

CRC Abalone Research Forum

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Project No. 2011/773



**AUSTRALIAN
SEAFOOD
COOPERATIVE
RESEARCH CENTRE**

September 2012



National Research
FLAGSHIPS
Food Futures



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Australian Government
**Fisheries Research and
Development Corporation**

ISBN: 978-1-925982-40-4



An Australian Government Initiative



Non-Technical Summary

2011/773 CRC Abalone Research Forum

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PROJECT OBJECTIVES:

- to engage with national and international industry members, researchers and managers, working on topics similar to CRC projects elsewhere in the world
- to enhance the outcomes from CRC abalone projects through engaging with and communicating to numerous national and international stakeholders.

OUTCOMES ACHIEVED

The CRC Abalone Forum was run in Hobart in May 2012 in conjunction with the International Abalone Symposium.

This was a communication, engagement and training exercise with most CRC abalone projects represented. We were especially interested in areas that could contribute to the CRC legacy:

- 1) The reseedling workshop was held to review and reinvigorate the concept of abalone enhancement. Enhancement operations were showcased from Japan, the USA and NZ.
- 2) The CRC has substantial investment in marketing. The forum assisted with this through the presentation of information on global production and markets. The intent was to develop a better-informed Australian research and industry community fully aware of the latest global trends.
- 3) A workshop was held to progress the development "Snailbase" which involved participants from several countries.

The conference and thus the forum attracted a large number of registrants (261) from 19 countries. The forum dealt with areas of special relevance to CRC projects and was effective in generating outputs from the CRC with many papers currently under review for publication in a refereed journal. The forum also included sponsorship for industry registrations which contributed to the larger than usual participation of industry in this type of event (130 registrations).

LIST OF OUTPUTS PRODUCED

Proceedings of the CRC Abalone Forum are in the process of being published as a peer reviewed scientific journal (J. Shellfish Res.), which will include papers from CRC abalone projects.

ACKNOWLEDGEMENTS

This project was completed with the help of the IAS 2012 organising committee who were: Craig Mundy, Dean Lisson, Grant Pullen, James Harris, Mark Crane, Natalie Moltschaniwskyj, Peter Cook, Peter Kube, Sharon Appleyard, Jillian Freeman and Nick Savva.

1. Introduction

1.1 Need

The CRC has a significant investment in abalone production from both aquaculture and wild catch sectors. This project addressed two needs across this broad suite of projects.

The first was to engage with national and international industry members, researchers and managers, working on similar topics elsewhere in the world to prevent repetition of existing and future research, learn from their experiences, and to ensure that CRC research is cutting edge. The second was to enhance the outcomes from these projects through engaging with and communicating to numerous national and international stakeholders.

The forum was a cost effective opportunity to address these needs for CRC projects on abalone for both production sectors. It was held as part of the 8th International Abalone Symposium in Hobart in May 2012 so that research and participants from elsewhere could be part of the sessions.

The forum was to be based on areas of CRC research activity: 1) Reseeding; 2) Marketing ; 3) SnailBASE; and 4) Aquaculture nutrition.

1.2 Objectives

- to engage with national and international industry members, researchers and managers, working on topics similar to CRC projects elsewhere in the world
- to enhance the outcomes from CRC abalone projects through engaging with and communicating to numerous national and international stakeholders.

2. Methods

The CRC forum was run across at four sessions (equivalent to one day) within the 8th International Abalone Symposium, May 2012, Hobart. Industry extension was enhanced by a moderated discussion forum at the end of each topic.

The proposed CRC forum activities were:

- 1) Reseeding workshop This workshop on enhancement covered four areas: How to manage stock recovery; how to assess and model recovery of stocks; broodstock transfer to rebuild stocks; and reseeded to rebuild stocks. In all these areas we are looking for research that

considers what leads to success or failure.

- 2) Global Markets. Abalone production has historically marketed product as a commodity with little market research beyond trends in production and trade.
- 3) SnailBASE workshop. Abalone researchers require a single open access genome resource site as current collections of genome data are dispersed. This workshop discussed establishing a single web portal to collate abalone genomic data. The facilitators were Natasha Botwright and Gene Wijffels (CSIRO).
- 4) Aquaculture nutrition. This session of contributed papers provided research results from those involved in abalone nutrition and discussed the issues limiting production and efficient food utilisation.

3. Results and Discussion

Summaries of workshops associated with the CRC Abalone Forum are presented below. The Forum attracted CRC stakeholders with ACA and AAGA held meetings associated with the conference. There was good attendance from overseas from a range of countries. The number of research and industry attendees were remarkably even with 131 and 130 attendees respectively.

Country	Number
UK	2
Taiwan	1
Oman	1
Italy	1
Hong Kong	1
Spain	1
Ecuador	1
Singapore	2
Philippines	2
Canada	2
Chile	3
South Korea	4
Japan	9
China	10
Mexico	12
USA	18
South Africa	33
New Zealand	36
Australia	122

AAGA members have recently received travel bursary from CRC to visit Korea as a follow-up to the IAS meeting.

Snailbase workshop. The workshop was attended by around 40 Australian and international delegates. The workshop provided delegates with an insight into the opportunities and issues associated with the development of an international genome data collection and data sharing portal. The outcomes from the workshop include representatives from seven countries agreeing to pursue the development of an abalone portal. Delegates also agreed that sequencing of at least one abalone species was essential to building a solid foundation for future abalone ‘-omics’ research. Workshop facilitators are initiating the first step in producing a paper to delineate how the community will proceed and the key components required for the portal. Outside of this agreement Australian representatives from five institutes are actively pursuing funding to initiate development of the portal and to sequence the first abalone genome; a SIEF proposal was submitted in July 2012.

Reseeding Workshop

Around 40 people including both industry and researchers attended this workshop. Reseeding has become an increasingly accepted approach for replenishing wild abalone stocks. Applications range from stock rebuilding following catastrophic failure, enhancing natural recruitment, or increasing commercial productivity in areas displaying limited recruitment. With few exceptions (Japan), larval and juvenile research to date has been proof of concept, and full-scale commercial trials over large geographic areas have not been undertaken. Translocation of mature wild abalone is contingent on access to a source population, and therefore has limited potential. The workshop discussed how research can deliver solutions on efficiency bottlenecks for larval or juvenile reseeded and whether stock enhancement will always be limited in application to small areas of known high productivity.

Presentations explored field methods of stock enhancement/reseeding and evaluating survival to help direct future efforts and maximise efficacy. Discussions excluded issues of aquaculture production or disease, which were covered in other sessions.

Reseeding as a concept for abalone production falls in between aquaculture and wild fisheries. This concept was explored further by Tony Legg from the British Channel Islands where the Ormer, *Haliotis tuberculata* is revered. His project brought together the principal European abalone farmers to resolve a large number of issues holding back the sustainable seabased farming of the Ormer. One of the many significant outcomes was a new culture system for European sea-based culture, the Abblox unit.

Many papers were presented on reseeded which gives an indication of the growing interest in this approach:

Lachlan Strain*, Anthony Hart. *Trade offs between size-at-release and site quality influence survival and economics of stock enhancement in greenlip abalone*

Anthony Hart*, Lachlan Strain, Frank Fabris *An ecological approach to commercial scale stock enhancement in greenlip abalone*

Ricardo Searcy-Bernal*, José Espinoza -Montes, Casandra Anguiano-Beltrán
Restocking of abalone (Haliotis spp.) populations in Mexico

Adele Whyte*, Ngaio Tiuka, Paul Roberts, Tony Craig, Aramuru Ropaha,
Bayden Barber, Dean Barber, Bae Hamlin, Jill Munro, Robin Hape, Ngavi
Pekepo, Jim Hutcheson, Rangitane Tipene, Jenny Mauger *Reseeding pāua*
(abalone) on the East Coast of the lower North Island of New Zealand: a
collaboration between Iwi, Hapū and Industry

Ian Taniguchi, Derek Stein, Kai Lampson. *Exploring recovery tools for pink*
(Haliotis corrugata) and green (Haliotis fulgens) abalones in Southern
California

Joanne Lessard*, Zane Zhang and Alan Campbell *A pilot project to enhance*
northern abalone, Haliotis kamtschatkana, reproduction in Barkley Sound,
British Columbia, Canada: II. Growth results

Christine Hansen, Joanne Lessard*, Alan Campbell *A pilot project to enhance*
northern abalone, Haliotis kamtschatkana, reproduction in Barkley Sound,
British Columbia, Canada: III. Mark recovery results

A pilot project to enhance northern abalone, Haliotis kamtschatkana,
reproduction in Barkley Sound, British Columbia, Canada: I. Results from
density surveys Joanne Lessard*, Alan Campbell

Investigation of green abalone (Haliotis fulgens) culturing techniques for
conservation Brent Scheiwe, Rowena Valderrama, Susan Wang*, Melissa
Neuman

Abalone nutrition turned out to be such a significant research issue globally
that it was not possible to review in a single session workshop. Consequently
papers were presented over two sessions, with a highlight being guest
chairing by Graham Mair! Papers presented were:

New formulated feed for abalone reduces fishmeal use and satisfies WWF
standards Rowan Yearsley*, Clifford Jones, Alex Winckler, Peter Britz

Dietary protein level and water temperature interactions for greenlip abalone,
Haliotis laevis David Stone*, James Harris, Georgia Mercer, Hanru Wang,
Elise Schaefer, Matthew Bansemmer

Abalone nutrition from an aquaculture perspective: A review Justin Kemp*,
Peter Britz

Development of natural algal diets for juvenile greenlip abalone in the later
nursery phase Lachlan Strain*, Michael Borowitzka, Sabine Daume

Application of acidifying agents in artificial diets for South African abalone,
Haliotis midae Lourens de Wet*, Neill Goosen, John French

Influence of daylight parameters as governing mechanism on feeding activity of South African abalone, Haliotis midae Desmare Van Zyl*, Lourens De Wet, Le Daan Rousseau

Histological changes in Haliotis laevigata in response to different dietary protein levels and water temperatures James Harris, Elise Schaefer*, David Stone, Gordon Howarth

Effects of dietary lipids on growth, fatty acid composition and Δ^6 fatty acid desaturase expression in juvenile abalone, Haliotis discus hannai Ino Kangsen Mai*, Mingzhu Li, Gen He, Qinghui Ai, Wenbing Zhang, Wei Xu, Zhiguo Liufu, Huihui Zhou, Yanjiao Zhang

Effects of seasons, growth conditions and drying methods on the biochemical composition variations in four macroalgae suitable for abalone nutrition Gercende Courtois de Viçose*, MarÃ a del Pino Viera, Marisol Izquierdo

Development of multi-strain conglomerate of probiotic bacteria to improve juvenile abalone (Haliotis iris) growth rates Jinan Abass Hadi, Noemi Gutierrez-Maddox, Andrea Alfaro

The role of bacteria in the nutrition of postlarval abalone (Haliotis laevigata) Sam Hair*, Nicky Buller, Sabine Daume, Michael Borowitzka

Diversity of Digestive Enzymes and Biochemical Properties of Major Polysaccharide Degrading Enzymes of the Disc Abalone, Haliotis discus discus Kentaro Niwa*, Hideaki Aono, Tomoo Sawabe

Broodstock diet affects reproductive success and recruitment in pãua, Haliotis iris Jane Symonds*, Graeme Moss, Sarah Allen, Kevin Green, Michael Bruce

Colour chart for the estimation of microalgal concentration: a practical approach Ma. de Lourdes Trujillo-Valle*, Carmen Vagas-Peralta, Rigoberto Delgado-Vega, Cristian Gallardo-Escárate, Miguel Del Rio-Portilla

Preliminary development of various seaweed-based diets and their suitability for abalone Haliotis tuberculata coccinea Reeve Maria Del Pino Viera*, Gercende Courtois de Viçose, Lidia Robaina, MarÃ a Soledad Izquierdo

Effects of dietary glutathione on growth, antioxidant responses of juvenile abalone Haliotis discus hannai Ino Wenbing Zhang*, Qiyong Chen, Wei Xu, Chenglong Wu, Kangsen Mai

Abalone Marketing. The original intent of the Abalone Forum project had been to hold a workshop session on abalone marketing research because of the substantial CRC investment in this area. Unfortunately we were unable to attract papers based on abalone marketing research.

Nonetheless, several papers dealt with global issues of abalone markets and also summaries of regional production. These were amongst the best

received papers by CRC research and industry stakeholders.

Papers were:

*Abalone aquaculture in **Korea*** Choulji Park Genetics and Breeding Centre, National Fisheries Research & Development Institute, South Korea

*Current status of abalone aquaculture industry in **China*** Caihuan Ke, College of Ocean & Earth Sciences, Xiamen University, China

*The competitiveness of the **Chilean** abalone aquaculture industry* Roberto Flores-Aguilar, Centro i-mar, Universidad De Los Lagos, Chile

*Update on the **NZ** abalone scene – farming & wild harvest* Jeremy Cooper, Chief Executive Officer, Pāua Industry Council, New Zealand

***European** Perspective* Tony Legg, Jersey Sea Farms, United Kingdom

*Current status of abalone resources and fisheries in **Japan*** Toyomitsu Horii, Hokkaido National Fisheries Research Institute, Fisheries Research Agency

*Forty years of **Australian** abalone fishery production: good luck and good management?* Stephen Mayfield, Molluscan Fisheries, SARDI Aquatic Sciences, Australia

*Status of abalone fisheries and aquaculture along the West Coast of **North America***. Laura Rogers-Bennett, California Department Fish and Game

*Update on the status of the **South African** industry* Peter Britz, International Abalone Symposium President.

Symposium papers reporting CRC research

Many seminars were given that reported on AS-CRC projects, which provides impetus for publication of this research. An incomplete list of talks acknowledging the AS-CRC are given below.

Dang, V.T., et al. "Antiviral activity and resistance to abalone viral ganglioneuritis

Botwright, N. et al. "Gonad maturation of temperate cultured Australian abalone"

Hart, A. An ecological approach to stock enhancement in greenlip abalone

Stone, D et al 'Dietary protein level and water temperature interactions for greenlip abalone

Mendoza-Porras, O et al "Differential protein expression in *Haliotis*

laevigata Donovan 1808 after UV and temperature induced spawning

Keys, E. "Habitat enhancement to increase productivity in commercial greenlip abalone fishery West Australia

Gardner, C et al "Measuring the economic performance of Australian abalone fisheries"

Hoshino, E. "Price relationships for imported abalone in the Japanese market"

Moltschaniwskyj, N. Maximising value by reducing stress-related mortality in wild harvested abalone

5. Benefits and Adoption

The project is expected to assist in the communication and development of the many abalone aquaculture and fisheries in the CRC. This was through communication and discussion of recent research, such as with the numerous presentations of abalone nutrition research or enhancement. In other cases there was tangible project development, such as through the SnailBase workshop.

6. Further Development

N/A

7. Planned Outcomes

This was a communication, engagement and training exercise for all CRC abalone projects. Its outcome was to build the CRC legacy in abalone production. We were especially interested in two areas that could contribute to the CRC legacy:

- 1) The reseeded workshop aimed to reinvigorate investment in abalone enhancement. Enhancement operations were showcased from Japan, the USA and NZ.
- 2) The CRC has substantial investment in marketing. The forum assisted with this through the presentation of information on global production and markets. The intent was to develop a better informed Australian research and industry community fully aware of the latest global trends.

Public Benefit Outcomes

Nil (abalone quota units and aquaculture farms are privately owned)

Private Benefit Outcomes

Each of the four issues addressed through this project (stock enhancement, snailbase, nutrition, and global markets) have been identified as research priorities for increasing the value of production from wild or aquaculture abalone.

Linkages with CRC Milestone Outcomes

The abalone forum addresses CRC Milestones of:

3.2 - Research education and training through Research Program 1

3.2.2 - Outputs from Research Program 1 customised to develop education and training tools and processes, training conducted and suitability of tools and processes evaluated

3.7 - Knowledge from Research Program 2 converted into education and training tools

3.7.1 - Outputs from Research Program 2 customised to develop education and training tools and processes, training conducted and suitability of tools and processes evaluated

8. Conclusion

The CRC Abalone Forum was run effectively. It attracted a large number of registrants (261) from 19 countries. The forum was effective in generating outputs from the CRC with many papers currently under review for publication in a refereed journal. Project development was also facilitated through workshops dealing with some important issues in abalone research. These include the snailbase and reseeded workshops, plus sessions on abalone nutrition and global market trends.