Seafood CRC Post Doctoral Fellow: Integrated value chain performance benchmarking studies (economics, logistics and product quality).

POST DOCTORAL SCIENTIST - Dr Janet Howieson

SUPERVISOR - Professor Alexandra McManus

Project No. 2009/727

AUSTRALIAN SEAFOOD COOPERATIVE RESEARCH CENTRE

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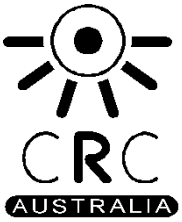

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Non-Technical Summary

CRC 2009//727: Seafood CRC Post Doctoral Fellow: Integrated value chain performance benchmarking studies (economics, logistics and product quality).

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PROJECT OBJECTIVES:

1. Develop a research capacity within the Seafood CRC to support industry participants in analysing and improving their supply chain performance
2. Provide expertise to help analyse seafood supply chain performance for at least 5 Seafood CRC participant businesses and guide implementation of key performance improvement measures.
3. Develop a suite of tools, resources and targeted training to assist seafood businesses analyse and improve their supply chain performance.
4. Establish a supply chain technologies hub within the CRC's Australian Seafood Productivity Improvement Centre (ASPIC).

NON-TECHNICAL SUMMARY

At the commencement of the Seafood CRC in 2007, CRC participants identified the need to improve competitiveness and profitability through improved supply chain management as one of their highest priorities. However, a lack of research capacity in whole of seafood supply chain monitoring and management was also identified. As a result the CRC decided to fund a post-doctoral position in integrated value chain performance benchmarking studies (incorporating economics, logistics and product quality) to build research capacity in this area. Dr Janet Howieson was appointed to the position which was based at the Centre of Excellence for Science, Seafood and Health (CESSH) at Curtin University. Dr Howieson managed the Supply Chain Performance theme at CESSH.

As a result of the project generic methods/frameworks have been developed for a range of supply and value chain analyses and these frameworks have been tested in case studies. A group of staff and students, both at Curtin and in collaboration with other institutions such as SARDI, QDAFF and UTas have been trained in seafood supply and value chain analysis techniques. Videos describing some of the methods were also produced for industry extension.

As well, more than 10 separate projects have been funded with specific industry partners to undertake supply and value chain analysis, with concomitant recommendation, implementation and evaluation of interventions to improve individual supply chain performance. These project results were the basis for >10 presentations to various industry groups and conferences explaining the techniques and the results of the projects. A number of peer reviewed journal articles have also been published/submitted.

The result of the postdoctoral fellow funding were partially used as the basis to successfully apply for continued funding of the CESSH until 2016.

OUTCOMES ACHIEVED

1. A number of skilled researchers able to provide research support, services and advice about supply chain performance improvement to Australian and other seafood businesses.
2. The Australian seafood industry has access to a suite of supply chain monitoring methods, resources and training to help them better manage their supply chains to improve profitability
3. A number of seafood businesses are effectively using modern supply chain performance management tools and technologies and have been able to improve profitability, through increased shelf-life, decreased drip loss and successful new product development. .
4. An Australian network (the Seafood Post-harvest research hub) of supply chain performance

improvement research capacity is now available to assist the Australian seafood industry to resolve their supply chain performance issues

LIST OF OUTPUTS PRODUCED

1. Attendance and significant scientific input around supply and value chain performance into CRC activities and project development.
2. Ongoing participation and input into CRC participant and aligned events and meetings where post-harvest issues are on the agenda.
3. Development of standard methodology and How to guide to conduct seafood supply chain analysis (video series).
4. Industry training in supply chain analysis and results.
5. Industry case studies in supply and value chain performance.
6. Presentation at conferences.
7. Peer reviewed scientific publications.
8. Funding approval for and successful implementation of >10 other aligned seafood supply chain performance research projects.
9. 8 post graduate students trained in seafood supply and value chain performance methodology.

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1 Introduction

At the commencement of the Seafood CRC in 2007, CRC participants identified the need to improve competitiveness and profitability through improved supply chain management as one of their highest priorities. This was reflected in the outputs and milestones of the Seafood CRC agreement, the CRC OzSeaValue theme and plans of various CRC participants including the WAFIC Strategic plan.

Internationally there are some very useful tools that have been developed to help businesses analyse their supply chains from a product, economic, logistic and information flow perspective. These tools assist industry to identify opportunities for improvement, implement interventions and measure performance improvements. Effective seafood supply chain analysis involves applying multi disciplinary analytical methods at many different points in the supply chain (before and through harvest, transport, storage, transformation and retail) and the integration of these to get a holistic understanding of where interventions might be most effective. These interventions may include quality (eg by changing storage techniques or implementing rapid diagnostic technologies), development of new products from the same resource (including examination of total utilisation of waste) or better economic/consumer/market management (eg choice of best harvest strategy/timing to optimize profitability, decreasing supply chain logistics costs, understanding markets and consumer needs etc). While there are some companies routinely using these tools in Australia their use was not common within the Seafood CRC participants and there was little capacity in research providers to provide services and support in this area.

The CRC had previously funded a number of supply chain and benchmarking studies in product quality, economics and logistics. In some cases (e.g. initial Seafood CRC partners economic benchmarking studies on Farmed Prawns and Oysters) these had been undertaken by an external consultant, as there was no capacity within the existing CRC providers to undertake the projects. As well the projects have often been conducted in isolation. It was envisaged that the post doctoral scientist employed by this project was intended to build on these initial Seafood CRC partner supply chain studies, and develop a national supply chain performance research hub to ensure and maximise future collaborative effort. The outcome would be a network of skilled seafood supply chain managers able to provide seafood businesses with advice and assistance in conducting supply chain analysis and performance improvement.

During 2008 the Government of South Australia funded Professor Andrew Fearnes to help SA based primary production industries to analyse their value chains and identify opportunities for improvement. One of the target sectors was the Spencer Gulf Prawn Fishermans Association. This work by Professor Fearnes represented a novel approach to supply chain analysis in Australian primary industries. The proposed post doctoral scientist was also tasked to work to build capacity in the areas of work undertaken by Professor Fearnes and his co-investigators, to ensure that outcomes of this study were incorporated into future CRC funded supply chain studies.

In 2008 Curtin University received approval for funding ($500,000) from the WA Government to establish a Centre of Excellence for Seafood Science and Health. One of the two research themes of the Centre was seafood supply chain performance.

This project had relevance to the Seafood CRC OzSeaValue Theme Business Plan. In particular to Strategy 2: Build Australia's seafood product and development, processing and supply chain R&D capacity in public and commercial entities and the concept proposal National Seafood Productivity Improvement Centre (NSPIC). It was intended that the result of this project would be a hub of the NSPIC focussing on supply chain benchmarking and analysis. Strategy 3 – Development of new approaches to monitoring and managing seafood supply chain performance and the concept proposal - Integrated supply chain performance benchmarking studies (economics, logistics, product quality). The project was also intended to coordinate CRC supply chain work, underpinned by a number of supply chain research themes. Formal links were to be established between Curtin University, University of Tasmania and a number of other CRC research providers to enable the benefits of these synergies to be realised.

The project was also intended to meet Outcomes under the A, B, Sea Theme relating to graduation of PhD, Masters and Honours students in supply chain studies and to provide industry training in supply chain analysis and management.

1.1 Need

This project was aimed at increasing the capacity to provide Australian seafood businesses with assistance in analysing and improving their supply chains and thus improve their profitability and ability to meet and respond to their customer's needs.

The need for building this capacity was identified in the early years of the Seafood CRC and was reflected in the OzSeaValue Theme Business Plan which outlined CRC investment in this area.

Similarly CRC participants WAFIC, ACA, ACPF, APFA, Oyster Consortium, Simplot and SFM had developed or were developing supply chain projects that needed a coordinated and multi-disciplinary research response. This lack of capacity was recognised by Curtin University and WAFIC and a supply chain performance research theme was incorporated into the newly funded Centre of Excellence for Seafood Science and Health (CESSH).

As a result a CRC post-doctoral scientist in integrated supply chain management was also funded to work on this area from within CESSH. This position was filled by Dr Janet Howieson from 2009-2014. This report summarises the outcomes/outputs of the post-doctoral scientist position.

1.2 Objectives

1 Develop a research capacity within the Seafood CRC to support industry participants in analysing and improving their supply chain performance
2 Provide expertise to help analyse seafood supply chain performance for at least 5 Seafood CRC participant businesses and guide implementation of key performance improvement measures.
3 Develop a suite of tools, resources and targeted training to assist seafood businesses analyse and improve their supply chain performance.
4 Establish a supply chain technologies hub within the CRC's Australian Seafood Productivity Improvement Centre (ASPIC),

2 Methods

Methods for the project are described under five different areas as identified in the development of the work plan for the post-doctoral scientist position. It is to be noted that this report acts as a general summary document. The post-doctoral developed and applied supply chain management techniques in a number of separate CRC projects, and developed methods and results of this work is reported separately in the relevant specific project reporting.

2.1 Professional and Personal Development

To increase her knowledge and understanding of the post-doctoral research area, Dr Howieson undertook a desktop exercise and literature review to summarise supply chain benchmarking and analytical methodology into seafood supply chains with a particular emphasis on Australian systems. The review incorporated relevant findings from two previous Seafood CRC reports in rapid diagnostics and traceability.

The desktop exercise included research/results whereby specific seafood supply chain performance has been improved (based on where possible quantification of increased profitability) and by what intervention mechanisms. CRC Company members were also approached and requested to provide advice (where appropriate) on how they have improved their supply chain performance.

This component resulted in the development of agreed and consistent seafood supply chain analytical methodology and protocols including identification of possible new technologies to assist in supply chain analysis (traceability, freshness, rapid diagnostics).

This component also involved collaboration with the co-investigators to identify specific opportunities within their areas of expertise to increase the knowledge and skills of the post doctoral scientist.

During the postdoctoral study Dr Howieson attended a number of courses/events aimed at professional

and personal development. This included supervision of post-graduate students and mandatory training associated with such supervision.

2.2 Development and Coordination of Seafood Supply Chain Expertise.

Dr Howieson was tasked to develop and coordinate a network of seafood supply chain research expertise (both in Australia and nationally). This component included a review of the capabilities (and gaps) of all CRC research providers and identification of the services they could contribute along the supply chain. A review of all the current seafood supply chain projects was also undertaken. These data formed the basis of a database of the capabilities of Seafood CRC research providers.

Part of the role of the postdoctoral scientist included helping develop and coordinate seafood supply chain benchmarking and analyses in Australia leading to a supply chain performance improvement technology hub in the ASPIC (or similar), and work with other CRC participants who wanted to improve their supply chain performance. This role was successfully facilitated by establishing links with existing projects and working collaboratively in developing new projects, attending CRC events, liaising with national and international experts and attending relevant meetings/conferences.

2.3 Development and Implementation of Supply Chain Monitoring Projects.

Dr Howieson undertook a range of supply chain analysis and aligned projects for participating seafood CRC industry partners.

2.4 Development of Supply Chain Monitoring Tools and Resources

A further aim was to develop a series of resources, tools and targeted training for use by Seafood CRC participants wishing to undertake supply chain analysis.

Based on the results of the literature search, research capability study and initial supply chain piloting studies, a series of video how to guides were developed to assist other Seafood CRC partners to undertake similar benchmarking and intervention studies internally.

2.5 Post graduate Supervision.

Dr Howieson was tasked with facilitating an increase in Australian seafood supply chain research capacity by developing and supervising Honours, Masters and PhD projects in various aspects of seafood supply chain analysis.

3 Results

3.1 Professional and Personal Development

Personal and professional development undertaken by Dr Janet Howieson was divided into three areas: presentation and publication of results from scientific studies; personal training; and awards/invitations related to the scientific work undertaken.

3.1.1 Presentation and Publication of Results.

Published, Submitted or Prepared Journal articles

The following peer reviewed publications were published, submitted or were close to submission during the reporting period:

1. Howieson, J and Lawley, Meredith (2010). Implementing whole of chain analysis for the seafood industry: A toolbox approach, in Dr Paul Ballantine and Dr Jorg Finsterwalder (ed), Australian and New Zealand Marketing Academy (ANZMAC) Annual Conference 2010, Nov 29 2010, pp. 1-8.University of Canterbury, Christchurch New Zealand: Department of Management, College of Business and Economics, University of Canterbury.
2. McManus A, Hunt W, Howieson J, Cuesta-Briand B, Storey J (2012) Attitudes towards seafood and patterns of consumption in an Australian coast town. Nutrition Bulletin 2012; 37(3): DOI:10.1111/j.1467-10.2012.01978
3. Howieson, JR, Hastings K, Lawley M (2013) Creating Value in the Supply Chain for Australian Farmed Barramundi - Whole of Chain Perspective Journal of International Food & Agribusiness Marketing, 25:4, 287-297
4. Lawley M and Howieson J (2013) What Chefs Want When Buying Australian Seafood . Journal of International Food & Agribusiness Marketing (in press)
5. Howieson J., Lawley M and Selen W (2014) New Product Development in Small Food Enterprises Journal of New Business Ideas & Trends (in press)
6. Denham F., Howieson, J., Solah, VA and Biswas, W. (2013) Sustainable supply chain management in the seafood industry: past, present and future approaches. J of Cleaner Production (submitted)
7. Denham, F Biswas W., Solah, VA and Howieson, J.(2014) Greenhouse gas emissions from a Western Australian finfish supply chain J of Cleaner Production (submitted)
8. L.F. Fuentes-Amaya, J. Howieson , J. Fernandez-Piquer, S. Munyard (2014) Sensory, microbiological and chemical changes in vacuum-packaged Blue Spotted Emperor (*Lethrinus* sp), Saddletail Snapper (*Lutjanus malabaricus*), Crimson Snapper (*Lutjanus erythropterus*), Barramundi (*Lates calcarifer*) and Atlantic Salmon (*Salmo salar*) fillets stored at 4 ºC (submitted)
9. Howieson JR, Hunt W, Denham F and Munyard S (2014) Quality degradation of Blue Spot Emperor (*Lethrinus* sp), Crimson Snapper (*Lutjanus erythropterus*) and Saddletail Snapper (*Lutjanus malabaricus*) fillets at retail outlets and the impact of harvest conditions (in prep).
10. Johns C, Kimber N, Lawley M, Howieson J (2014) Closing the loop with a VCA: Identifying, Implementing and Evaluating improvement projects in an Australian Prawn Fishery (in prep)

Conference Presentations

The following relevant conference presentations were presented during the reporting period

1. Howieson (2010) Issues and Opportunities for Australian Seafood Women: AWIA/WINSC joint conference, 10-11 September, Darwin (Invited)
2. Howieson JR (2011): Improving the Supply Chain for Selected WA Seafood species. Seafood Services Australia Network Meeting 24 February, Perth (Invited).
3. Howieson JR (2011): Supply Chain analyses and Value Chain Analyses: What's in it for the Seafood Industry Seafood CRC Planning Day 7 July Adelaide (Invited)
4. Howieson JR, Munyard S and Denham F (2011): Improving Shelf-life of Snapper fillets: impact of addition of sanitisers on whole fish and fillets. Aust Soc of Microbiology 11-13 Oct 2011 Hobart.
5. Howieson JR (2011) Minimising graying of barramundi fillets ABFA/APFA conference 3-5 August, Sydney.
6. Howieson JR (2011): National Prawn Market Development Strategy ABFA/APFA conference 3-5 August, Sydney
7. Howieson JR and Jecks P (2012): Putting the Consumer First: Practical Seafood Examples Australasian Aquaculture Conference Melbourne, 1-4 May 2012 (Invited).
8. Howieson, JR Cuesta-Briand, B (2012) "Expert-led Accelerated Seafood Product Development: A Case Study. 2012 International Food Marketing Research Symposium, Philadelphia, PA, USA, 8-10 June
9. Howieson, JR, Hastings K, Lawley M (2012) Creating Value in the Supply Chain for Australian Farmed Barramundi - Whole of Chain Perspective 2012 International Food Marketing Research Symposium, Philadelphia, PA, USA, 8-10 June
10. Tonkin R, Howieson J, Denham F, Fernandez L (2013) Fish to dish: issues and opportunities for the saddletail snapper supply chain. 46th Annual AIFST Convention "Yesterday, Today and Tomorrow", Brisbane 14-16th July, 2013
11. Denham F, Biswas W, Howieson J (2013) *Environmental Impact of a finfish supply chain in Western Australia: analysis, interventions and opportunities* 8th Life Cycle Conference 'Pathways to Greening Global Markets' Manly,12-16 July 2013.
12. Howieson JR (2012) Identification of factors impacting on fillet greying and other end-user quality attributes in farmed barramundi ABFA/APFA conference 1-3 August, Cairns .
13. Howieson JR, Munyard S, Denham, F. and Tonkin, R. (2012) Microbiological Monitoring through seafood supply chains: issues and opportunities. CBSM Perth 24 August (Invited).
14. Kleindienst R, Wilkinson R, Partridge G, Howieson J (2013) Comparison Of Harvest Strategies For Improving Flesh Quality In Yellowtail Kingfish *Seriola lalandi* And Barramundi *Lates calcarifer* Asian-Pacific Aquaculture 2013. Ho Chi Minh City. 10 - 13th December 2013. World Aquaculture Society

15. Jecks P, Howieson J (2013) Value adding Seafood 1st Asia Pacific Food Innovation Conference Perth 11-12 June 2013
16. Howieson JR, Denham F and Fernandes L (2013) Monitoring quality and safety through seafood supply chains: issues and opportunities. Environmental Health Australia Conference Perth 24-26 Sept 2013 (invited).
17. Lawley M and Howieson J (2013) What Chefs Want When Buying Australian Seafood International Food Marketing conference, 10-13 June Budapest.
18. Watling J, Tan C, Howieson J (2013). Provenance establishment of Australian and overseas prawns using their natural element fingerprints. 2013 Ridley Aqua-Feed Prawn and Barramundi Conference; 2013 Jul/Aug; (AU).
19. Howieson J (2013) Supply and Value chain Analyses for the Australian seafood industry WINSC National Conference, Port Lincoln 25 Oct 2013 (invited).
20. Howieson J, Carter D, Bell B, Leyland L and Colquhuon E (2014): Implementing Traceability in a Remote, High Volume Fishery: Issues, Opportunities, Benefits. World Aquaculture Conference 7-10 June, Adelaide (invited)

3.1.2 Personal Development Training

Dr Howieson attended:

- a course conducted by 'Peak Performance' in Sydney on 13-14 June 2013 designed to gain effective negotiation skills
- the ESE in Brussels in April 2013
- Post graduate Supervision annual refresher 2011, 2012 and 2013. Curtin University.

Dr Howieson organised a trial of the 'group explorer' consultative process to set post-harvest research priorities with 9 major WA seafood companies in November 2013. Feedback from participants was very positive.

3.1.3 Invited training and Awards.

Dr Howieson was invited to develop and subsequently delivered a four-day course in seafood supply chain monitoring/post-harvest practice in Singapore in March 2014. The first two days were spent training scientists at AVA in supply chain monitoring techniques, the third day was visits to industry to provide expert advice, the fourth day was spent delivering a full day seminar to 80 participants (Figure 1). Associate Professor Meredith Lawley and Dr Tom Madigan assisted Dr Howieson in delivering the training.

Dr Howieson was awarded the Research, Development and Extension award at the WA Seafood Industry awards in July 2013 (Figure 2). Dr Howieson was also a top three finalist in the National Seafood Industry Research, Development and Extension Awards in October 2013.

Dr Howieson is a finalist in the 2014 Curtin University Innovation and Commercialisation award.

Figure 1: Dr Howieson, Assoc Prof Lawley and Dr Madigan with Singapore AVA scientists.

Figure 2: Dr Howieson awarded the 2013 WA Seafood Industry Research Development and Extension award.

3.2 Development and Coordination of Seafood Supply Chain Expertise

The project resulted in agreed definitions and methodologies for whole of chain analyses for the seafood industry. Whole of chain analyses were divided into supply chain analyses and value chain analyses.

a. Supply chain analyses are about improving performance of an existing chain. Sampling and analytical procedures have been developed to undertake supply chain analyses, with development of specific methodologies to measure temperature, drip loss, microbiology (both generally and spoilage specific), spoilage, quality (quality index and sensory attributes), economic evaluation and carbon footprint (life cycle assessment) through supply chains. These specific methods and implementation case studies, including benefits of interventions are detailed in the final reports for CRC 2009/709 (Saddletail snapper, crimson snapper, blue spot emperor, pink snapper, octopus, pearl meat), CRC 2010/775 (sardines), 2011/721 (barramundi) and 2011/748 (five Australian prawn supply chains). Electronic traceability as a supply chain tool was tested in the Northern Prawn Fishery (CRC 2012/702). Development of these supply chain monitoring methods and procedures has involved collaboration with scientists at Pathwest Laboratory Medicine (Steve Munyard), DEEDI (Sue Poole), SARDI (Karen McNaughton, Richard Musgrove, Cath Macleod, Tom Madigan) and UTAS (Mark Tamplin). In addition, supply chain analyses capacity has been built at CESSH with training of staff (Wendy Hunt, Felicity Denham, Kerry Choo) and students (Jenny Ng, Karl Hansal, Luisa Fernandes, Felicity Denham, Rowan Kleindienst).

b. Value chain analyses (VCA) are about identifying market opportunities through end user consultation (consumers and food service) and then interviewing through chain to understand the relationships, product and information flow to develop/adjust supply chains to meet the identified market opportunity. A framework for this work with the Seafood CRC was developed though consultation with Prof Hamish Gow (Massey Uni) and Assoc Prof Tiffany White (University of Illinois), in association with expertise already available at the University of Adelaide.A value chain analysis will normally result in a series of prioritised improvement strategies/projects, which can then be implemented, and evaluated for impact on the test value chain. Value chain analyses, identification of improvement projects, and implementation and evaluation are described in the final reports for CRC 2008/793.10 (Shark Bay prawn, Moreton Bay Seafood Industry Association and Spencer Gulf prawn) and for barramundi (CRC 2008/794.20). Value chain analysis techniques were initially employed in the development of the national Prawn Marketing Strategy (CRC 2011/736) and were also part of the accelerated new product development framework developed and implemented in the successful launch of Abacus crab cakes on the food service market (CRC 2010/708). The VCA project work has involved collaboration with PIRSA (Nathan Kimber and Craig Johns (now at Uni of Adelaide), USC (Assoc Prof Meredith Lawley) and DEEDI (David Byrom).

It is probably of note that following the review of the current seafood supply chain literature and research activity, Dr Howieson and Professor Lawley published a paper on implementing whole of chain analysis for the seafood industry: A toolbox approach which enabled industry to decide on their type of analyses to be employed based on their aims and objectives (Howieson and Lawley 2010).

The ASPIC was not forwarded during the term of the Seafood CRC however Dr Howieson is a leading member of the newly formed ASCRC Post Harvest Research Hub which will meet at least twice each year. The focus of the Hub is to bring together senior researchers with specific expertise in seafood post- harvest research. This network aims to build relationships and facilitate the development of collaborative research projects in the post-harvest space. To date, the Hub has strong support and research representation for five partner organisations being: Curtin University, University of Sunshine Coast, SARDI, QDAFF and UTAS. Four hub meetings were held between November 2012 and May 2014.

New relationships with Dr Howieson have been recently formed with Chris Cook (Uni of Wollongong) who has an engineering team specialising in developing processing equipment solutions and Chris Downs (CSIRO) giving access to a fully equipped product development kitchen hosted by CSIRO.

Dr Howieson delivered a three day course in seafood supply chain monitoring/post-harvest practice in Singapore in March 2014.

3.3 Development and Implementation of Supply Chain Monitoring Projects

The following projects have been funded incorporating the expertise of Dr Howieson, usually as Principal Investigator. As appropriate separate milestone and final reports have been submitted for each of the projects, individual project results are not covered in the current report. All project reports can be sourced from the Seafood CRC website. In these projects, Dr Howieson contribution as a Principle Investigator, Co-investigator, was 'in kind'.

- McManus A, Howieson J. (2009) Seafood CRC Research grant ($447,000) to develop, pilot, implement and evaluate sector/condition specific resource/education packages that seek to establish regular consumption of seafood as a healthy dietary choice.
- Howieson J and Whalley A (2009) Seafood Women: Seizing the Initiative (2009): Office of Women ($34,500)
- Howieson J, Williams H, Tamplin M, (2009) Improving the Supply chain for WA Seafood, Seafood CRC ($166,000) (2009-2012) with Approved Variation (2012) for further $75,000.
- Howieson J, Tay G and Williams (2009) Dried WA Seafood Products for the Asian market: A Pilot Study Seafood CRC ($74,000)
- Lawley M, Howieson J and others (2009) Repositioning farmed barramundi on the domestic market (USC) Seafood CRC ($365,000)
- Howieson J, Jecks P, Susman J, Barber A, Williams H (2010): Accelerated Value-added Product Development: blue swimmer crab pilot Seafood CRC ($203,000)
- Howieson J, Stewart G, Hollamby K, Lawley M, Anderson D, Dentoni D, Gow H, White T (2010): Optimising quality and value in domestic prawn value chains Seafood CRC ($359,000) (2010-2013) with approved Variation (2011) for extra $49,000.
- Howieson J, Giffney A and Rowe T (2010) New product development for low value, high volume species - WA Sardines Seafood CRC ($73,000)
- Williams H and Howieson J : Finfish Waste (2010): Audit and Potential for Utilisation. : Seafood CRC Masters scholarship ($10000) (Student Jenny Ng)
- Howieson J, Glencross B, Little S (2011) Understanding and minimising "greying" in farmed barramundi fillets Seafood CRC ($49,000)
- Howieson J, Brooks K, Hollamby K, Fogarty J and Lawley M (2011) National Prawn Market Development Strategy, Seafood CRC ($350,000)
- Howieson J (2011) To investigate the links between parasite infestation and fillet quality in farmed Yellowtail Kingfish in central Western Australia Seafood CRC masters scholarship (student Rowan Kleindienst) ($15300)
- Tamplin M, Howieson J (2012) Time-temperature management to maximise returns through the prawn supply chain Seafood CRC ($150,000)
- Howieson J, Tamplin M, Bremner A (2012) Innovation in Traceability the Australian Seafood Industry: Austral/NPF case study Seafood CRC $141000.
- McManus, Howieson (2013) CESSH Post-Harvest Seafood Program 2013-2016 ($1.4 million).

Dr Howieson will be taking responsibility for SP 1: Waste ($300,000) and SP6: Collaborative processing initiative ($500,000),

- Howieson (2013) Australian Seafood Apprentice Chef and Commercial Cookery Online Training Series ($99800)
- Howieson (2013) (Prawn QA) Maximising the quality of Australian wild-caught prawns (Quality Assurance) (ACPF) ($350000)
- Howieson J (2014) Biotoxin Risk Assessment for the Western Australian seafood industry (contract with DOHWA ($27500).
- Howieson, Jecks (2014) Waste transformation methods for value added products for the catering market.($270000)

3.4: Development of Supply Chain Monitoring Tools and Resources

The following summarises the supply chain monitoring tools and resources that have been developed as part of this project.

- Methodologies for a suite of supply chain analyses have been developed and trialled in a number of WA seafood supply chains. A series of 'How to' videos for industry explaining the benefits of supply chain analysis and how to undertake this type of analyses has been launched and is now available on the Seafood CRC website. The videos include an introductory and testimonial video, as well as specific videos for temperature monitoring, quality index development, drip loss, economic evaluation and microbiology.
- An industry Quality Index (QI) panel has been recruited and trained for the QI development and analyses, and to assist in extension of QI to industry. Some of these industry QI panel members (eg from MG Kailis and Kailis Bros) are now assisting in training other members of their organizations in the use of the QI.
- In consultation with Prof Hamish Gow and others, a framework for VCA has been developed and was trialled with three different fisheries in the ACPF funded prawn project.
- A user guide for the accelerated product development methodology has been prepared and distributed.
- Dr Howieson has led a project entitled 'Australian Seafood Apprentice Chef and Commercial Cookery Online Training Series' in 2013/14 which produced a suite of seafood specific training tools for apprentice chefs.

Dr Howieson is a co-investigator on a Quality index extension project (with QDAFF) to develop a QI mobile phone app.

3.5 Post graduate Supervision.

Dr Howieson has supervised the following post-graduate students.

Completed

- Jenny Ng (Masters of Food Science research project (2010) Finfish Waste: Audit and Potential for Utilisation.
- Karl Hansal (Honours) (2010) Dried seafood for the Asian market.
- Luisa Fuentes ((Masters of Food Science research project) (2012): Evaluation of the effectiveness of the Standard Plate Count as an Indicator of Seafood Spoilage in finfish fillets.
- Rowan Kleindienst (Masters by Research) (2012-2014) To investigate the links between parasite infestation and fillet quality in farmed Yellowtail Kingfish in central Western Australia Seafood CRC
- Elinsa Gilead Massawe (Masters of Food Science research project) (2013) Optimisation of freezing for Aust salmon fillets).
- Carol Low (Masters of Food Science research project) (2013) Prawn quality and shelf-life.
- Abubakary Saad Mbadjo (Masters of Food Science, research project) 2013 Production of high protein biscuits from dried fish frames.

Carol, Elinsa and Abubakary were international students and have returned to their employment in the Seychelles and Tanzania respectively. Karl currently has a product development role at Simplot. Luisa has a Quality Assurance Role at Smiths Crisps. Rowan has been working at CESSH undertaking a biotoxin risk assessment of WA seafood products. Jenny is working at Curtin University on value add grain development.

Current

- Felicity Denham (PhD) Environmentally Sustainable Seafood Supply Chains : Analyses, Issues and opportunities.
- David Byrom (Masters by Research) Moreton Bay Fresh Prawn Fishery - Customer Focus and Sustainability

4 Discussion

4.1 Supply chain analysis

The Post Doctoral Scientist position at CESSH was developed to undertake effective seafood supply chain analysis, using a standardised methodology that incorporated analyses protocols for a range of parameters through harvest, transport, storage, transformation and retail. The methodology was to be designed to test the effectiveness of various targeted supply chain intervention strategies aimed at increasing product value or decreasing cost.

The supply chain analysis methodology, developed as part of this project, has been rigorously tested and proven effective across a number of supply chains. Parameters that can now be tested using the standardised methods are: physical conditions; microbiological analysis (composition and safety); biochemical analysis (spoilage products); nutrient analysis and contaminant analysis. The methods can also be used to conduct an economic analysis including: analysis of costs of alternative production strategies; profitability of developing new products either from edible portions or from waste; and assessing possible new markets.

One of the most important outcomes of this project is the translation of the research outputs into practice. For example, the supply chain analysis methodologies developed by Dr Howieson has now been validated along four supply chains with results identifying critical points for intervention to improve either product quality, productivity and/or profitability of the chains under review.

As part of the extension and training component of this project, CRC participants have been afforded the opportunity to work Dr Howieson through collaboratively analysing localised supply chains using the validated methodology. It is expected that further collaborations may include formal training of CRC participants and researchers in the implementation and analysis of supply chains. Furthermore, Dr Howieson will continue to consult with industry and provide this technical service on a fee-for-service basis.

4.2 Building scientific capacity to support the Australian seafood industry

Another aim of this project was to build scientific capacity and expertise to service the needs of the Australian seafood industry. Dr Howieson has worked diligently in the past five years to develop relationships and collaborations with CRC partners across Australia with the view to sharing expertise and building capacity in supply chain analysis and associated research. The results of her efforts are evident in the number of projects completed with ‘true’ industry partners who have been involved from the onset of each of the projects. The inclusion of, and consultation with, end-users throughout the research process has resulted in outputs and outcomes that have direct and practical value to the end-users.

Another valuable outcome of this project is ‘people’ development, not the least being Dr Howieson herself. The skills and expertise she has gained in the implementation of supply chain analysis and how to work effectively with a very diverse primary industry, are to be commended. Janet is now regarded as one of the leading scientists in this area of research across Australia.

Dr Howieson has committed to supporting at least one student each semester. This has resulted in the support of nine students (in collaboration with other supervisors across Australia), most of whom are now working within the Australian seafood industry.

4.3 Network of supply chains researchers

The final aim of the project was to develop and expand capacity for analysing and improving seafood supply chain performance within the CRC. The detail provided in this report clearly shows the extent of the networks that have been developed through her collaborate efforts. Dr Howieson is also a member of the CRC Post Harvest Research HUB which meets at least three times a year to progress post-harvest research in Australia.

5 Benefits and Adoption

As stated in Section 3.3 the supply and value chain analysis tools have been incorporated into a range separate projects with defined industry partners. As such the analyses have been adopted widely.

In regard to defined industry benefits the following can be reported.

- The Love Australian Prawns campaign has been launched across Australia.
- MG Kailis have decreased drip loss in their retail store and improved quality to their processing supply chain partners as a result of the analyses completed. MG Kailis routinely monitor temperature using techniques developed in the project.
- Two new value add seafood products (Abacus crab cakes and Cape Le Grand sardines have been commercially launched).
- Austral Fisheries routinely monitor temperature in their prawn supply chains.
- Shark Bay Wild and Moreton Bay Fresh branding have been launched underpinned by value chain research. Spencer Gulf prawns have been the focus of a retail branding strategy (with evaluation) as a result of value chain research.
- Quality, temperature and shelf-life data from the project has been distributed to major retailers by producers.

6 Further Development

A new CESSH 2013-2016 project has been funded with Dr Howieson taking responsibility for SP 1: Waste ($300,000) and SP6: Collaborative processing initiative ($500,000). This project also incorporates a technical advisory function with Dr Howieson subsequently approached for assistance with supply chain monitoring work with abalone and other sectors. It is expected this function will continue with projects funded through industry contribution or other funding sources.

It is expected that Dr Howieson will return to Singapore in 2015 to again work with the Singapore industry.

7 Planned Outcomes

Public Benefit Outcomes

1. A number of skilled researchers able to provide research support, services and advice about supply chain performance improvement to Australian and other seafood businesses.
2. The Australian seafood industry has access to a suite of supply chain monitoring methods, resources and training to help them better manage their supply chains to improve profitability
3. An Australian network (the Seafood Post-harvest research hub) of supply chain performance improvement research capacity is now available to assist the Australian seafood industry to resolve their supply chain performance issues
4. The Australian seafood industry has been made aware of the potential benefits to their business through undertaking supply and value chain research.
5. Development of a National Prawn Market Development Strategy.

Private Benefit Outcomes

1. A number of seafood businesses are effectively using modern supply chain performance management tools and technologies and have been able to reduce their costs and improve shelf-life.
2. Specific supply chain separate projects have been approved and implemented meeting specific

industry needs.

Linkages with CRC Milestone Outcomes

Outcome 2 - Increased access to premium markets through fulfilment of consumer demands for safe, high-quality, nutritious Australian seafood
Output 2.1 - Traceability technologies to assure seafood quality and integrity and to deliver value chain efficiencies
Milestone 2.1.2 - Technology and capability to support implementation of ongoing traceability systems developed
Output 2.3 - Predictive tools to increase value chain efficiency
Milestone 2.3.1 - Quality Index Method for 20 commercially important Australian species available for commercial use
Milestone 2.3.3 - Predictive tools developed, trialled and available to industry to better manage food safety risks associated with microbiological hazards in the Australian seafood cool chain
Output 2.8 - Smart processing technologies and practices
Milestone 2.8.1 - Innovative technologies for controlling spoilage to enhance shelf-life and marketability identified, implemented and evaluated for five seafood products
Milestone 2.8.2 - Innovative technologies and approaches to improve processing efficiencies by recovering under-utilised product, and reducing waste trialled and evaluated for three seafood sectors
Milestone 2.8.4 - Supply chain performance evaluated and interventions trialled to maximise shelf life, minimise waste, improve live transport and protect quality attributes and nutritional properties of the seafood products for at least six seafood chains

8 Conclusions

In conclusion the following statements summarises the project against the original objectives.

1. Develop a research capacity within the Seafood CRC to support industry participants in analysing and improving their supply chain performance

Generic methods/frameworks have been developed for a range of supply and value chain analyses and these frameworks have been tested in case studies. A group of staff and students, both at Curtin and in collaboration with other institutions such as SARDI, QDAFF and UTas have been trained in supply and value chain analysis techniques.

2. Provide expertise to help analyse seafood supply chain performance for at least 5 Seafood CRC participant businesses and guide implementation of key performance improvement measures.

More than 10 separate projects have been funded with specific industry partners to undertake supply and value chain analysis, and recommend, implement and evaluate the impact of the proposed interventions. There have been >10 presentations to various industry groups and conferences explaining the techniques and the results of the projects.

3. Develop a suite of tools, resources and targeted training to assist seafood businesses analyse and improve their supply chain performance.

A range of tools and resources have been developed for industry use.

4. Establish a supply chain technologies hub within the CRC's Australian Seafood Productivity Improvement Centre (ASPIC),

Although the ASPIC was not formed the CRC Post Harvest Research hub is now a formal group underlying the many informal collaborations that have developed as part of this project.