to costs, and in fact VSH extended the time of the consultation at their own cost because they saw the benefits of doing so. Therefore, for future development we would encourage a project that allowed for more time on-site, and if necessary at the cost of hosting industry workshops.

The industry workshops served as a means to share information between hatchery managers, and with industry. For future projects, we would recommend the Hub facilitates an annual get-together of hatchery managers and invited guests in one location only, for an entire day. This would better channel the resources of the consultant, and energy of the group toward discussion around hatchery specific issues. Meetings would ideally be in NSW (with the focus on SRO); however the benefits of rotating from state to state would definitely be considered. It would also be encouraged to include a hatchery session at any future conferences and industry meetings to ensure hatchery development is accepted as a systematic and regular part of industry priorities and dialogue. Any communications of this kind should be managed by a third party, i.e. SOCo.

Future consultation projects should also include focus on the efficient use of broodstock. The SRO breeding program is transitioning from mass selection into a family breeding program therefore the management of broodstock will need to ensure a sufficient supply for potentially more commercial hatcheries. Using family lines for commercial production requires structured crosses and strip spawning; therefore broodstock management will be critical to ensure a sufficient supply each season. Training hatcheries in this spawning techniques and assisting SOCo in developing a strategic broodstock management protocol would be beneficial.

Extending consultation to include a formal training component would be beneficial for new entrants into the hatchery business. For example, facilitating structured in-hatchery training courses for industry and tertiary students through collaboration with registered training organisations such as TAFEs would be a very worthwhile addition, and something we are already embarking on.

Extension and Adoption

Facilitating an increased hatchery production capacity for the SRO industry is a primary objective in SOCo's strategic vision, and through this project SOCo have set the foundations for future projects. The Hub formed important first links between an external hatchery consultant, commercial and government hatchery managers, research scientists, and NSW industry members. Being a diverse array of benefactors, this project has formed communication and awareness channels between industry groups across five states, through the broad network base of each of the participants.

SOCo, through consultation with the industry, the Oyster Committee, hatchery managers and consultants have secured additional funding to extend the Hub program, which would also include training and longer consultation periods, as mentioned in Recommendations above.

Around a dozen to 20 industry members attended the workshops in north and south NSW, and served as a means to discuss the current status of SRO hatchery production and the breeding program. SOCo maintain a very active communications initiative with the industry in NSW, and therefore any extension to the Hub will be advertised across the industry and to other states through several networks.

Through social media, SOCo were able to advertise the Hub and the hatchery tour publicly, and we aim to boost converge of future projects through our social media. In this instance, SOCo are privy to the fact that our social media covered was accessed and shared by a few prominent marine scientists and interstate hatchery managers on their social media platforms. While not a huge online presence, we are still encouraged that we're reaching these groups in Australia and overseas, and that social media is in fact playing a role in awareness for the Hub and Australian oyster industry as a whole. Social media is a form of communication that we will certainly continue to use and encourage among our networks.

The NSW DPI Port Stephens Fisheries Institute was involved in the Hub through hosting a workshop and hatchery tour on their site, while presenting latest data on the SRO family breeding program and hosting displays of selected lines of SRO. Staff from the aquaculture research team, the hatchery, biosecurity, and aquaculture management were present and involved in both of the workshops. Their support and positive feedback from the Hub program is encouraging, and they've extended the opportunity to discuss the options for SOCo to host future projects and hatchery tours, and on-site training at their hatchery facilities.

Project coverage

Hatchery Hub Workshops were advertised on SOCo website, to contacts via email, and via Twitter. A summary of the key outcomes of the Workshops and the Hub were disseminated in our April Company Snap Shot, and on our website. There was no coverage with the media or government departments.