

2013-711: Centre of Excellence for Science, Seafood and Health Sub-Programs 2-5 (2013-2015)

Final Report and Outputs



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**CESSH (Programs 2-5) Final Report
FRDC 2013-711**

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In submitting this report, the researcher has agreed to FRDC publishing this material in its edited form.

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Executive Summary

This report summarises the outputs of Sub-Programs 2-5 of FRDC 2013-711: Centre of Excellence for Science, Seafood and Health. The report focuses on the period between January 2013 and June 2015 after which time the Sub-programs were ceased. The Sub-programs were entitled: Retailer 2020, Food Policy Research, Research Advisory Service and Education, Communication and Extension. However, in reviewing the research, many of the outputs were common to several of the programs so will be reported in this way rather than under each sub-program.

Highlights of the work include

- a. A detailed systematic review on the relationship between seafood consumption and health benefits across a range of chronic conditions. This information was used to develop a resource for General Practitioners which summarised the specific health benefits of seafood against these conditions and also a series of condition specific “Seafood and Health” booklets for consumers. These booklets covered diabetes, pregnancy, cancer, arthritis and cardiovascular disease. The booklets and GP resource were made available in hard cover and electronically. These evidence-based booklets are still used by medical practitioner and Allied Health Professionals however it is advised that the front pages be updated to include current health statistics. The information relating to diet and chronic disease prevention remains relevant as supported by current evidence.
- b. A “seniors” project commenced with a systematic review of the literature around the changing requirements of adults as they age. An in-depth analysis of the specific nutritional needs of seniors at a biochemical level was then conducted with consideration of the reduced ability to absorb nutrients as we age. A detailed description of the average weekly nutrients seniors should consume was developed in table form. These were subsequently used to develop meals specific to the needs of seniors (with advice from a dietician, biochemical nutritionist and food scientist). Focus group sessions were then conducted with seniors to gauge their consumption of seafood, preferred preparation methods and perception of affordability of seafood in their diet. As a result of these sessions, a series of low cost recipes based on the specific nutritional needs of senior were trialled with 120 seniors at an aged care facility. The trails were very successful with over 5000 recipe cards subsequently printed and distributed to seniors. Electronic version of the cards were also made available. Feedback was very positive and the facility distributed the information on the recipe cards to the wider aged care community. It was envisaged that a seniors recipe book would be developed however this resource was not progressed beyond draft stage due to financial constraints.
- c. A detailed food labelling guide for seafood SME’s was produced and was made available electronically. The guide was well received at the time. Although currency was maintained by including hyperlinks to the relevant Food Standards in the electronic document, significant changes to at least one section of the food labelling laws were introduced in 2016/17 therefore the resource should be reviewed and new links added as required.
- d. A detailed database of >120 seafood training and grant opportunities was developed and made available to the Western Australian seafood industry in 2013. Although comprehensive, this database should be updated
- e. The text from eighteen separate documents relating to specific aspects of seafood handling, and previously produced under the WA Department of Fisheries Seafood Quality Management Initiative (SQMI) was collated preparatory to updating by WAFIC. The documents were then provided to WAFIC which finalised the CESSH component of this part of the project. WAFIC are

yet to decide whether to update the individual documents or develop a new integrated training module.

In summary the project has resulted in the development of a number of seafood industry resources, which, with relevant updating where appropriate, still address many current seafood industry issues.

1. Introduction

The Centre of Excellence for Science, Seafood and Health (CESSH) was established at Curtin University in 2009. The CESSH was aligned with the Seafood Co-operative Research Centre and was established with the assistance of \$500,000 from the WA Government.

Between 2008 and 2013 the CESSH was a successful seafood post-harvest research centre with outputs including \$3.4 million in grant funding, 21 conference presentations, 11 peer reviewed journal articles, and 32 media stories. In addition industry outcomes included four new seafood products on the market place, three seafood branding strategies implemented (including the National Love Australian Prawns strategy), and a range of supply chain monitoring techniques and technologies implemented in various countries across Australia.

Given this success, a decision was made to provide additional funding to the CESSH through a three year Seafood CRC legacy project. The need for the continuation was articulated as below:

The seafood industry is facing unprecedented challenges (WAFIC 2020 Strategy, FRDC R&D 2015). The networks established by CESSH have laid a strong foundation to attract national and international investment partners. For the first time, the whole industry along the supply chain and post-harvest is working together to achieve outcomes that benefit the WA (and national seafood industry) and the health of the Australian population. It is essential that the industry is able to remain viable and indeed grow, within the constraints of an ever changing economic, technological and food security landscape.

There is a need for a continued go-to place that the industry can access to gain support to develop new products, investigate novel and improved means of harvest, reduce production costs and provide evidence of the value of consuming seafood. CESSH needs to build on existing strong capacity areas and establish expertise in areas that are currently not available in WA to service the growing and diverse needs of industry. This could afford industry a point of difference in the provision of world class support to answer research and science questions that impact on growth, quality or profitability in a timely fashion, an essential service for a primary industry.

Following consultation with industry and a steering committee to inform research priorities, the CESSH legacy project (CRC/FRDC 2013-711) was set up with the following sub-programs.

Sub Program 1: Waste minimisation and management: optimisation of supply chains to reduce waste; total utilisation of seafood products; and innovative product development from under-utilised species

Sub Program 2: Retailer 2020 - Develop an understanding of multi-channel consumer retail environments (current and future trends) to support Australian businesses to capitalise on new and emerging opportunities.

Sub Program 3: Food policy research - maintain currency of expertise and knowledge in: regulation of food labelling and food laws; nutrition and health claims; nutritional dietary guidelines and the human health benefits of seafood to inform industry marketing initiatives and nutritional claims

Sub Program 4: Research advisory service - Develop a technical advice service to provide assistance along the supply chain; assist and upskill industry to apply for research funds; provide

food technology advice (e.g. nutritional composition); provide health benefit advice to industry (market advantage); and develop tailored industry and consumer resources.

Sub Program 5 - Education, communication and extension - respond to industry post-harvest training needs; inform industry of relevant research findings in a variety of formats appropriate to the end-users; and build post harvest research and scientific capacity that is imbedded within the industry.

Sub Program 6 - Collaborative manufacturing hub - investigate and trial collaborative manufacturing hubs to reduce costs and maximise efficiencies in developing and commercialising new products

In June 2015 the CESSH was reviewed and as a result Sub-programs 1-6 were ceased and three new subprograms were established. These new sub-programs were 2013.711.20 (CESSH: Management, Extension, Network), 2013-711.30 (New opportunities for underutilised species) and 2013-711.40 (New opportunities for seafood processing waste). The earlier results for Sub-programs 1 and 6 were rolled into this new structure, and Sub-programs 2-5 were terminated.

This report summarises the results of Sub-programs 2-5 from January 2013 to June 2015. It is noteworthy that, often, the outputs of these Sub-programs were unfinished due to the termination of the funding.

2.Objectives

The Objectives of the specific Sub-Programs are summarised below:

Sub-program 2: Retailer 2020 - Develop an understanding of multi-channel consumer retail environments (current and future trends) to support Australian businesses to capitalise on new and emerging opportunities.

Sub Program 3: Food policy research - maintain currency of expertise and knowledge in: regulation of food labelling and food laws; nutrition and health claims; nutritional dietary guidelines and the human health benefits of seafood to inform industry marketing initiatives and nutritional claims.

Sub Program 4: Research advisory service - Develop a technical advice service to provide assistance along the supply chain; assist and upskill industry to apply for research funds; provide food technology advice (e.g. nutritional composition); provide health benefit advice to industry (market advantage); and develop tailored industry and consumer resources.

Sub Program 5 - Education, communication and extension - respond to industry post-harvest training needs; inform industry of relevant research findings in a variety of formats appropriate to the end-users; and build post-harvest research and scientific capacity that is imbedded within the industry.

3. Methods, Results, Discussion

3.1 Project Governance

In January 2013 a Program Steering Committee (PSC) was formed to oversee the overall program. The PSC consisted of one representative each from FRDC, WAFRAB, Seafood CRC and Curtin University plus a Chair. CESSH provided the Secretariat.

The Program Steering Committee (PSC) comprised the following:

- Chair- Tony Tate
- Chair WAFRAB - Mark Tucek
- MD Seafood CRC - Dr Len Stephens
- ED FRDC - Dr Patrick Hone
- Director Office R&D Curtin University - Charlie Thorn
- CESSH Director – Prof Alexandra McManus

The Secretary was Dr Janet Howieson.

The following specific sections describes the major research of Sub-programs 2-5 during the project period. Following this Table 1 summarises all the sub-programs, and the intended methods, results and published outcomes of the research. Much of the outcomes are documented as appendices as they stand alone. Where intended outputs were not achieved the reasons are also outlined in Table 1.

3.2. Health Benefits of Seafood and Chronic Disease.

A systematic review of literature of publications was conducted using a comprehensive research strategy to identify evidence supporting the health benefits of seafood for the prevention and management of chronic conditions. A total of 373 publications met the criteria and were assigned a level of evidence based on the National Health and Medical Research Council (NHMRC) Hierarchy of Evidence. Two reviewers independently assessed each peer-reviewed publication and rated the strength of evidence from each study. The ratings were then compared and those with different ratings were discussed and an agreed level of evidence assigned. A total of 262 publications had a sufficiently high level of evidence linking seafood to the prevention or management of a chronic health conditions thus were included in the review.

Significant levels of evidence supported the regular consumption of seafood for the prevention and management of several chronic conditions. The strongest evidence is around the reduction of risk for all cause mortality, coronary heart disease, diabetes, mental health disorders, and nutrition related cancers. There is also strong evidence supporting the benefits of regular seafood consumption that is high in Omega 3 fatty acids, for optimal brain development and function, management of inflammatory conditions (such as arthritis, asthma and hay fever) plus control of inflammation associated with lung cancer and chronic pulmonary obstructive disorder (COPD), a common conditions associated with impaired lung function. Evidence shows the regular consumption of seafood high in Omega 3s delays the onset of Alzheimer's Disease in susceptible people and slows the progress of the disease in those already affected. There is emerging evidence supporting a seafood rich diet for people with cystic fibrosis; kidney disease; liver disease; and osteoporosis.

Further, eating seafood as the main protein source can provide significant benefits in the dietary management of overweight and obesity.

It is also important to note the evidence supporting the health benefits of eating seafood as opposed to taking omega 3 fish oil supplements. Seafood an excellent source of omega 3s but it also contains many nutrients that help the body to perform efficiently and effectively. These include: lean protein for cell repair and energy; vitamin D and calcium for bone and teeth health; calcium for muscle, heart and nerve function; selenium to prevent cell damage and promote healing and immune function; iodine (together with selenium) to regulate thyroid function and metabolism; iron to help the blood carry oxygen to cells and for energy production; and zinc to aid healing and for normal growth and development.

The systematic review is attached as Appendix 1. An aligned document, “Review of literature relating to the health benefits of regular consumption of seafood as part of a healthy diet” was also developed (Appendix 2). The information from the systematic review was also used to develop a resource for General Practitioners (Appendix 3) which summarised the specific health benefits of seafood against selected chronic conditions. This resource details 18 chronic conditions: with sections for each condition: definition of the condition; what are the odds of developing the condition in Australia; the good news about nutrition and the condition; how seafood can help; and how to take action. As well a series of condition specific “Seafood and Health” booklets for consumers were produced. These booklets covered arthritis (Appendix 4A), cancer (Appendix 4B), cardiovascular disease (Appendix 4C), diabetes (Appendix 4D) and pregnancy (Appendix 4E). All documents from this were made available in hard cover and electronically.

3.3 “Seniors” and Seafood.

A “seniors” and seafood project was undertaken to promote the health benefits of the regular consumption of seafood to seniors, a growing and largely underserved demographic in Australia.

A systematic review of the literature around the changing requirements of adults as they age was conducted followed by an in-depth analysis of the biochemical nutrient requirements of seniors. Results were provided at the nutrient level and published as part of a collaborative strategy to prevention and/or delay onset to Alzheimer’s Disease (Creegan R, **McManus A** (Martins R Ed). *Understanding Alzheimer’s Disease*. Pan Macmillan Australia 2013 ISBN 978-1-74261-198-3). With advice from a dietician, biochemical nutritionist and food scientist, the evidence from the systematic review was used to develop meals specific to the needs of seniors.

3.3.1 “Seniors” Focus Groups

Focus group sessions were then conducted with seniors to gauge their consumption of seafood, preferred preparation methods and perception of affordability of seafood in their diet. The methods, results and discussion of these focus group sessions are attached as Appendix 5. Based on the results of the focus groups the recommendations for the next steps were:

1. Quick and inexpensive recipes along with hints of preparation of fish and seafood should be investigated to encourage seniors to include seafood regularly in their diet.

2. The cost and availability of seafood were perceived barriers to regular consumption. Lower cost varieties and forms (eg frozen) of fish and seafood that are easily accessible, should be promoted (including ways to prepare them).
3. Education about portion size

3.3.2 Development and Trials of Seafood meals specifically for “Seniors”

A series of low cost recipes based on the specific nutritional needs of senior were developed (as per the previous paragraphs) using the NUTTAB 2010 nutrient composition database (hosted by Food Standards Australia and New Zealand - FSANZ) to identify specific nutritional composition of a variety of fish and seafood species (particularly low cost species such as Australian Salmon, Mulloway, Sardines and Bream).

The meals were then trialled with 120 seniors at an aged care facility (for methods, results and discussion see Appendix 5B). The trails were very successful with over 5000 recipe cards subsequently printed and distributed to seniors. Electronic versions of the cards were also made available. Feedback was very positive and the facility distributed the information to the wider aged care community. It was envisaged that a seniors recipe book would be developed however this resource was not progressed beyond draft stage due to financial constraints.

Reproduced below is the conclusions and recommendations.

Conclusions

Seniors like to consume fish and seafood that is tasty. The majority of participants in this study preferred mild to moderately flavoured meals however around 40% said that that the meals could have been improved with more flavouring. The most common responses given by these participants were: “needs more salt”, “tasteless”, “needs more curry”.

Research shows that as we get older we become less sensitive to taste. Taste losses can be attributed to factors such as ageing, age-related disease, poor oral health, drugs (including drug interactions) and zinc deficiencies. The ‘tastiness’ of the meals may be improved by adding ingredients with stronger flavours such as fresh or dried herbs, garlic, ginger, onion, chilli, citrus juice and seeds such as caraway or mustard seed. The most preferred meals, the Asian style fish and the pesto crusted Salmon contained ingredients with strong flavours such as garlic, ginger, chilli, spring onion, basil (pesto), parsley and parmesan cheese which made the meals more tasty.

In summary, the most pertinent findings from this study were that seniors preferred to prepare their own meals at home and around 40% said they would regularly purchase seafood meals that were tailored to the nutritional requirements of seniors if available in the supermarket for less than \$5 per serve.

Given the expected exponential growth in the seniors market over the next 5-10 years in Australia and globally, this research indicated several major market opportunities for the seafood market.

Recommendations

1. There is a significant market gap in the availability of affordable, nutritionally specific, ready-meal meals for seniors in Australia.

2. Although the majority of seniors in this study preferred cooking at home, there is an opportunity to provide smaller chilled or frozen portions (80-100gms) of seafood aimed at the seniors market.
3. To cater for the specific nutritional requirements of seniors aged 60 years and over (an increasing market that is not well catered for), 'flavour pouches' could be developed to add to a seafood portion together with two or three basic ingredients to create an affordable seafood meal that can be readily prepared at home.
4. It is important to ensure ready-made meals or recipes aimed at the seniors market are nutritional bioavailable to the target market and 'tasty'. It is however important that salt is not the only additional flavour considered. The addition of ingredients with stronger flavours such as garlic, ginger, herbs, spices, citrus juice, seeds, or onion should be considered..

Following a "seniors" seafood resource, containing recipes, preparation tips and nutritional information was drafted (see Appendix 5B) but it was never finalised and extended as the project was ceased. However, individual recipe cards for the tailored meals were produced and made available on request.

3.4 Labelling and other Food Policy Advice

A detailed food labelling guide for seafood SME's was produced and made available electronically (Appendix 6). The guide was well received at the time. Although currency was maintained by including hyperlinks to the relevant Food Standards in the electronic document, significant changes to at least one section of the food labelling laws were introduced in 2016/17 therefore the resource should be reviewed and new links added as required.

During the reporting period Professor McManus was a Board member and a Senior Scientific Advisor to the Omega 3 Centre and also was an Associate Member of the Australian Food & Grocery Council (AFGC). Both these positions facilitated rapid dissemination of new policy decisions relating to seafood to the seafood industry.

3.5 Seafood Training and Grant Opportunities

3.5.1 Seafood Education & Research Database (SERD)

SERD: The Seafood Education and Research Database (*SERD*) was developed as a directory of major national and international entities that have some involvement in communication, education, research and workforce development that could be of value to the seafood industry. *SERD* was developed as an online resource that could be added to by the seafood industry, collaborators or training entities to maximise the comprehensiveness and currency of the document. The database has been developed as an excel file as it is a universally available program and, as such, can be easily forwarded to industry members as requested.

Methods: Web searches were performed using three mainstream databases with different ranking systems; Google, Bing and Yahoo7 Websearch. The terms 'seafood education', 'seafood research' and 'seafood nutrition' were used. While determining education entities, the term education was taken in a very broad sense. It encompasses such widely varying sources as primary, secondary and tertiary education, Hazard Analysis Critical Control Point (HACCP) education, seafood nutrition and seafood related global health initiatives, sustainability education and seafood species selection and cooking techniques. These represent just a few areas incorporated under the education umbrella in this database. The major aims of each entity were usually derived directly from the available

information provided on the website, appearing in quotation marks. Where this was not available, a brief summary of externally perceived aims was created. The ease of negotiation and access to pertinent information on the websites was highly variable, and where information could not be located, a TBA code (To Be Added) was placed in the field. As SERD was concerned with a dynamic and continually developing field, it would need to be updated periodically, with new sites added and existing sites revisited to ensure currency.

Results: SERD includes 156 possible education, training, communication and research opportunities that could be of value to the development, maintenance or up-skilling of the Australian seafood industry. The information on the database may also have value to those who work or collaborate with the seafood industry.

An excel database has been created detailing the following information from each training opportunity: name of the organisation or entity offering the opportunity; CEO, Director, Managing Director or Head; contact details; major aims of the opportunity; description; government/non government; URL and country of main operation. Table 1 summarises the focus of the training opportunities contained within the database, noting if the source is national or international.

Table 1. Focus of training opportunities from the SERD database - March 2014

Description/ focus	National	International
All aspects - training / leadership /management	11	7
Apprenticeship / traineeship	6	1
Aquaculture	9	19
Business management / economics / resilience	3	5
Conservation / sustainability	12	20
Govt and industry regulation	9	9
Marine environment / management	10	15
Microbiology / food science and technology	3	7
Nutrition / health / benefits	7	16
Science / education / research	14	14
Sector specific - education/ training/ marketing	13	11
Stock breeding / feeding / management	4	6
Trade / technical advice or training	1	8
Workforce development - in water	20	16
Workforce development - post harvest	16	15

Conclusion: There are a number of entities around the world, including Australia that focuses on the major training and education needs of the seafood industry. The opportunities identified mostly focus on: general seafood industry workforce development (in the water and post harvest); aquaculture; conservation/ sustainability; scientific/education research; and sector specific training including promotion and marketing. However, as with the labelling guide this database would now require significant updating to be relevant. Not that the database is not reproduced in this report due to the size of the file but can be provided on request.

3.5.2 Seafood Quality Management Initiative documents

The text from eighteen separate documents relating to specific aspects of seafood handling, and previously produced under the WA Department of Fisheries Seafood Quality Management Initiative (SQMI) was collated preparatory to updating by WAFIC.

The documents identified as requiring updating are:

- Handbook for on-board handling of demersal gillnet and longline catch;
- Seafood retailers guidelines;
- Seafood retailers handbook;
- Effective sanitation for the seafood industry;
- Guidelines for handling live seafood;
- Guidelines for live seafood in aquaria
- Code of practice for the West Australian demersal gillnet and longline fishery
- Code of practice for handling Pilbara trawl fish
- Code of practice for handling northern demersal scalefish
- The seafood industry training package – what it is?
- Seafood and the food standards code
- Demystifying HACCP
- SQMI information sheet 1 the model food act and the food standards code
- SQMI information sheet 2 food safety programmes
- Code of practice for the harvest and post harvest handling of live marron for food
- The West Australian quality finfish guide: A practical, easy-to-use guide for the WA finfish industry

All the text was provided to WAFIC however, no further update/activity was completed during the term of the project.

3.6 Retail Sales and Trends

A proposed project outcome of Sub-program 2 was obtaining and interpreting seafood retail sales data and identifying trends to prioritise possible future research activity. However, it was noted that locating data on sales of seafood within Australia was a difficult task as there are no standardized data collection systems national or within States or territories of the seafood sales data in Australia and individual companies (eg supermarkets) either do not release data or obtaining such data incurs a significant cost.

There are, however some reports that focus on specific areas of sales within the seafood industry. CESSH staff reviewed a number of key publications and data sources to develop a discussion paper (Appendix 7) on recent retail sales of Australian seafood. Trend data was included where available. Following discussion with WAFIC and others in the industry, the next step was to decide who the end-users of the report would be and what additional data should be collected to make the document of value to the industry. However this work was ceased when the project was reviewed.

3.7 Overview of all Sub-Programs

Table 2 below, summarises the proposed objectives, methods and outputs of FRDC 2013.711 Sub-programs 2-5 between the reporting dates of January 2013 and June 2015. Current status of the outputs are described as well as explanatory notes when the research direction was changed.

Table 2: CESSH Project FRDC 2013-711: Sub-Programs 2-5: Detailed Objectives and Outputs 2013 – June 2015

SP2. Retailer 2020

Project	Objectives	Intended Outputs & Extension	Status at end of Project (June 2015)
Building brand loyalty in changing retail environments and mediums to maximise profitability and increase market share.	<ol style="list-style-type: none"> 1. To maintain currency of food and seafood retail trends 2. To understand how to use social media to its full potential and the potential impact social media has on seafood retail 	<ol style="list-style-type: none"> 1. Scoping report of current behaviours and proposed trends in Australian seafood retail. 2. Quarterly electronic communiqué and email distribution list established and operational within sectors of the Australia seafood industry interested in retail that specifically address trends nationally and internationally that could impact on the profitability of the Australian seafood industry. 3. Industry feedback 	<p>Scoping report of retail sales information in Australia (Appendix 7)</p> <p>Industry email distribution list/database: produced.</p> <p>Quarterly electronic communiqué: (not done due to resignation of CESSH communications expert then at direction of steering committee)</p> <p>Case Studies: changes in business practice based on trend data (not done)</p>

SP3. Food policy research

Project	Objectives	Outputs & Extension	Status at end of Project (June 2015)
Maintaining currency of information relating to food policy	<ol style="list-style-type: none"> 1. To maintain currency of expertise and knowledge in: regulation of food labelling and food laws; nutrition and health claims; nutritional dietary guidelines and the human health benefits of seafood to inform industry marketing initiatives and nutritional and health claims. 	<ol style="list-style-type: none"> 1. Summaries of issues of interest to the seafood industry relating to food laws and regulations provided on a regular basis to maintain currency. 2. Notification to industry of food labelling changes that have the potential to impact on their businesses 3. Submissions to FSANZ, NHMRC and other regulatory bodies commenting on 	<p>Regular communiqués with industry on food policy, nutrition and health claims through industry bodies (completed)</p> <p>Dissemination of relevant information to industry through formal and informal networks (produced a brochure, Appendix 6: Navigating the Food Standards Code: A guide for SME's)</p> <p>Submissions and comments on policy, guidelines etc as</p>

Project	Objectives	Outputs & Extension	Status at end of Project (June 2015)
		food labelling or health/nutritional/dietary guidelines that have the potential to impact on the seafood industry.	appropriate (completed).
Development of a nutrition resource for general practitioner waiting rooms	<p>1. To raise awareness of the benefits of eating seafood, as part of a healthy diet, in the prevention and management of chronic conditions.</p> <p>2. To develop a resource for use in GP waiting rooms that provides evidence about a diet high in seafood and its health benefits</p>	<p>1. Systematic review of evidence around seafood and health</p> <p>2. A GP waiting room magazine promoting the health benefits of seafood</p>	<p>Review of literature relating to the health benefits of regular consumption of seafood as part of a healthy diet (Appendix 2) and Health benefits of seafood for the prevention and management of chronic conditions: A systematic review (Appendix 1) GP resource (Appendix 3) and five, condition specific consumer "Seafood and health" booklets produced (Appendix 4A to 4E).</p> <p>Preliminary scoping of requirements for GP waiting rooms magazine and development of prototype. Production, distribution and evaluation not conducted at direction of steering committee.</p>
Development of nutrition resources for seniors	<p>1. To close a gap in the market for nutritional balanced seafood-based meals for designed for seniors</p> <p>2. To develop a series of nutritionally balanced meals suitable for these seniors using a variety of species</p>	<p>1. Consultation with seniors regarding preferences for types of seafood, style of ready meals preferred, cost enablers/barrier to seafood purchases, types of recipes and nutrition resources wanted and needed.</p> <p>2. At least five nutritional balanced seafood-based meals tailored specifically for seniors.</p> <p>3. A number of nutritional resources tailored to the specific needs of seniors.</p>	<p>Report on focus group consultation with seniors (Appendix 5A).</p> <p>Report on development and trial of meals with seniors (Appendix 5B). Individual Recipe cards produced. Designed seniors seafood resource with recipes and other handling and nutritional tips but not finalised at direction of steering committee (Appendix 5C).</p>

SP4. Research advisory services

Project	Objectives	Outputs & Extension	Status at end of Project (June 2015)
Provision of technical advice on supply chain optimization	1. To provide technical advice along the supply chain.	1. A fee for service technical service	No such costed advice achieved.
Building capacity in the seafood industry to develop research funding proposals	1. To build capacity within the seafood industry to apply for research funds and engage in and lead their own research programs in collaboration with researchers and scientists.	1. Audit of selected seafood companies with sufficient size, potential capability and capacity to apply for research funding. 2. Training of key personnel in the basic requirements of identifying a research need, developing a research proposal and applying for research funds. 3. A training module outlining the basic steps required to apply for research funding available online as a simple PDF document.	Identification of seafood businesses that have the potential to apply for and conduct research either in house or in partnership with others. (not done) Assist senior staff from five seafood businesses in WA to gain competencies in developing research funding proposals (not done)
Food technology advice	1. To provide food related advice on nutritional composition and food labeling, including nutritional information panels for seafood	1. A review of food laws, guidelines, regulations and codes governing food products in Australia will be interpreted and all relevant information pertaining to seafood will be recorded electronically 2. Consultation with industry on preferred formats for information transfer to industry.	Provision of relevant information to industry on food laws, regulations and guidelines (see labelling guide Appendix 6). Ongoing dissemination of food policy information to industry.
Standardisation of existing SQMI	1. To streamline existing SQMI resources into a standardised electronic format in user-friendly	1. Extract text from existing SQMI documents (all 18 available in PDF format	All 18 documents collated and text extracted. Text supplied to WAFIC for further action, review of text and development of agreed format).No further action by

Project	Objectives	Outputs & Extension	Status at end of Project (June 2015)
documents	language in simple PDF formats	only). 2. Provide text in word format to WAFIC so that it can be updated. 3. Develop a standardised format for the SQMI documents. 4. Reformat the revised SQMI documents into the new format and convert to PDFs. 5. Provide PDFs to WAFIC for distribution.	WAFIC, therefore no further action by CESSH.

SP5. Education and extension

Project	Objectives	Outputs & Extension	Status at end of Project (June 2015)
Development of the Curtin Seafood Business Resilience Program	1. To develop the Curtin Seafood Business Resilience Program 2. Trial the CSBR Program with small seafood business owners in a regional area in WA	1. Development of Curtin Seafood Business Resilience (CSBR) Program 2. Consultation with industry re preferred mode/s of delivery of program to industry 3. Pilot of CSBR program in WA and report on outcome of pilot program	Program was not developed at request of CESSH steering committee.
Document seafood industry training and extension and opportunities for the seafood community	1. To document existing and proposed training courses/ modules/ degrees that are relevant to building capacity within the seafood industry workforce. 2. To provide information to industry about existing post harvest	1. A systematic review of existing training and education opportunities 2. Consultation with major sectors of the seafood industry to identify and document industry post harvest training needs.	Database of training opportunities developed and summary document produced ID post harvest training needs through consultation with industry, subsequent update of database and dissemination to industry.

Project	Objectives	Outputs & Extension	Status at end of Project (June 2015)
	<p>training opportunities.</p> <p>3. To identify gaps in industry post harvest training needs</p>	<p>3. Consult with seafood businesses, owners or operators who have completed training within the last decade to discuss their experiences</p> <p>4. Develop database of training and education opportunities relevant to the seafood industry</p> <p>5. Dissemination of information to industry</p>	

4. Conclusions

This report summarises the outputs of FRDC 2013-711: Sub-Programs 2-5 between January 2013 and June 2015. A number of studies in the health benefits and seafood, seafood policy and education and training areas were completed or partially completed before the project was reviewed.

Much of the research and extension material remains pertinent to current issues for the Australian seafood industry, and consideration may be given to updating and further extending some of the outputs.

5. Recommendations

If funding could be obtained, the following activities are recommended.

- Broader extension of the GP resource and consumer specific booklets relating to seafood health benefits and specific chronic conditions.
- Finalise and publish the draft Seafood for “seniors” recipe book.
- Update the seafood labelling guide and the SQMI documents.
- Update and develop communication strategy for SERD.

6. Extension and Adoption

6.1 General Extension and Adoption

Table 3 outlines how the outputs of the project were, and continue to be, extended and communicated to the end user, including managers, other researchers, industry and where applicable the broader community.

Table 3: CESSH Outputs, Status and Uptake

Subprogram and Appendix number	Resource	Where available	Uptake/comment from industry
3 (Appendix 1)	Systematic review of seafood and health and chronic conditions	CESSH files	Formally published, consider broader extension.
3 (Appendix 2)	Literature review of health benefits of seafood as part of a healthy diet	CESSH files	Formally published. Journal articles OA Women’s Health 2014;3(1): 142-145 & Journal of Men’s Health 2011;8:252-257 Consider broader extension.
3 (Appendix 3)	GP Guideline for seafood and health	CESSH website (some printed)	Very well received, consider broader extension.
3 (Appendix 4)	Consumer documents	CESSH website (some	Very well received, consider

Subprogram and Appendix number	Resource	Where available	Uptake/comment from industry
	on seafood and health (five conditions)	printed) WAFIC website	broader extension.
3 (Appendix 5A)	Results of focus group session with seniors	CESSH files	Consider publication in peer reviewed journal
3 (Appendix 5B)	Results of meals and sensory session with seniors	CESSH files Presented at World Seafood Congress 2015	Published in peer reviewed journal – British Journal of Nutrition 2015;113(10):1499-1517
3 (Appendix 5C)	Seniors resource and recipes	Completed. Resource provided to residents in Swancare Homes Pty. Available as part of a published book and disseminated through a peer reviewed journal article in an international journal. Recipes developed and available online.	Online recipes published. Book published: ISBN 978-1-74261-198-3. Discussion with Centre for Research on Ageing, Alzheimer’s Australia and Maggie Beer Foundation to promote specific nutritional needs of seniors including seafood as essential to their diet. Good progress made in this space with the entities actively promoting seafood. Opportunities for industry to increase visibility in the marketplace with this growing consumer group.
2	Seafood Industry communication list	CESSH files	Suggest this list could be amalgamated with FRDC list
3 (Appendix 6)	Labelling guideline for industry	CESSH website	Well received by industry, needs updating
4	Text from 18 SQMI documents	With WAFIC	Previously have been very well received by industry ... Consider updating.
5	List of seafood training resources	CESSH files	Consider updating.
5	Discussion paper on seafood retail sales trends.	CESSH files	

6.2 Publications (2013 to 2015)

Books

1. Creegan R, **McManus A** (Martins R Ed). Understanding Alzheimer's Disease. Pan Macmillan Australia 2013 ISBN 978-1-74261-198-3
2. Hunt W, **McManus A**. (Hall-Moran V Ed). Maternal and infant nutrition and nurture: Controversies and challenges. Quay Books 2013 ISBN 978-1-85642-435-6

Peer Reviewed Journal Articles

1. Creegan R, Hunt W, **McManus A**, Rainey-Smith S. Diet, nutrients and metabolism: Cogs in the wheel driving Alzheimer's Disease pathology? *British Journal of Nutrition* 2015; 113(10): 1499-1517. (Impact factor 3.342)
2. Hunt W, **McManus A**. Women's health care: The potential of long-chain Omega-3 polyunsaturated fatty acids. *OA Women's health* 2014; 3 (1):142-145. doi.org/10.4172/2167-0420.1000142
3. Nichols P, **McManus A**, Krail K, Sinclair A, Miller M. Recent advances in omega-3: Health benefits, sources, products and bioavailability. *Nutrients* 2014; 6: 3727-3733 doi:10.3390/nu6093727 (Impact factor 3.276)
4. **McManus A**, Hunt W, Storey J, McManus J, Hilhorst S. Perceptions and preferences for fresh seafood in an Australian context. *International Journal of Consumer Studies*. 2014; 6:1-7 doi:10.1111/ijcs.12076 (Impact factor 0.521)
5. **McManus A**. Australian Dietary guidelines and the environmental impact of food 'from paddock to plate'. *Medical Journal of Australia* 2013; 199(7): 457 (Impact factor 2.853)
6. **McManus A**, Hunt W. Consumption of omega-3 fatty acids and women's health. *OA Women's Health* 2013; 1 (2):11-20 (IF 1.417)
7. **McManus A**. Education innovation in primary care. *Australasian Medical Journal* 2013; 6(4):203-204
8. **McManus A**. Health promotion innovation in primary health care. *Australasian Medical Journal* 2013; 6(1):15-18

Published reports

1. Hunt W, **McManus A**, Investigation into consumer preference for West Australian potatoes March 2015. Centre of Excellence Science, Seafood & Health (CESSH), Curtin University, Perth. Report 25032015 March 2015
2. **McManus A**. Navigating the Food Standards Code: A guide for small to medium enterprises. Centre of Excellence Science Seafood & Health (CESSH), Curtin University Australia. Funded by Seafood CRC Project 2014/705 Report 15122014 December 2014
3. **McManus A**. Hunt W, McManus J, Creegan R. Investigating the health and well-being benefits of recreational fishing in Western Australia. Centre of Excellence Science, Seafood & Health (CESSH), Curtin University, Perth. Report 22092014 September 2014 ISBN 978-0-9872086-3-7
4. Hunt W, **McManus A**, Creegan R, Tonkin R. Investigation into consumer preference for West Australian potatoes July 2014. Centre of Excellence Science, Seafood & Health (CESSH), Curtin University, Perth. Report 31072014 July 2014
5. **McManus A**, Pohlenz-Saw J, McManus J, Hunt W. Health benefits of seafood for the prevention and management of chronic conditions: A systematic literature review. Centre of Excellence Science, Seafood & Health, Curtin University, Perth. Report 310314 March 2014 ISBN 978-0-9872086-2-0
6. **McManus A**, Pohlenz-Saw J, McManus J. Review of literature relating to the health benefits of regular consumption of seafood as part of a health diet. Centre of Excellence Science, Seafood & Health, Curtin Health Innovation Research Institute, Curtin University, Perth. Report 311013 Oct 2013

Conference presentations

1. **McManus A, Hunt W.** Fish, seafood and Omega 3 fatty acids in maternal and infant nutrition: Implications for public health messages. *5th International Conference on Maternal and Infant Nutrition and Nurture: Relational, Bio-cultural and Spatial Perspectives*. University of Western Sydney, NSW 5-7 November 2014.
2. **McManus A.** The health benefits of seafood for people living with diabetes. Dietitians Association of Australia WA Branch. Symposium: *There is no such thing as a diabetes diet, or is there?* The Boulevard Centre Cambridge Library Building Floreat WA 10 October 2014.
3. **McManus A, Hunt W, McManus J, Storey J, Hilhorst S.** Consumer understanding: Fresh, frozen, chilled and thawed. Asia Pacific Food Innovation Conference. Technology Park, Bentley Western Australia. 9-12 June 2013
4. **McManus A.** Health messages and new food labeling legislation. Marketing 'Cram' Conference. Adelaide Education Development Centre Hindmarsh, Adelaide. 1 May 2013.
5. **McManus A.** Putting research into practice: Benefits to the Australian seafood industry. Department of Commerce, Perth Western Australia. 3 April 2013.
6. **McManus A.** Nutrition and Alzheimer's Disease: Another piece of the puzzle. Kingia-Tindara Auxillary. Swan Care. Bentley Western Australia. 26 February 2013.
7. **McManus A.** CESSH research program: servicing the research needs of the Western Australian seafood industry. Western Australian Fishing Industry Council Board. Fremantle Western Australia .21 February 2013.
8. **McManus A.** Seafood post harvest research in Australia. Western Australian License Holders Engagement Project. Hillarys Boat Harbour, Hillarys. Western Australia. 30 January 2013.

Media

1. **McManus A.** WA's fresh food future open for bidding: asset fire sale continues. Story by Emma Young WA Today and Brisbane Times 3 July 2015.
2. **McManus A, Hunt W, Storey J, White J.** Fishing your way to a healthier mind, body and spirit. OutdoorsFIRST.com Reference of story by Jenny Falconer. 10 November 2014.
3. **McManus A.** Seafood consumption for brain health. ABC 774 Melbourne with Compere Katy Gallichio Afternoon Show 31 October 2014
4. **McManus A.** Numbers are up for year 12s. Adelaide Advertiser, Adelaide Report by Tim Williams & Dianne Mattsson. 15 October 2014
5. **McManus A.** The get smart diet: Seven foods for brain health. The New Daily. Report by Susannah Guthrie. 14 October 2014
6. **McManus A.** Seafood and health. Sydney Morning Herald. Carla Grossetti reporter. July 2014
7. **McManus A.** Women with breast cancer, children with autism and seniors benefit from dropping in a line. ABC Online <http://www.abc.net.au/local/audio/2013/12/20/3915369.htm> for mp3 file 20 December 2013
8. **McManus A.** Healthy and affordable seafood-based meals at Christmas. CurtinFM Afternoon Program Compere Jenny Seaton 19 December 2013