

# Developing a dynamic regional brand – focus on flavour

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THE UNIVERSITY  
OF QUEENSLAND  
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THE UNIVERSITY  
OF QUEENSLAND  
AUSTRALIA



# **FRDC PROJECT 2010/228**

## **DEVELOPING A DYNAMIC REGIONAL BRAND – FOCUS ON FLAVOUR**

### **FINAL REPORT**

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*Jan 2013*

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## NON TECHNICAL SUMMARY

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### OBJECTIVES:

1. To develop a set of accurate and informative educational tools delivering against trade requirements
2. To establish the basis of a uniform and coordinated educational program that features a target list of seafood species available on the Eyre Peninsula
3. To capture highly synchronised technical and creative communications

### NON TECHNICAL SUMMARY:

#### OUTCOMES ACHIEVED TO DATE

This project has delivered technical sensory language that accurately and precisely describes the flavour and texture of key seafood species to the seafood industry of the Eyre Peninsula. Industry members and producers have been trained on the sensory properties of their products and are equipped with knowledge of how to apply sensory language to their products for their customers.

The seafood industry of the Eyre Peninsula has embraced the “Eyre Peninsula Seafood Flavour wheel” and is already using it in the promotion of their products. In addition local, national and international seafood producers and end-users have indicated a strong interest in the results and outputs of this project and the potential application of the seafood flavour wheel in their respective businesses.

The uptake of the outputs from this project by the industry will support and strengthen the Brand Eyre Peninsula (Seafood Frontier) and increase consumer and customer value for seafood products from this region.

The Eyre Peninsula seafood industry formed Brand Eyre Peninsula in 2006, a collaborative market development program aimed to increase sales and market position in the domestic and export market. Integral to the brand is the education of the species' attributes to all key stakeholders of the value chain including seafood wholesalers, retailers, food service and media.

The main objective of this project was to develop accurate information tools that could be used to educate customers on the characteristic sensory properties of commercially important seafood products from the Eyre Peninsula region.

Sensory analysis was completed for 11 seafood species of Eyre Peninsula including Blacklip and Greenlip abalone, Southern Rocklobster, Southern Calamari, Spencer Gulf Western King Prawns, Snapper, King George Whiting, Southern Bluefin Tuna, Yellowtail

Kingfish, Native Oysters, Pacific Oysters and Blue Mussels. Including comparator products, 39 seafood products (including various species) from across Australian and New Zealand were assessed.

Sensory evaluation involved a panel of at least 10-14 trained sensory assessors over numerous sessions from February – September 2012. Careful attention was given to product cooking methodology and presentation formats. This ensured that the intrinsic sensory properties of each seafood species could be directly assessed (e.g. no seasoning or sauce added). In addition, the seafood products were tasted in a format that would commonly be used to serve to consumers.

During the sensory evaluation sessions, panellists developed a sensory vocabulary or 'lexicon' to describe the appearance, aroma, texture, flavour and aftertaste of each of the seafood products presented. This vocabulary formed the basis of the developed "Eyre Peninsula Seafood Flavour Wheel"– a tool used to assist users describe the sensory properties of seafood.

The quantitative and qualitative data gathered from the sensory evaluation sessions was translated into discrete product descriptions ('tasting notes') for each of the species and product format tasted. These descriptions are intended to be used by industry to promote the unique sensory characteristics of the seafood products from the Eyre Peninsula region.

The data was explored to determine if common themes could be found across all Eyre Peninsula seafood products. It was found that Eyre Seafood can be defined by:

- High flavour intensity. Eyre Peninsula seafood products were always among the highest in flavour (and often aroma) intensity compared with comparator products.
- Depth of complexity. Eyre Peninsula products were found to always have a range of flavours (multidimensional) present simultaneously.
- Vegetative or herbaceous notes. The Eyre Peninsula seafood products all exhibited a 'vegetative' or 'herbaceous' note either in aroma and/or flavour which was usually secondary to the main flavour/s type present. Product from other regions did not always exhibit a vegetative or herbaceous flavour/aroma.
- Firm but tender texture.

The information developed by this project was promoted through workshops and by public media to producers from the seafood industry, chefs, commercial users and consumers.

The information tools developed in this project will be used as a training guide benchmark and has the potential to expand to an Australian guide, inclusive of all seafood species. Specifically, the discrete sensory descriptions developed will assist the lack of knowledge and appreciation for the flavours of key seafood species specific to the Eyre Peninsula region.

Equipped with this knowledge, a united industry marketing approach will effectively connect customers with an experience of the unique regional flavour qualities of Eyre Peninsula's premium seafood. Through this experience, customers will learn to recognise the sensory attributes of Eyre Peninsula seafood and distinguish these products from those originating from other Australian and international regions.

**KEYWORDS: Eyre Peninsula, Seafood flavour, Sensory evaluation, lexicon.**

## **ACKNOWLEDGMENTS**

This project was funded by Fisheries Research and Development Corporation (FRDC) through a Tactical Research Fund (TRF). The project was managed by Kylie Giles, Project Manager - FRDC.

The conception and vision of this project was a direct outcome of previous work conducted by Lester Marshall (Coffin Bay oyster farmer and Seafood Officer), through his Nuffield Scholarship research conducted in 2008 [1]. Together with support from Patrick Hone, Managing Director FRDC, this project was formed.

Significant support was provided to this project through Regional Development Australia's Whyalla and Eyre Peninsula office in terms of staff time, particularly Stacey Fallon, Amanda Bridge, Charmaine Triffitt and Mark Cant, and funding towards transport of product from Port Lincoln to Brisbane.

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- Brendan Guidera (Pristine Oyster Farm)
- Lester Marshall (Coffin Bay Oyster Farm)
- Mark Andrews (South Australian Seafood's – Boston Bay Mussels)
- Simon Clark (Spencer Gulf and West Coast Prawn Fisherman's Association Inc.)
- Damon Edmunds (Streaky Bay Marine Products)
- Jim George (Western Abalone Processors)
- Gail Spriggs (Australian Southern Exporters)
- Craig McCathie (Port Lincoln Fresh Fish Co.)
- Rick Kolega (Sekol Farmed Tuna Pty Ltd)
- Kristina Georges (Managing Director, Samies Girl, Hamilton, Qld)
- Steve Murphy (Australian Ocean King Prawns, Hervey Bay, Qld)
- Rodney Treloggen (Chief Executive Officer, Tasmanian Southern Rocklobsters Fishermen's Association, Tas)
- Brett Arlidge (Kailis Bros, Cairns)
- Grant Muir (Custom Seafood Distributors, Qld)
- Chris Bourke (Moreton Bay Seafood's, Qld)



## BACKGROUND

From 2007 - 2009 Nuffield Scholar and Eyre Peninsula oyster farmer Lester Marshall undertook a research project “How to Develop a Dynamic Regional Brand: To Restore Health and Wellness to Rural Economies”. The main objective of Marshall’s study was to develop a working model for regional branding that would work across all regions of Australia, focussing mainly for the seafood sector. His research involved a ‘global focus tour’ across six different countries over 42 days visiting various food producers and learning from the experiences of many different businesses and individuals.

Findings from Marshall’s report detail the need for developing a brand for the region (Eyre Peninsula) and the need to make an “emotional connection” with your target market through describing the region’s point of difference. Marshall notes that the “...point of difference is the aroma, texture and flavour that are produced from our seafood products from within the different regions of Australia”, however, the “Australian seafood industry can’t communicate its point of difference” [1].

A key recommendation from Marshall’s study was to develop “tasting notes” that are “clear and easy to understand” which “describe the aroma, texture and flavour of the regions branded seafood products”.

A direct outcome of Marshall’s research was the development of the brand Eyre Peninsula “Australia Seafood Frontier” which positions the regions seafood industry as a leader in the Australia domestic market.

The Eyre Peninsula Regional Development Board undertook a “Seafood Mapping” program which identified key project priorities for each seafood sector. The consultation involved association executive officers and leading businesses. The proposed project involving development of a “Seafood Flavour Wheel” was identified as a Top 5 priority for all sectors interviewed.

Communicating the experience seafood flavour and texture is essential for industry to appropriately market the value of their products and connect with customers and consumers. The sensory properties of seafood are a critical determinant in consumer acceptance and enjoyment. Although consumers’ initial purchase will be based on price and visual cues such as colour and size, it is positive experiences of aroma, texture and flavour of seafood that will ensure customer loyalty in the future.

The sensory experience of seafood can be broadly divided into visual characteristics, aroma (smell), and in-mouth texture, flavour and aftertaste. While visual characteristics are obviously sensed by our eyes, aroma and flavour are experienced through a multi-modal combination of our senses. These include the taste-buds on our tongue (detecting basic tastes of salt, sweet, bitter, sour and umami), our olfactory system (detecting volatile aroma/smell components) and receptors located on the inner surface of the mouth which detect sensations such as metallic, astringency, heating and cooling characteristics. Texture is a physical sensation detected by chewing and feeling the structure of the sample within the mouth giving.

A flavour wheel or sensory lexicon is a tool used to record and describe the sensory properties of a target food or beverage [2]. The main phases common to the development of any flavour lexicon include appropriate “frame of reference” sample collection, language generation, and designation of definitions and references before a final descriptor list can

be determined [3]. This technical dictionary can be applied as a powerful research tool to profile sensory properties or used by industry to describe, compare and monitor the flavour of foods in production.

Sensory lexicons have been developed and published for a broad range of food products and typically focus on premium consumer foods such as wine [4-6] or cheese [7-9]. Lexicons have also been developed for specific seafood products in isolation [10, 11] for a specific purpose, or to compare within a species [12-14]. No reports were found in the literature that related to lexicon development for a diverse range of seafood products within a common geographical region.

## **NEED**

The Eyre Peninsula seafood industry formed Brand Eyre Peninsula in 2006, a collaborative market development program aimed to increase sales and market position in the domestic and export market.

Integral to the brand is the education of the species' attributes to all key stakeholders of the value chain including seafood wholesalers, retailers, food service and media. The results of market development initiatives have been communicated to the owner, head buyer or executive chef of businesses, however, the program failed to support training for key staff such as restaurant front of house and retail counter staff. There is a need for a simple, cost effective training tool due to the high turnover of these positions.

Australian and export clients have consistently requested a "Seafood Flavour Wheel" to assist in menu planning and tasting notes for chefs and sommeliers. Once developed, this tool would be distributed to an initial 500 existing clients to support immediate industry and consumer education. The development of the "Seafood Flavour Wheel" has an extensive level of support from its current client base.

The proposed "Seafood Flavour Wheel" will be a training guide benchmark and has the potential to expand to an Australian guide, inclusive of all seafood species. Specifically, the development of the Eyre Peninsula "Seafood Flavour Wheel" will assist the lack of knowledge and appreciation for the flavours of a target group of seafood species specific to that region.

Equipped with this knowledge, a united industry marketing approach will effectively connect customers with an experience of the unique regional flavour qualities of Eyre Peninsula's premium seafood.

Through this experience, customers will learn to recognise the sensory attributes of Eyre Peninsula seafood and distinguish these products from those originating from other Australian and international regions.

## **OBJECTIVES**

1. To develop a set of accurate and informative educational tools delivering against trade requirements - **ACHIEVED**
2. To establish the basis of a uniform and coordinated educational program that features a target list of seafood species available on the Eyre Peninsula - **ACHIEVED**
3. To capture highly synchronised technical and creative communications - **ACHIEVED**

## **METHODS**

### **General**

A literature review was conducted at the outset of the project to identify previously published sensory work conducted for the key species identified for evaluation in this project. The review is attached in Appendix 3 : Summary of Literature review, page 76. Vocabulary from the review was summarised for each species (or closely related species) and provided to sensory panellists to use if required during panel training sessions.

Prior to designing experiments and planning the research, a target list of products / species and key producers / suppliers was developed together with Project Officers from Regional Development Australia Board - Whyalla and Eyre Peninsula. Individual meetings were held with each target producer / supplier during a 3-day trip to Port Lincoln (17-19<sup>th</sup> Aug 2011) to gather information regarding product availability, seasonality, suitable comparator products, competitor products, cuts and cooking/presentation formats, key markets, typical end use / consumption of product, product quantities required, storage transport options. These meetings were also used to discuss the project plan and outputs with the industry and to gather relevant feedback.

In addition to industry consultations, information was gathered from key local chefs (for example, Chef David Pedro, Sarin's restaurant, Port Lincoln, SA) and local Queensland-based chef's regarding handling and preparation of samples. Information was also collected from seafood purveyors / suppliers, and through desk-top research wherever possible to validate and confirm the accuracy and reliability of information.

Details collected from product suppliers during initial discussion regarding product-specific information is summarised in Appendix 4 : Eyre Peninsula supplier details and summary of product specific information, page 82.

Optimising timing for product quality, nine discrete sensory descriptive analysis trials were planned between February and September 2012 (as shown in Table 1). Due to the limited time-frame of the study, trials were planned over two weeks involving 4-5 training sessions and 3-4 formal sessions with a maximum of 4 samples per trial. Should more time have been available, it would have been ideal to increase the number of training sessions, however, the training conducted was sufficient considering the objectives of the study.

Products / species were combined into the same sensory trial where a relevant and natural comparison could be made. For example, Native together with Pacific Oysters, Yellowtail Kingfish together with Southern Bluefin Tuna, Snapper together with King George Whiting. The nine trials were broadly categorised as: abalone; sardines, rocklobster, calamari, prawns, 'white-fish', 'oily-fish', oysters and mussels (Table 1).

Where there were several product cuts / formats to be assessed for any one product, it was not possible to include comparator product from other regions due to the capacity of the panel within the timeframes required. For example, 7 different product format variations of Greenlip and Blacklip abalone were required for assessment leaving no room for other comparator products.

Due to issues sourcing suitable Australian Sardines for the study during 2012, the second sensory trial for Australian Sardines and comparators was not conducted as part of this project. Thus only eight sensory trials were conducted.

Across the eight sensory trials conducted a total of 39 samples were tasted and individually assessed, comprising 24 different species from across Australia.

A summary of the sensory trials, including panel involvement, samples numbers, training sessions and presentation formats of each species, is given in Table 1.

**Table 1 General summary of descriptive analysis trials conducted**

<b>Trial</b>	<b>Samples, origin (serving method)</b>	<b>Sample number</b>	<b>Sessions</b>	<b>Panellists</b>	<b>Date of trial</b>
<b>1</b>	Abalone: Blacklip Abalone wild canned, SA (heated) Blacklip Abalone wild par-boiled, SA (sashimi) Blacklip Abalone wild, SA (wok-fry) Greenlip Abalone wild, SA (wok-fry) Greenlip Abalone farmed brined, SA (sashimi) Greenlip Abalone farmed, SA (wok-fry) Greenlip Abalone farmed, SA (sous vide)	7	5 training 3 formal	12	20 <sup>th</sup> Feb – 28 <sup>th</sup> Feb 2012
<b>2</b>	Australian Sardines ( <i>Sardinops sagax</i> ) (not conducted)	-			
<b>3</b>	Southern Rocklobster, SA (hot) Southern Rocklobster, SA (cold) Southern Rocklobster, Tas (cold) Tropical Rocklobster, Nth Qld (cold) Western Rocklobster WA (cold)	5	4 training 3 formal	12	17 <sup>th</sup> Apr - 1 <sup>st</sup> May 2012
<b>4</b>	Southern Calamari, SA (wok-fry) New Zealand Arrow Squid, NZ (wok-fry) Gould's Squid, SE Qld (wok-fry)	3	4 training 3 formal	13	10 <sup>th</sup> May - 17 <sup>th</sup> May 2012
<b>5</b>	Spencer Gulf Western King Prawns, SA (cold) Ocean Kings, Hervey Bay Qld (cold) Black Tiger Prawn, SE Qld (Farmed) (cold) Redspot King Prawn, Nth Qld (cold)	4	4 training 3 formal	12	22 <sup>nd</sup> May - 31 <sup>st</sup> May 2012
<b>6</b>	King George Whiting, SA (pan-fry) Yellowfin Whiting, Shark Bay, WA (pan-fry) Snapper, SA (pan-fry) Goldband Snapper, NT (pan-fry)	4	4 training 3 formal	12	12 <sup>th</sup> Jun - 21 <sup>st</sup> Jun 2012
<b>7</b>	Southern Bluefin Tuna Otoro, SA (sashimi) Southern Bluefin Tuna Chutoro, SA (sashimi) Southern Bluefin Tuna Akami/loin, SA (pan-fry) Yellowtail Kingfish Otoro, SA (sashimi) Yellowtail Kingfish Akami/loin, SA (pan-fry) Atlantic Salmon Otoro, Tas, (sashimi) Atlantic Salmon Akami/loin, Tas (pan-fry)	7	4 training 3 formal	14	10 <sup>th</sup> Jul - 25 <sup>th</sup> Jul 2012

<b>Trial</b>	<b>Samples, origin (serving method)</b>	<b>Sample number</b>	<b>Sessions</b>	<b>Panellists</b>	<b>Date of trial</b>
<b>8</b>	Native Oysters, SA (natural) Pacific Oysters, triploid, SA (natural) Pacific Oysters, diploid, SA (natural) Sydney Rock Oysters, Nth NSW (natural) Pacific, Tas (natural)	5	4 training 4 formal	13	6 <sup>th</sup> Aug - 21 <sup>st</sup> Aug 2012
<b>9</b>	Blue Mussels, SA (steamed) Blue Mussels, Tas (steamed) Greenlip mussels male, NZ (steamed) Greenlip mussels female, NZ (steamed)	4	4 training 3 formal	10	4 <sup>th</sup> Sept - 18 <sup>th</sup> Sept 2012

During the early stages of the project, a number of preliminary screening and training sessions were held with panellists (Nov-Dec 2011). The purpose of these trials was primarily to give the panel more experience tasting such a diverse range species and to sharpen their vocabulary development skills. It also provided the opportunity to practice and develop product handling, preparation, cooking and presentation techniques.

Conventional quantitative sensory descriptive analysis was employed for the sensory analysis of the seafood samples [15]. A 24-membered experienced trained panel were involved across the eight discrete trials, all of whom were staff and students of the Health and Food Sciences Precinct, Coopers Plains. At minimum 10 and a maximum 14 panellists were involved in any one trial depending on availability. They ranged in age from 22 to 62 years with an average age of 39 years. There were 11 male and 13 female panellists comprising a range of nationalities and ethnic backgrounds including mainly Australian, Chinese, Taiwanese, French, Italian, Indian, Spanish and African (Zimbabwean).

Typically, training sessions were conducted over one and a half weeks (4 or 5 sessions, each of ~45 minutes duration), and involved 3 or 4 discussion sessions and one individual practice session using the computers in the booths. Training and discussion sessions took place in an open board room where participants evaluated products both individually and as a group followed by discussion led by panel leader Smyth. During training, the panellists generated a set of descriptive terms using the seafood samples and using a preliminary list of sensory vocabulary that had been collected for that product type from the preliminary tastings and literature review<sup>i</sup>. The terms were listed by the panel leader and, through panel discussions, redundancy was removed from the vocabulary list leaving the most accurate and relevant language. By consensus, a list of appearance, aroma, in-mouth texture, flavour and aftertaste terms were selected to rate during the formal sessions. The practice booth session ensured the panel were familiar with the set-up to be used during the formal assessment sessions, and were confident rating the samples using the scales and terms developed. For each sensory trial the attributes selected including their definitions are given in Appendix 5 : Sensory descriptions and definitions used during each trial, page 85. Sensory reference standards were developed for each aroma term where possible during the training and usually consisted of food stuffs or other organic materials. The composition of each reference standard developed in this study for each sensory trial is given in Appendix 6 : Composition of Sensory Reference standards

<sup>i</sup> For the 'oily fish' training sessions, a Japanese texture lexicon was used to assist panellists in developing texture terms that could be readily translated to Japanese (also shown in Appendix 5 : Sensory descriptions and definitions used during each trial, page 85).

used for each sensory trial, page 103. Every single sample was presented at least 3 times during the training phase.

Formal rating sessions were held in which panellists evaluated the seafood samples in triplicate (3 or 4 sessions, each of ~20 minutes duration). Formal evaluation sessions were typically held within a few days of each other and always within one week. Depending on the trial, between 3 and 7 samples were presented per replicate to each panellist each session in randomly ordered coded plastic cups with lids, or foil tart trays covered with foil (for hot samples), or in an ice tray (as for oysters). A randomised presentation design was used within each replicate for all trials, except for abalone and calamari. Abalone and calamari were found to change dramatically in terms of sensory properties after cooling and needed to be presented immediately after cooking, thus the panel tasted these in the same sequence within replicates.

Formal assessments were conducted in the sensory laboratory at the Health and Food Sciences Precinct at Coopers Plains, Brisbane, which contains twelve isolated booths equipped with computers, temperature control (22°C) and under day-light equivalent lighting. During the formal sessions, the panel were also presented with the set of freshly prepared sensory reference standards, a printed attribute definition list and fresh drinking water for rinsing between samples. For certain products, namely oysters, water crackers were also presented to assist with palate cleansing. Panellists were asked to smell the reference standards and then to evaluate each sample and rate the intensity of the attributes using an unstructured 15 cm line scale (0-10), anchored typically from none to high.

### ***Data acquisition and analysis***

The data acquisition software used was Compusense *five* (version 5.0.49, Compusense Inc, Guelph, Ontario, Canada). Data were exported into Microsoft Excel and statistically analysed using JMP (version 6.0, SAS Institute Inc., Cary, NC, USA).

Analysis of variance (ANOVA) was performed on the raw data set (panellists x replicates x samples) for each sensory attribute to determine if there were significant differences among the samples. The mean scores were calculated from the summarised data set and Tukey-Kramer HSD was applied to determine ranking of sample scores within attributes.

### ***Development of seafood flavour wheel and product descriptions***

Sensory language collected from the eight discrete sensory trials was collected and redundancy (replication) removed according to the definitions developed. The vocabulary was grouped logically according to sensory property (i.e. appearance, aroma/flavour, and texture) and further grouped systematically into sensory term categories. This process was assisted by referring to grouping systems applied in other existing sensory lexicon tools (refer to [4, 16-19]). A draft version of the 'Eyre Peninsula Seafood Flavour Wheel' was developed and used during industry consultation sessions.

The individual product descriptions were developed from plots of the mean data for each product focussing on major attributes and points of difference between comparator products. Attribute descriptions and definitions together with intensity ratings were incorporated into written descriptions for each product. Training session 'brainstorming' vocabulary data for each product was also re-visited to assist with defining the unique qualities of each product. Full attribute descriptions were developed and subsequently summarised and shortened, without compromising accuracy, to suit publication material.

The flavour wheel and product descriptions were modified appropriately in accordance with feedback from sensory panellists, chefs, industry and other users. The final sensory lexicon developed consists of a concise list of attributes that describe the breadth of the flavour types exhibited in the samples presented in this study.

### **Sample collection, storage, and preparation and presentation format**

#### ***Trial 1 - abalone***

All abalone product was sourced from Eyre Peninsula, SA, and transported frozen by air from Port Lincoln, SA and collected from Brisbane airport. Product boxes were immediately temperature logged and stored at -30°C until used. Canned product was stored at 2°C.

All product was freshly prepared on the same day as each tasting session. For all abalone samples, 10-15 g was served to each panellist during the assessment sessions.

For wok-fried product, abalone were semi-thawed overnight at 2-4°C, scrubbed with a brush to clean, trimmed (removing frills and foot), and sliced very thinly (~2 mm) short-ways across the foot and pieces were cut in half. Sliced sample was patted dry with paper towel, covered and kept chilled at 4°C until required for cooking. For cooking, the scrupulously clean wok was heated until smoking, rice-bran oil (selected for its high smoking point and low flavour influence) sprayed into the wok and brought back to just smoking, 150-200g sliced abalone added and constantly tossed 5-10 seconds until just curling at the edges and immediately removed and served to the panel in small foil tart trays. Batches of sample were cooked in this way on demand.

Canned product was removed from 2°C immediately before use, trimmed as described above and sliced as thinly as possible short-ways across the foot. Canned product was served to the panel cold in foil tart trays at room temperature.<sup>ii</sup>

The sous vide involved cooking the abalone from frozen in a vacu-sealed bag in a water bath at 70°C for 24 hours. Product was removed from the water bath, trimmed as above, sliced as thinly as possible short-ways across the foot. Sous vide product was kept warm and presented immediately in small foil tart trays.

Sashimi abalone were semi-thawed overnight at 2-4°C, scrubbed with a brush to clean, trimmed (removing frills and foot), and sliced very thinly (~2 mm) short-ways across the foot and pieces were cut in half. Pieces were served in small foil tart trays, covered and kept at 4°C until served directly to panellists.

#### ***Trial 3 – Rocklobster***

Southern Rocklobster was sourced live from Eyre Peninsula, SA (8 live, ~2.7 kg each, total 21.7 kg) and from Custom Seafood Distributors, Qld (5 live, ~1.7 kg each, total 8.6 kg), and Tropical Rocklobster was sourced from Kailis Bros, Cairns, North Qld (7 live, ~1.2 kg each, total 9.5 kg). A box of 'sashimi-grade' frozen Western Rocklobster was sourced from Custom Seafood Distributors, Qld (10 whole, ~0.5 kg each, total 5.0 kg).

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<sup>ii</sup> Note: on advice from supplier, canned abalone was reassessed informally in November 2012 after heating in can for 4 hours. Sensory attributes were found to be more intense versions of the cold canned product.

On arrival each live Rocklobster was weighed and transferred to a 16°C specialised seafood tank until required for cooking and tasting. Each type and source of Rocklobster was kept separate.

All product was killed using a salt ice slurry and cooked the day before each tasting session and kept overnight at 2°C. For all Rocklobster samples, 20-30 g was served to each panellist during the assessment sessions.

Prior to cooking, Rocklobsters were killed in a salty (3.5%) ice slurry at 1 °C (~30 minutes). Rocklobsters were removed and transferred into a boiler (containing 1 : 10 ratio, product : sea water) at rolling boil. Rocklobsters were cooked for approximately 1 - 1.5 minutes per 100 g for small Rocklobsters (<1 kg). For example, a 600 g Rocklobster was cooked for 9 minutes while a 1 kg Rocklobster was cooked for 12 minutes. Rocklobsters of >1 kg size were cooked for 12 minutes plus 1 minute extra for every 100 g over 1 kg. Larger Rocklobsters (>2 kg) were cooked for 22 minutes plus 0.75 minutes extra for every 100 g over 2 kg. Rocklobsters were cooked until an internal temperature of 82°C was reached. Once cooked, Rocklobsters were removed to a salty ice slurry to cool (30 mins), and kept overnight at 2°C in an esky containing free draining ice.

For preparation of cold Rocklobster, lobsters were cut in half lengthways, the tail meat removed from shell, each half sliced across the tail into 2 cm portions, transferred into small foil tart trays and immediately served at room temperature.

Re-heating of the SA Southern Rocklobster tail for evaluation as a hot product involved leaving ½ a tail in shell, covering with foil, and heating at 180°C at 20% humidity for 10.0 minutes. The tail was removed from shell, sliced across the tail into 2 cm portions, transferred into small foil tart trays, covered with foil and immediately served.

#### ***Trial 4 – calamari***

Fresh cleaned Southern Calamari (3 kg) from Eyre Peninsula, SA, was transported by air from Port Lincoln, SA and collected from Brisbane airport. Tubes ranged in size from 150 to 250 mm length. Fresh whole Gould's Squid Moreton Bay, Qld, (3.9 kg) was purchased from Samie's Girl, Hamilton, and was cleaned 'in-house'. Local Qld and SA samples were immediately separated into individual pouches and vacu-sealed (1-3 tubes per pouch), 'snap-frozen' and stored at -30°C until used. Cleaned New Zealand Arrow Squid (5 kg) was purchased as pre-frozen tubes from Samie's Girl, Hamilton, and stored at -30°C.

All product was freshly prepared on the same day as each tasting session. For all calamari/squid samples, 10-15 g (~3 pieces) was served to each panellist during the assessment sessions.

Calamari were semi-thawed overnight at 2-4°C and subsequently the tubes sliced into triangles (50 – 70 mm). Sliced sample was patted dry with paper towel, covered and kept chilled at 4°C until required for cooking. For cooking, the scrupulously clean wok was heated until smoking, rice-bran oil sprayed into the wok and brought back to just smoking, 150-200 g sliced calamari added and constantly tossed 60 - 90 seconds until just curling at the edges then immediately removed and served to the panel in small foil tart trays. Batches of sample were cooked in this way on demand.

#### ***Trial 5 – prawns***

Frozen Spencer Gulf Western King Prawns (*Melicertus latisulcatus*) from Eyre Peninsula, SA (10 kg, 28 prawns / kg), were transported by air from Port Lincoln, SA and collected



from Brisbane airport. Frozen Redspot King Prawns (*Melicertus longistylus*) from Townsville, Qld, were sourced from Moreton Bay Seafood's (10 kg, 54 prawns /kg) and frozen Ocean King Eastern Prawns (*Melicertus plebejus*) from Hervey Bay, Qld (5 kg, 19 prawns / kg) were sourced from Steve Murphy's. Farmed Black Tiger Prawns (*Penaeus monodon*) were sourced from SE Qld as frozen product (10 kg, 32 prawns / kg). All prawns were stored at -30 °C until used.

All product was freshly prepared on the same day as each tasting session. For all prawn samples, one whole and one peeled prawn (deveined and trimmed) of each type was served to each panellist during the assessment sessions.

Two thawing methods were compared, namely: overnight thawing at 2-4 °C, and rapid thaw in chilled salt water on the day of tasting. Informal tastings indicated the prawns thawed overnight were found to have superior flavour and texture. Thus, prawns were semi-thawed overnight at 2-4 °C and subsequently prepared into plastic cups.

#### ***Trial 6 – 'white-fish', King George Whiting and Snapper***

Fresh fillets of Snapper and King George Whiting (5 kg each) from Eyre Peninsula, SA, were transported by air from Port Lincoln, SA and collected from Brisbane airport. Fresh Goldband Snapper (4.0 kg) from NT and frozen Yellowfin Whiting from Shark Bay, WA (2 x 2 kg shatter packs) were sourced from Samies Girl, Hamilton. Fresh fillets were portioned equally into individual bags (400-500 g), vacu-sealed, 'snap-frozen' and stored at -30 °C until used.

All product was freshly prepared on the same day as each tasting session. For all white fish samples, 20-40 g of each type was served to each panellist during the assessment sessions.

Fish fillets were semi-thawed overnight at 2-4 °C and subsequently trimmed (pin-bones and fins removed) and Snapper samples were cut into large manageable pieces for cooking (~100 – 150 mm lengths x 60 mm width). Whiting samples were cooked as whole fillets with skin-on while Snapper samples were skinned. A Silex Grill was used to cook fillets at 180 °C for 5 min and 3 min, for whiting and Snapper respectively, turning half way and cooking with the Silex lid down (spacer on). Fillets were then rested for 30 seconds under foil, then cut into portions (20-40 g) and prepared into foil tart trays and wrapped with foil. Samples were either served immediately or kept warm at 65 °C until required according to the balanced presentation design.

#### ***Trial 7 – 'oily-fish, Southern Bluefin Tuna and Yellowtail Kingfish***

Fresh whole sides of Yellowtail Kingfish from Eyre Peninsula, SA (8 sides at ~1.2-1.5 kg each), and frozen Southern Bluefin Tuna back portions (8 vacu-sealed packs) and belly portions (8 vacu-sealed packs) from Eyre Peninsula, SA (100 – 150 mm width portions, ~10 kg total) were transported by air from Port Lincoln, SA and collected from Brisbane airport. Fresh skinned Tasmanian Atlantic Salmon fillets (Tassal) were sourced from Samie's Girl, Hamilton (4 fillets, 7 kg total), cut into back and belly portions (of 150 – 200 mm width) and divided into individual bags and vacu-sealed. Fresh samples were immediately 'snap-frozen' and stored at -30 °C until used.

All product was freshly prepared on the same day as each tasting session. For all sashimi samples 15-20 g (2-3 slices) and for cooked sample 20-30 g (2-3 pieces) of each type was served to each panellist during the assessment sessions.

Fish portions were semi-thawed overnight at 2-4 °C and subsequently trimmed (pin-bones and fins removed) and skinned where applicable. At this point Yellowtail Kingfish was cut to separate the belly flap and the back (loin) portion.

For sashimi the 'otoro' (belly) cut was used for the three species and for Southern Bluefin Tuna the 'chutoro' (part behind the belly before the back) was also used. Semi-thawed portions were cut into manageable blocks (~40 x 40 mm x 150 mm lengths), thinly sliced (0.5 – 0.8 mm) across the grain with a sharp heavy knife and pieces prepared into plastic cups with lids. Sashimi samples were stored at 4 °C until served.

The back (loin) 'akami' portions were cut into steaks (15 mm thickness) across the grain, wrapped in plastic and kept at room temperature until cooked. Steaks were cooked on a Silex Grill at 240 °C for 25 seconds each side (Silex grill lid off) and allowed to rest for 30-60 seconds under foil before slicing. Cooked steaks were cut with a very sharp knife into strips (10 mm thick) and where necessary (i.e. the tuna) the strips cut into shorter lengths (30–40 mm long). Cooked pieces were prepared into foil tart trays and wrapped with foil. Samples were either served immediately or kept warm at 65 °C until required according to the balanced presentation design.

### ***Trial 8 – oysters***

Fresh live Pacific diploid (total 20 dozen), triploid (total 20 dozen) and native Oysters (Angasi Oysters, total 20 dozen) from Eyre Peninsula, SA, were transported by air from Port Lincoln, SA, and collected from Brisbane airport each week over the three weeks of the oyster sensory trial. Large Tasmanian Pacific Oysters (total 20 dozen) from Ashmore foods, Rosny Park, Tas, and Sydney Rock Oysters (total 20 dozen) from Northern NSW, were sourced from Samie's Girl, Hamilton. On arrival in the laboratory, all oysters were removed from packaging and resorted into hessian bag lined foam eskies with the cup sitting up (lid on top), and stored covered in wet hessian at 8 °C until used. For the Native Oysters, pressure was applied on top of the oysters to prevent them opening and drying out. Oysters were checked daily and sprayed with water to keep moist. All oysters were evaluated within 4 days after arrival.

All product was freshly prepared on the same day as each tasting session. Prior to tasting, oysters were scrubbed and rinsed under a cold tap to clean and to remove any visible sand worms prior to shucking. For all oyster samples, two shucked oysters and not rinsed (one turned one not turned in the shell) of each type was served 'natural' on a bed of crushed ice in a deep plastic tray to each panellist during the assessment sessions.

### ***Trial 9 – mussels***

Fresh live Blue Mussels, Boston Bay in vacu-sealed 1 kg bags (totalling 16 kg, ~42 mussels per kg), from Eyre Peninsula, SA, were transported by air from Port Lincoln, SA, and collected from Brisbane airport each week over the three weeks of the mussel sensory trial. Fresh live Tasmanian Spring Bay Blue Mussels (totalling 16 kg, ~42 mussels per kg) and frozen New Zealand Greenlip mussels (~16 kg, 16 mussels per kg) were sourced from Samie's Girl, Hamilton. Fresh samples were stored at 2-4 °C until used and frozen Greenlip mussels were stored at -19 °C. All mussels were evaluated within 4 days after arrival.

All product was freshly prepared on the same day as each tasting session. Prior to tasting, mussels were scrubbed and rinsed under a cold tap to clean and de-beard where necessary. For the Blue Mussels, 4-5 mussels (males and females combined) of each

type was served per panellist while the Green Mussels, one male and one female were served separately to each panellist during the assessment sessions.

## RESULTS/DISCUSSION

Sensory analysis was completed for 12 of the most commercially significant seafood species of Eyre Peninsula including Blacklip and Greenlip abalone, Southern Rocklobster, Southern Calamari, Spencer Gulf Western King Prawns, Snapper, King George Whiting, Southern Bluefin Tuna, Yellowtail Kingfish, Native Oysters, Pacific Oysters, and Blue Mussels. Including comparator products, 39 seafood products (including various species) were assessed from across Australian and New Zealand.

A total of eight discrete sensory descriptive analysis trials were held focussing on specific product categories namely abalone, rocklobster, calamari, prawns, white-fish, oily-fish, oysters and mussels. Within each category the Eyre Peninsula product or products were compared with seafood products of the same species from other regions, or other species of the same product type that were considered competitor products. This assisted with defining the point of difference for the Eyre Peninsula product.

Due to the time limitations on this project, each discrete sensory trial was conducted within a 2-3 week timeframe with 4-5 training sessions and 3-4 formal evaluation sessions. Ideally, more time for panel training would have benefitted the results from quantitative evaluation, however, for the purpose of developing language and products descriptions, the training period was sufficient.

The data was explored to determine if common themes could be found across all Eyre Peninsula seafood products. It was found that Eyre Seafood can be defined by:

- High flavour intensity. Eyre Peninsula seafood products were always among the highest in flavour (and often aroma) intensity compared with comparator products.
- Depth of complexity. Eyre Peninsula products were found to always have a range of flavours (multidimensional) present simultaneously.
- Vegetative or herbaceous notes. The Eyre Peninsula seafood products all exhibited a 'vegetative' or 'herbaceous' note either in aroma and/or flavour which was usually secondary to the main flavour/s type present. Product from other regions did not always exhibit a vegetative or herbaceous flavour/aroma.
- Firm but tender texture. The Eyre Peninsula seafood products assessed were typically never found to be soft or tough in texture.

Interpretation of the results of this work must take into account that the sensory analysis focussed on Eyre Peninsula seafood that had been optimised for seasonality and condition. Comparator products were also selected to be the best possible quality available at the time of the tastings, however, condition and seasonality was not always optimal for comparator product. For example, the Sydney Rock Oysters were not at peak condition when compared to the Eyre Peninsula Native and Pacific Oysters.

The information developed by this project has been promoted through workshops and by public media to producers from the seafood industry, chefs, commercial users and consumers. A list of media publications of the work conducted in this project is provided in Appendix 8 : Summary of Media coverage of the project to date, page 121.

Results of the sensory analysis of each category of products are provided in the following sections of this report. Feedback obtained from the industry consultation process undertaken as part of this project is provided in section titled 'Benefits and adoption' (page 67).

## Development of the flavour wheel and products descriptions

Vocabulary from the analysis of the 39 seafood products provided the basis for the “Eyre Peninsula Seafood Flavour Wheel” provided in Appendix 7 : Eyre Peninsula Seafood Flavour wheel (page 119). The language across the eight discrete sensory studies involving the 39 seafood products is listed together with definitions in Appendix 5 : Sensory descriptions and definitions used during each trial (page 85). This language was compiled and categorised to form the flavour wheel tool and consequently is not only relevant to Eyre Peninsula seafood but can be extended for use to seafood products similar to those included in this study.

The flavour wheel designed in this project accommodates how the human mind works in recognising sensory properties of foods. The centre part of the wheel defines the broad category within which the sensory property being assessed fits (e.g. aroma/flavour, appearance or texture). The second circle of terms more specifically define the sensory property and allow the brain to search for broad terms to describe the property of interest. The third and outer circle of the wheel can be used to more specifically define and articulate the sensory property observed.

Product descriptions or ‘tasting notes’ were also developed for each of the 39 samples formally assessed and the original descriptions are given in Table 2. Certain descriptions were changed slightly and all descriptions were shortened for use in marketing material (as shown in Appendix 7 : Eyre Peninsula Seafood Flavour wheel, page 119). With approval from industry and FRDC these descriptions will be disseminated in further marketing material by the industry as appropriate to key audiences.

**Table 2 Summary of flavour descriptions developed for Eyre Peninsula products**

seafood	type/cut, preparation	Short sensory description
Blue Mussel	steamed	Plump and moist. Vibrant ivory to bright orange and purple. Clean ocean notes. Extremely tender, juicy and a little chewy. Complex and intensely savoury, salty and sweet, roast meaty and crustacean with steamed veg and a hint of butter.
Southern Calamari	wok-fry	Moist, blue-white flesh. Smoky, caramelised notes with toasted pine nuts. Firm, tender and crisp. Complex flavours, savoury, char-grilled, oceanic and nutty with a hint of vegetative and bread crust. A mouth-coating savoury finish.
Yellowtail Kingfish	sashimi (otora)	Translucent beige coloured and marbled appearance. Odourless. Crisp but tender with mouth coating fattiness. Delicate fresh oyster, savoury and rendered fat flavours.
Yellowtail Kingfish	pan-seared	Glistening, tan-coloured flesh. Intense aroma of caramelised white meat and clean ocean. Juicy flavour of baked white fresh fish, savoury, sweet and slight tartness persisting.
Southern Bluefin Tuna	pan-seared	Glistening Turkish delight appearance. Intense caramelised white meat, some cooked broccoli notes. Extremely juicy and tender, a mouth-coating fattiness. Tart, savoury, sweet and salty, flavour of baked fresh white fish. Flavours persist.

<b>seafood</b>	<b>type/cut, preparation</b>	<b>Short sensory description</b>
Southern Bluefin Tuna	sashimi (otora)	A marbled, glistening ruby grapefruit colour. Odourless. Melt-in-mouth tenderness, slippery, gelatinous, a mouth-coating fattiness. Intense savoury flavours, some tartness, avocado nuttiness, fresh oyster and herbaceous. Lingering flavours.
Southern Bluefin Tuna	sashimi (chutoro)	Bright, glistening, Turkish delight appearance. Hint of clean ocean odour. Melt-in-mouth tender. Intense tartness, savoury and some fresh oyster flavours that persist.
Southern Rocklobster	chilled	Vivid white, glossy flakes. Crab-like and fresh ocean some cooked vegetable. Slightly crisp, extremely tender, melt-in-mouth. Intensely sweet ocean, crab-like and savoury with a hint of toasted bread crust. Persisting flavours.
Southern Rocklobster	warmed	Vivid white flakes. Complex and intense aroma of fresh ocean, crab-like roast potato and vegetable notes. Slightly crisp, melt-in-mouth tender. Intensely crab-like, sweet ocean, savoury, cooked broccoli, some toasted bread crust. Savoury flavour persists.
King George Whiting	pan-fry	Moist, creamy-white fillet with fine flakes. Clean ocean, starchy vegetable, mushy peas and roasted nut aroma. Crumbly, melt-in-mouth. Complex flavours, sweet ocean, savoury, clean iodine-like, egg white, buttery and vegetative. Savoury, slight metallic finish.
Snapper	pan-fry	Moist, pinkish-white, large flakes. Roasted white meat and clean ocean notes. Firm, chewy and juicy. Intensely savoury, roasted with oceanic sweetness that persists.
Greenlip Abalone (farmed)*	brined, sashimi	Glossy white flesh with green lip. Mild clean ocean aroma. Crisp, crunchy, silky and chewy. Salty-sweet oceanic flavour, shellfish-like. Clean finish.
Greenlip Abalone (farmed)*	sous vide	Off-white flesh. Champignon, white-meat with ocean notes. Initially tender, spongy and silky, remains chewy. Savoury, sweet ocean, some saltiness. Slight savoury persisting.
Greenlip Abalone (farmed)	wok-fry	White-ivory flesh. Fried scallop, some roasted meat and baked fish notes. Tender and silky in mouth. Savoury fried scallop and sweet ocean flavours that linger.
Greenlip Abalone (wild)	wok-fry	Off-white flesh with green lip. Fried scallop and pork, slight baked fish note. Tender, silky, a little chewy. Savoury, sweet ocean with a little shellfish. Flavours linger.
Blacklip Abalone (wild, canned)	warmed	Off-white flesh. Champignon, white-meat with a hint of shellfish. Initially tender and spongy, remains chewy. Mild savoury, sweet ocean flavour, slight saltiness. Clean finish.
Blacklip Abalone (wild)*	par-boiled, sashimi	White-ivory flesh with brown lip. Oceanic and shellfish-like with steamed shitake mushroom notes. Chewy, squeaky, texture. Sweet ocean, savoury, slight saltiness. Mild lingering flavours.
Blacklip Abalone (wild)	wok-fry	Off-white flesh with brown lip. Intensely fried scallop and roast pork with baked fish note. Tender and silky. Savoury flavours that linger.

seafood	type/cut, preparation	Short sensory description
Native Oyster	natural	Plump, flat, pinky-mushroom colour with dark mantle. Tidal rock pool, mangrove and fresh fish notes. Firm, crisp, juicy and chewy. Intense, complex savoury flavours, hazelnut and asparagus, rocket-like, slightly salty and tart. Flavours persist with a metallic finish.
pacific oyster (diploid) standard	natural	Plump, bright, creamy with a hint of pink and a dark mantle. Fresh clean ocean with cucumber and fresh fish notes. Very crisp, juicy and bursts-in-mouth. Intensely sweet ocean, salty and savoury with a hint of asparagus. Sweet-savoury ligers.
pacific oyster (triploid) spawnless	natural	Plump, creamy with greyish tones and dark mantle. Fresh clean ocean, cucumber and fresh fish notes. Very juicy, burst-in-mouth. Intense saltiness, sweet and savoury with a hint of rocket and asparagus. Clean finish with lingering saltiness.
Spencer Gulf Western King prawns	chilled	Glossy pinky-peach orange with red highlights. Intense aroma of ocean-spray, fresh crustacean, some sea-weed and a hint of vanilla pod. Extremely juicy, firm, crisp and springy. Intense savoury and fresh crustacean flavours, salty-sweet, green vegetable and iodine notes with slight tartness. Persisting savoury flavours with a bread-crust like finish.

\* Not included in 'Eyre Peninsula Seafood Flavour Wheel'

### **Results from Abalone sensory evaluation**

The six products evaluated for abalone are pictured in Photo 1 (from left: Greenlip Abalone (wild), Greenlip Abalone (farmed, brined for sashimi), Greenlip Abalone (farmed), Blacklip Abalone (wild), Blacklip Abalone (wild, par-boiled for sashimi), Blacklip Abalone (wild, canned)). The Greenlip Abalone (farmed) was assessed by the panel as both as a wok-fry and a sous vide sample. This gave seven samples for assessment overall. Product sensory descriptions for the seven samples evaluated are given Table 3. The summarised data (average across panellists and replicated) are shown in Figure 1, Figure 2, Figure 3 and Figure 4.

Due to the large number of products from Eyre Peninsula requiring assessment within the abalone category, no product comparisons were made with other regions. Large differences were found between the products assessed.

The canned product was originally assessed as a sliced cold product but later was reassessed informally as a hot product. Essentially the product flavour types were the same, although more intensified in the hot product. The texture was slightly more tender in the heated canned product.

**Photo 1 The range of samples provided of Greenlip and Blacklip Abalone**



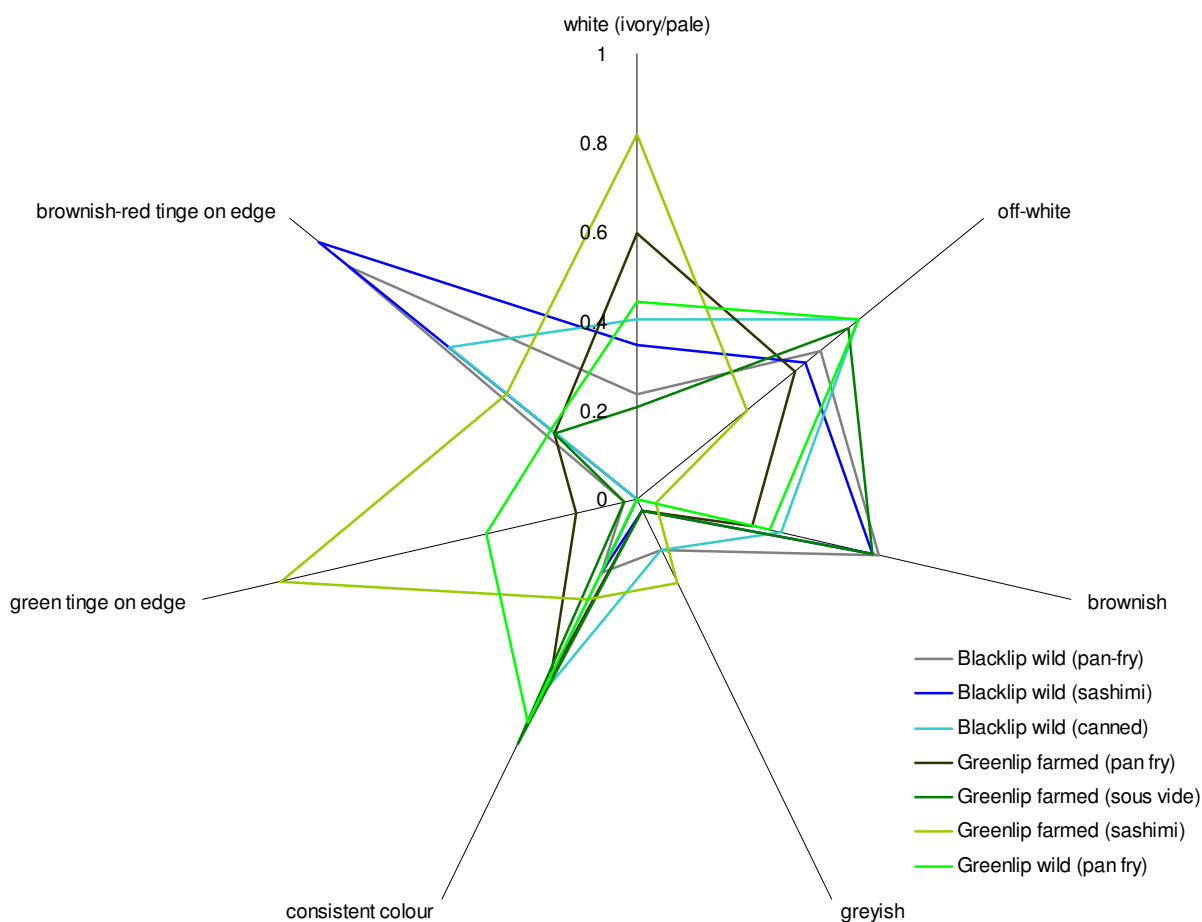
**Table 3 Sensory descriptions of Abalone**

sample	cooking method and presentation	Appearance, aroma, texture and flavour description summary (tentative)
Blacklip Abalone wild canned	Thinly sliced – served cold	Flesh is a consistent off-white colour with a brown tinge on the edges. Aroma is of champignon mushrooms and chicken lunchmeat with a hint of shellfish. Texture is initially tender and spongy but remains chewy. Flavour is a mild savoury, sweet oceanic and slightly salty, champignon mushroom and chicken-like with a hint of shellfish. Very little aftertaste.
Blacklip Abalone wild par-boiled (IQF)	Thinly sliced – sashimi served cold	Flesh is a pale white/off-white, slightly brownish colour with a brown tinge on the edges. An oceanic aroma with shellfish notes and a hint of steamed shitake mushroom. A chewy texture which is squeaky on the teeth. Flavour is sweet oceanic, shellfish-like and savoury, slight saltiness and a hint of shitake mushroom. A slight lingering savoury aftertaste.
Greenlip Abalone Farmed brined (IQF in-shell)	Thinly sliced – sashimi served cold	A glossy stark white flesh with a slight green tinge on the edge. A very mild and clean oceanic aroma with a hint of shellfish. A very crisp almost crunchy texture which is silky in the mouth then persists with some chewiness. A salty-sweet oceanic flavour which is shellfish-like (lobster or crab-like). Almost no aftertaste.
Blacklip Abalone wild (IQF)	Thinly sliced – wok fry served hot	Flesh is an off-white, slightly brownish colour with a brown tinge on the edges. An intense aroma of fried scallop with roast (pork) meat and a slight baked fish note. Texture is tender and silky in the mouth. A savoury flavour like fried scallop and roast (pork) meat with a little baked fish. A lingering savoury aftertaste.
Greenlip Abalone Farmed (IQF)	Thinly sliced – wok fry served hot	Flesh is a consistent white/off-white colour. The aroma of fried scallop with some roast meat and baked fish. Texture is tender and silky in the mouth. A savoury flavour of fried scallop with sweet oceanic. Slight roast meat and baked fish flavours. A lingering savoury aftertaste.

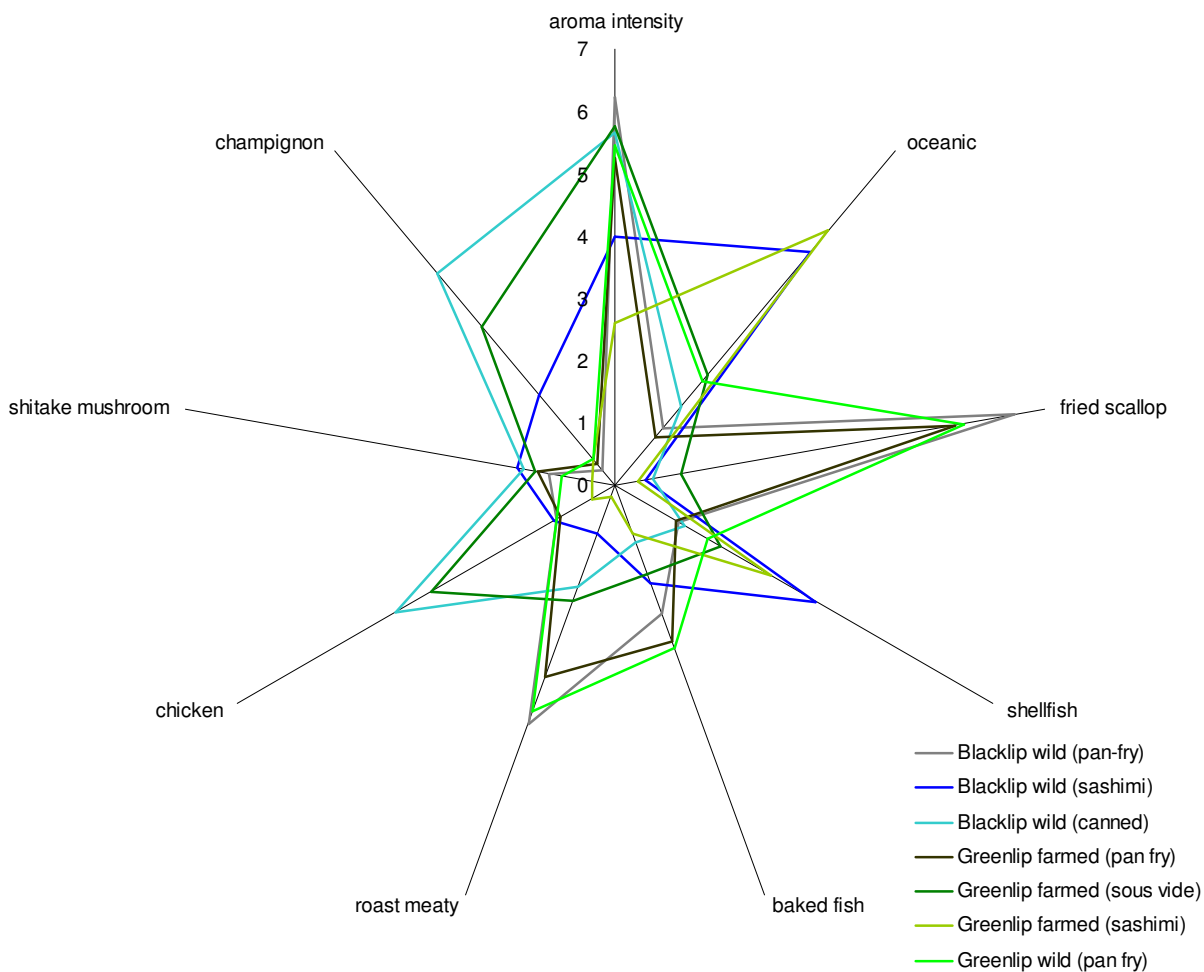


sample	cooking method and presentation	Appearance, aroma, texture and flavour description summary (tentative)
Greenlip Abalone Farmed (IQF)	Sous vide (24hr), thinly sliced – served hot	Flesh is a consistent off-white slightly brownish colour. Aroma is of champignon mushrooms, white-meat with some oceanic notes. Texture is initially tender and spongy, silky in the mouth but remains chewy. Flavour is savoury, some sweet oceanic and slightly salty, champignon mushroom and chicken-like. A slight lingering savoury aftertaste.
Greenlip Abalone Wild (IQF)	Thinly sliced – wok fry served hot	Flesh is a consistent pale off-white colour with a green tinge on the edge. An aroma of fried scallop with roast (pork) meat and a slight baked fish note. Texture is tender and silky in the mouth with some chewiness. A savoury flavour, sweet oceanic and fried scallop, some roast (pork) meaty with a little shellfish. A lingering savoury aftertaste.

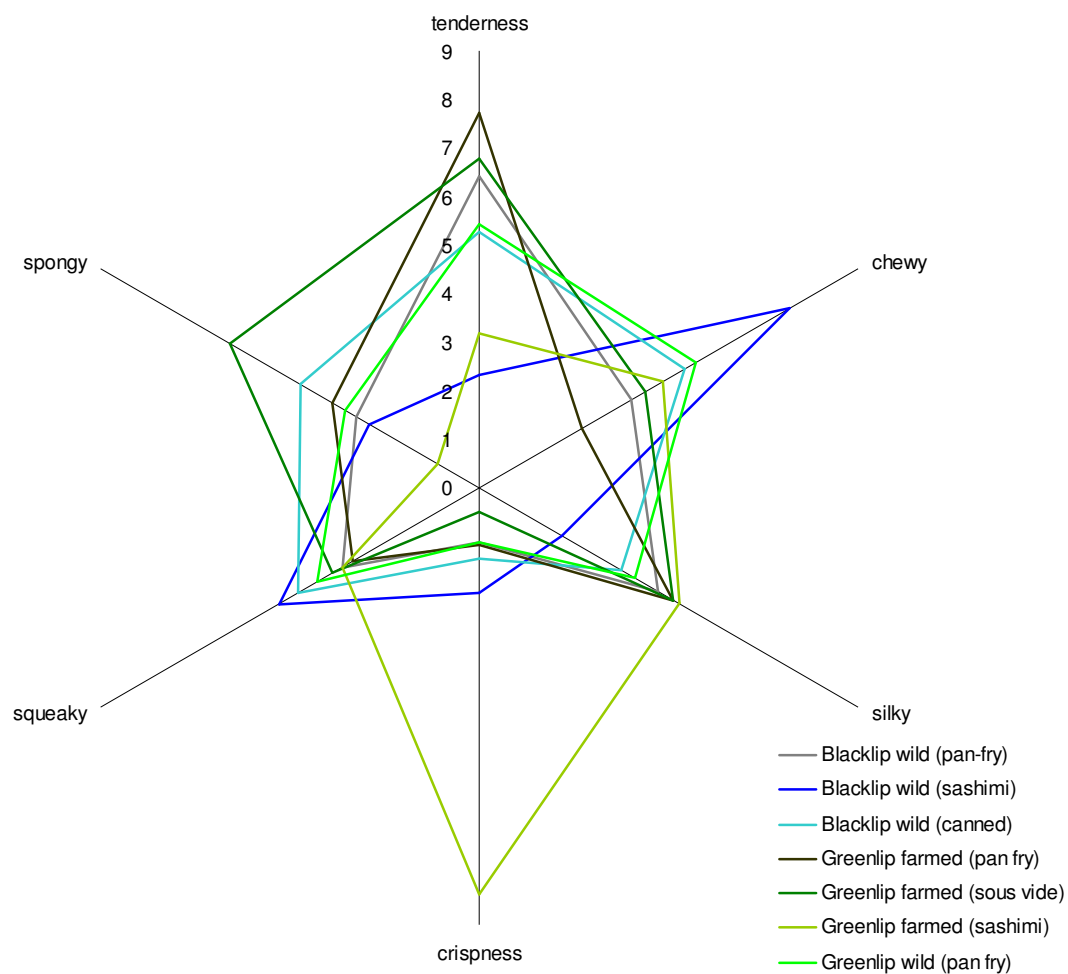
**Figure 1 Results from abalone sensory analysis for appearance (n=3, 12 panellists)**



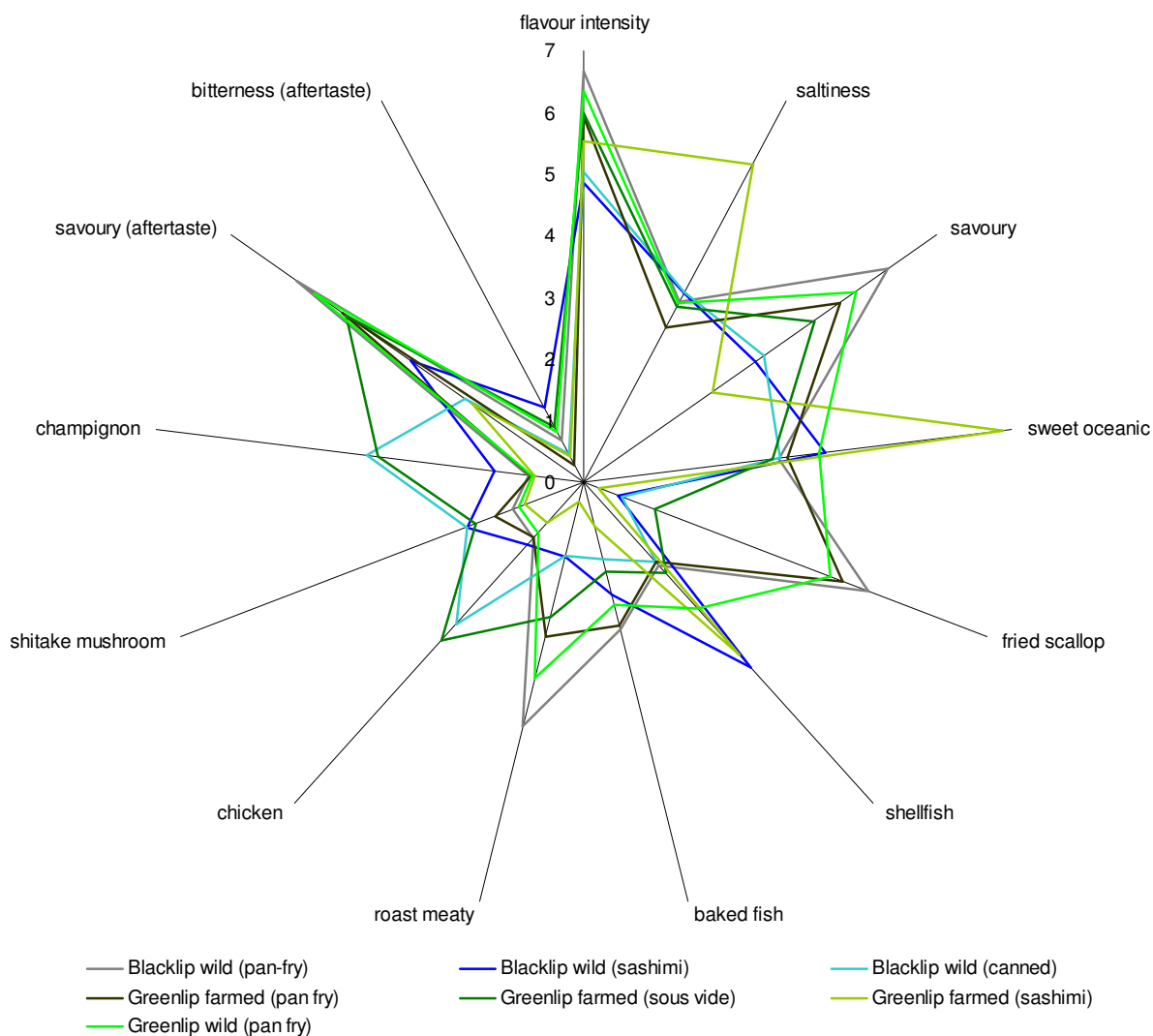
**Figure 2 Results from abalone sensory analysis for aroma (n=3, 12 panellists)**



**Figure 3 Results from abalone sensory analysis for texture (n=3, 12 panellists)**



**Figure 4 Results from abalone sensory analysis for flavour and aftertaste (n=3, 12 panellists)**



### **Results from Rocklobster sensory evaluation**

The samples evaluated for Rocklobster are pictured in Photo 2 (Eyre Peninsula Southern Rocklobster) and the full product descriptions are given Table 4. The summarised data (average across panellists and replicated) are shown in Figure 5, Figure 6, Figure 7 and Figure 8.

The Eyre Peninsula Southern Rocklobster was distinctly whiter than the other Rocklobster samples. It also was more intense in aroma and complexity as a hot sample. The Eyre Peninsula southern Rocklobster (cold) was similar in aroma and flavour profile to the Tasmanian product (cold) but texturally more tender, moist and crisp.

The Eyre Peninsula Southern Rocklobster was higher in flavour intensity as hot and cold product, had higher sweet ocean flavour, cooked vegetable flavour, toasted bread crust flavour and flavour persistence.

The WA Western Rocklobster was comparatively soft, dry, with more prawn broth flavour and aroma, while the Tropical Rocklobster was firmer in texture with notable fibres and generally lower in flavour and aroma intensity.

### **Photo 2 Rocklobster**



**Table 4 Sensory descriptions of Rocklobster**

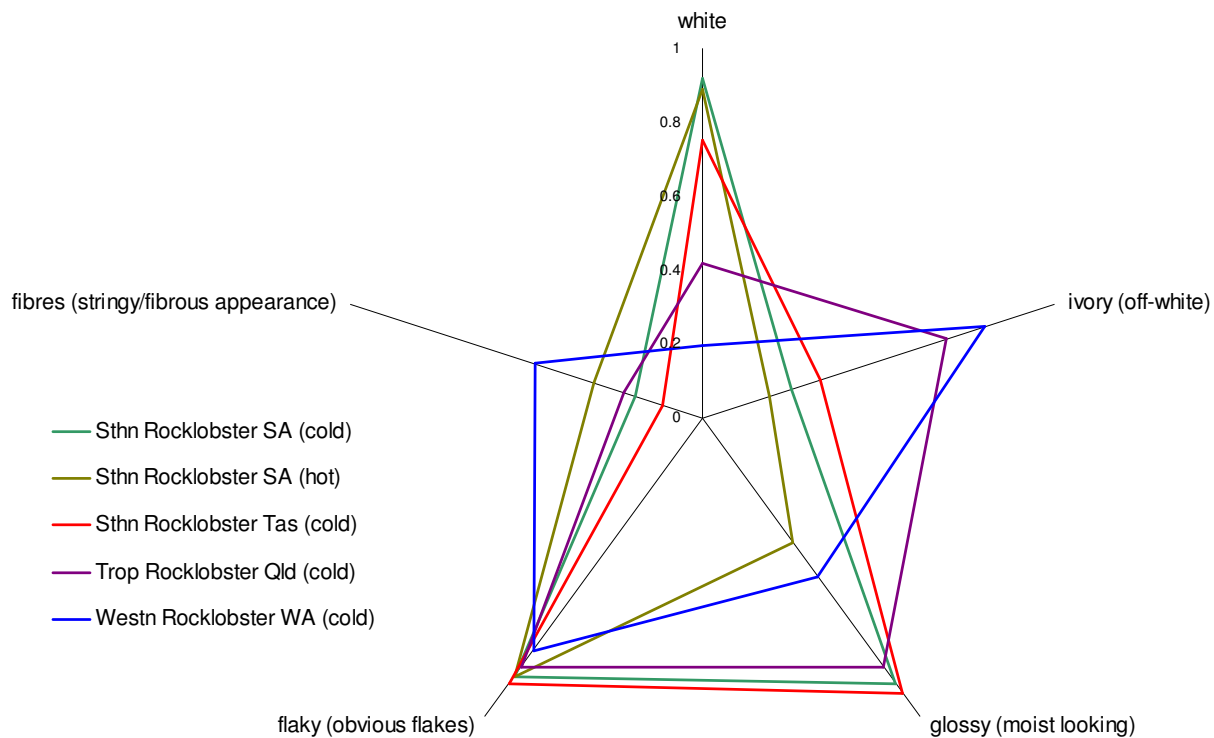
Sample	cooking method and presentation	Appearance, aroma, texture and flavour description summary (tentative)
Southern Rocklobster (SA) <sup>a</sup> Hot	Boiled whole, cooled, re-heated in shell, sliced tail portion served hot	A vivid white colour flesh with flaky appearance. An intense and very complex aroma. Fresh-ocean and crab-like, roast potato and vegetable notes Very tender, moist and melt-in mouth with a crispness to the bite An intense flavour, crab-like, sweet ocean, savoury and cooked vegetable. Some broccoli and toasted bread crust flavours. Savoury flavour persisting on the palate

Southern Rocklobster (SA) <sup>a</sup>	Boiled whole, cooled, sliced tail portion served cold	<p>A vivid white colour flesh, moist-looking, glossy and flaky in appearance</p> <p>A crab-like aroma, fresh-ocean and some cooked vegetable notes</p> <p>Extremely tender, moist and melt-in mouth with a little crispness to the bite</p> <p>An intense flavour, sweet ocean, crab-like and savoury, cooked vegetable and a hint of toasted bread crust</p> <p>Savoury flavour persisting on the palate.</p>
Southern Rocklobster (Tas) <sup>a</sup>	Boiled whole, cooled, sliced tail portion served cold	<p>A white colour flesh, very glossy with flaky appearance</p> <p>A crab-like aroma, rock pool (sea weedy) and some cooked vegetable and egg-white notes</p> <p>Very tender, moist and melt-in mouth with a little crispness to the bite</p> <p>A sweet ocean flavour, crab-like and savoury with some broccoli.</p> <p>Flavours persist on the palate</p>
Western Rocklobster (WA) <sup>b</sup>	Boiled whole, cooled, sliced tail portion served cold	<p>Ivory colour flesh with obvious flakes and stringy appearance</p> <p>A strong aroma of fresh ocean, crab-like and prawn broth with a hint of cooked egg yolk.</p> <p>Firmer texture but still tender and somewhat moist and melt-in-mouth, notable fibres</p> <p>A milder flavour of prawn-broth, crab-like, sweet and savoury.</p> <p>Flavours persist on the palate.</p>
Tropical Rocklobster (Nth Qld) <sup>a</sup>	Boiled whole, cooled, sliced tail portion served cold	<p>An off-white colour flesh, glossy with a flaky appearance</p> <p>A mild fresh-ocean and crab-like aroma.</p> <p>Tender and moist texture, notable fibres</p> <p>A mild flavour, sweet ocean, savoury and crab-like, a hint of vegetable</p> <p>Flavours persist on the palate.</p>

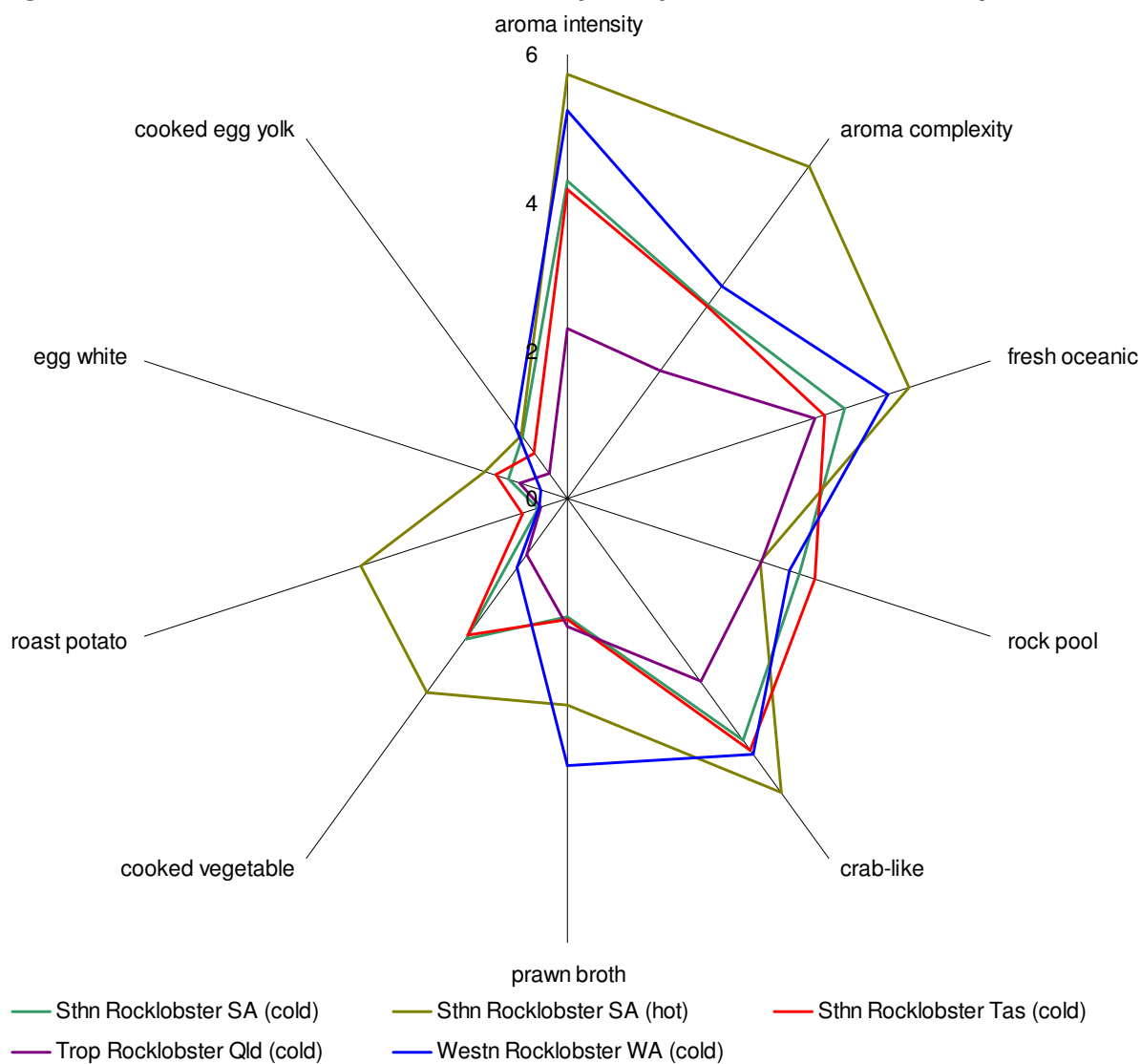
<sup>a</sup> The Southern Rocklobsters and Tropical Rocklobsters were obtained as live product and kept in tanks until required.

<sup>b</sup> The Western Rocklobster obtained were small whole raw pre-frozen product. They were thawed before cooking.

**Figure 5 Results from Rocklobster sensory analysis for appearance (n=3, 12 panellists)**

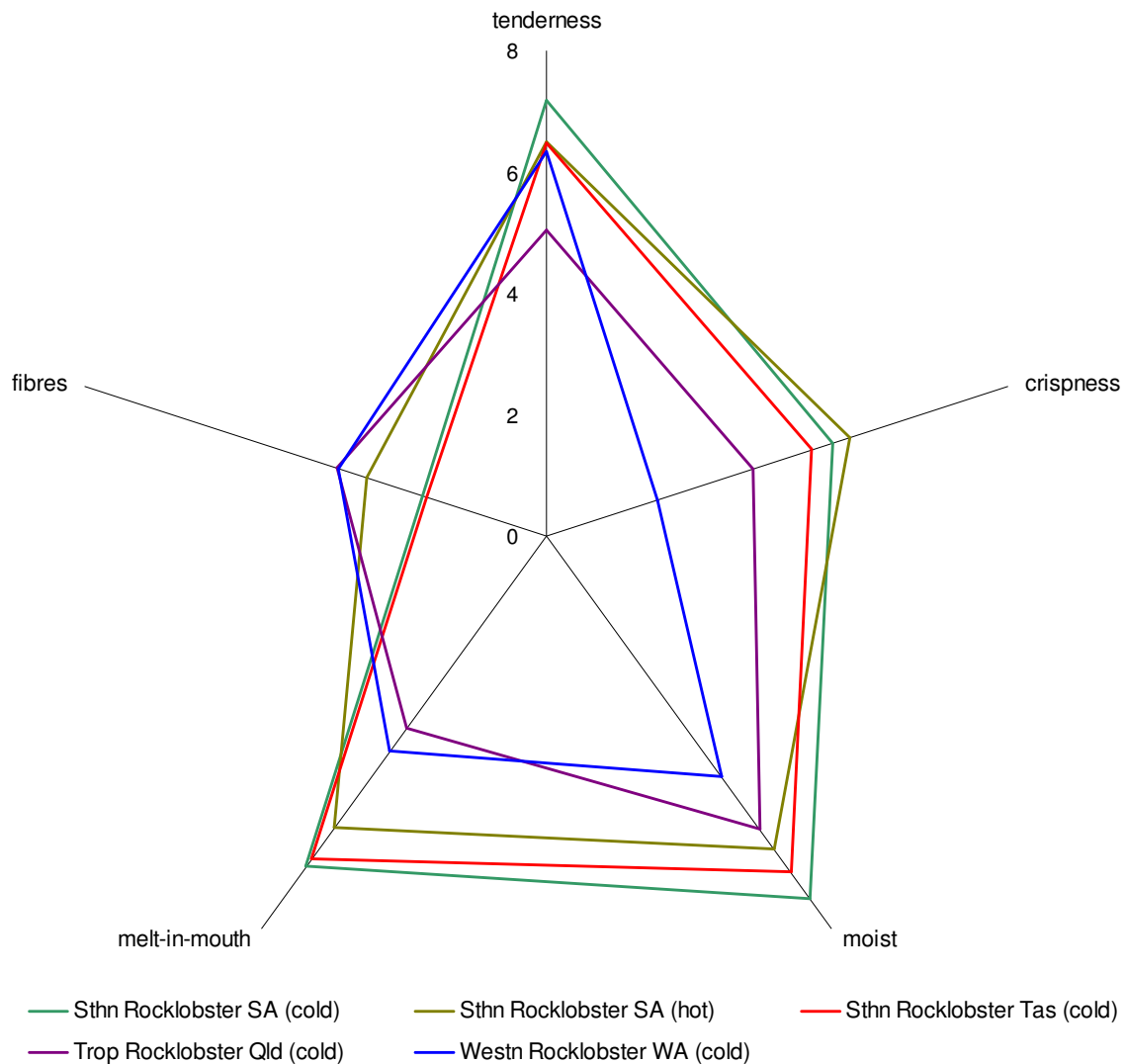


**Figure 6 Results from Rocklobster sensory analysis for aroma (n=3, 12 panellists)**

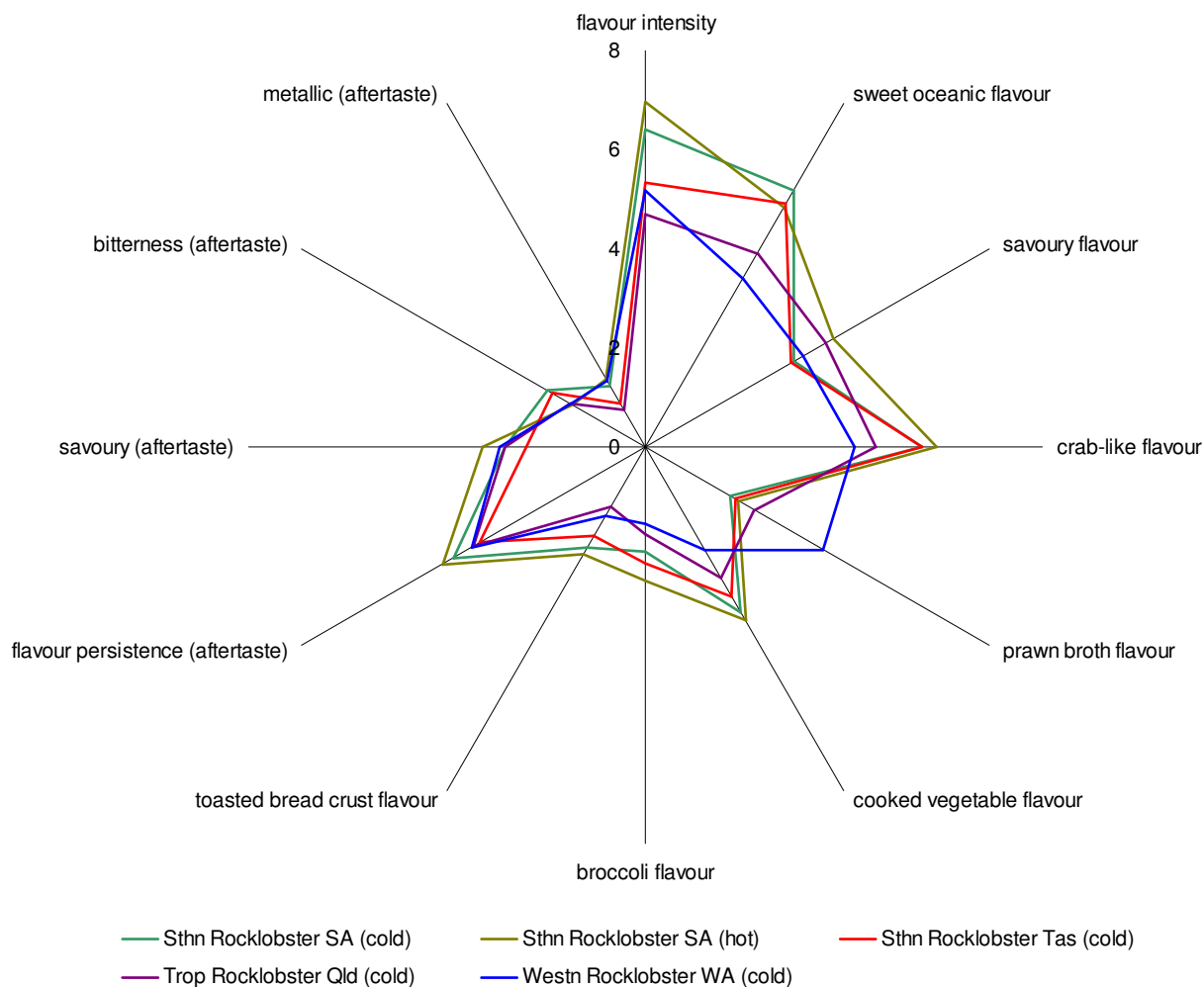




**Figure 7 Results from Rocklobster sensory analysis for texture (n=3, 12 panellists)**



**Figure 8 Results from Rocklobster sensory analysis for flavour and aftertaste (n=3, 12 panellists)**



### **Results from Calamari sensory evaluation**

The samples evaluated for calamari are pictured in Photo 3 (left to right: NZ Arrow Squid, Eyre Peninsula Southern Calamari, Qld Gould's Squid, and below: trimmed Southern Calamari). The product sensory descriptions are given Table 5 and the summarised data (average across panellists and replicates) are shown in Figure 9, Figure 10, Figure 11 and Figure 12.

The Eyre Peninsula Southern Calamari was distinctly blueish-white in colour and similar to the Qld Gould's Squid in aroma (caramelised and smoky BBQ, toasted pine nut). The Eyre Peninsula product was firmer in texture but still tender and intense in flavour, but not as high in flavour as the Qld and NZ products. Flavours of bread crust and vegetative notes were distinct in the Eyre Peninsula product.

The Qld Gould's Squid was pinkish-white in appearance and more translucent. It had a crisper texture, salty, sweet and savoury. The Qld Gould's Squid featured the longest flavour persistence, specifically a savoury aftertaste that lingered.

The NZ Arrow Squid was the most different to cook. The thick pieces (shown in the bowl on the left in Photo 3) released a great deal of moisture in the wok which rapidly cooled the initial wok temperature. The resulting wok was left with a residue that formed a crust on the surface of the wok after cooking. By comparison, the thinner pieces of the Qld and Eyre Peninsula product did not release much moisture meaning a higher cooking temperature. Further the wok remained relatively clean after cooking.

The NZ Arrow Squid was ivory-cream in colour and appeared moist and completely opaque. It had the highest aroma intensity and was very soft and glutinous in texture. It had very distinct flavours of shellfish, buttery and oceanic with a distinct buttery and oily/mouth coating aftertaste and mouth feel.

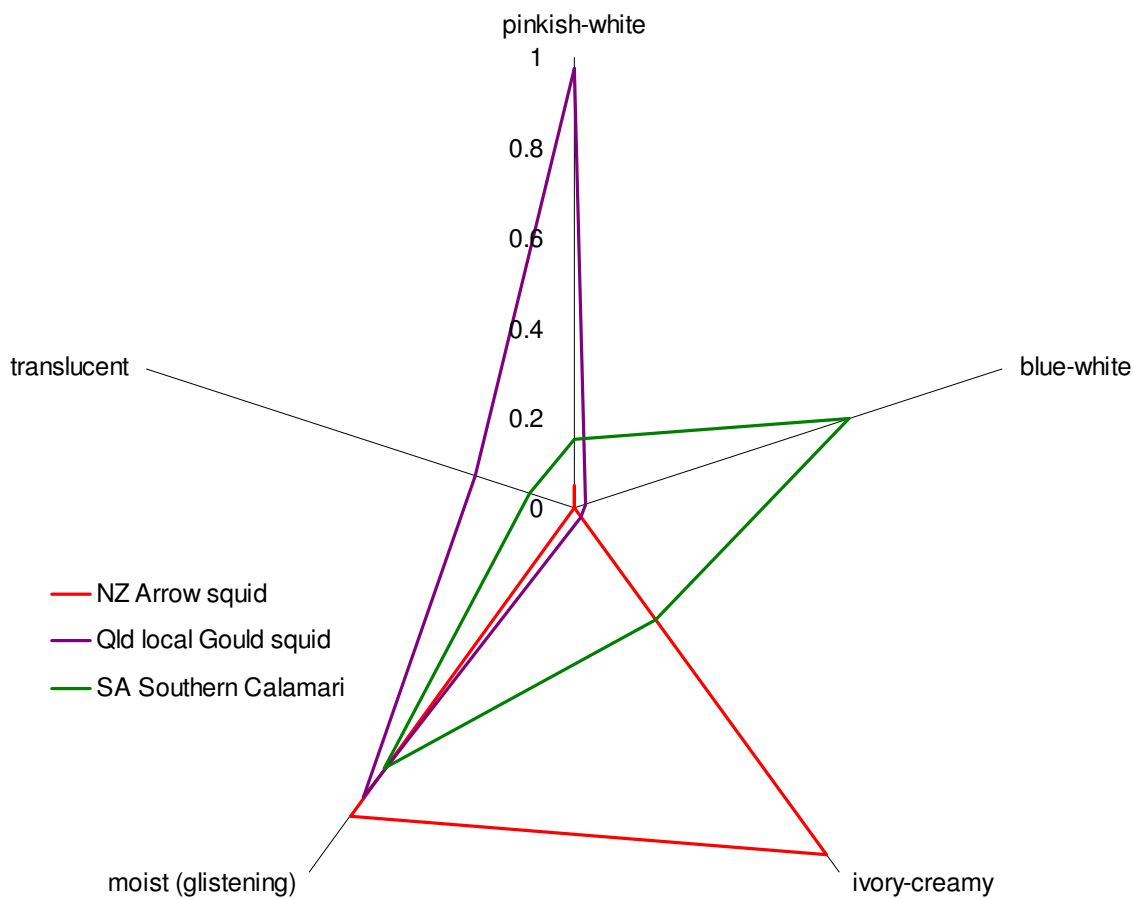
**Photo 3 Calamari**



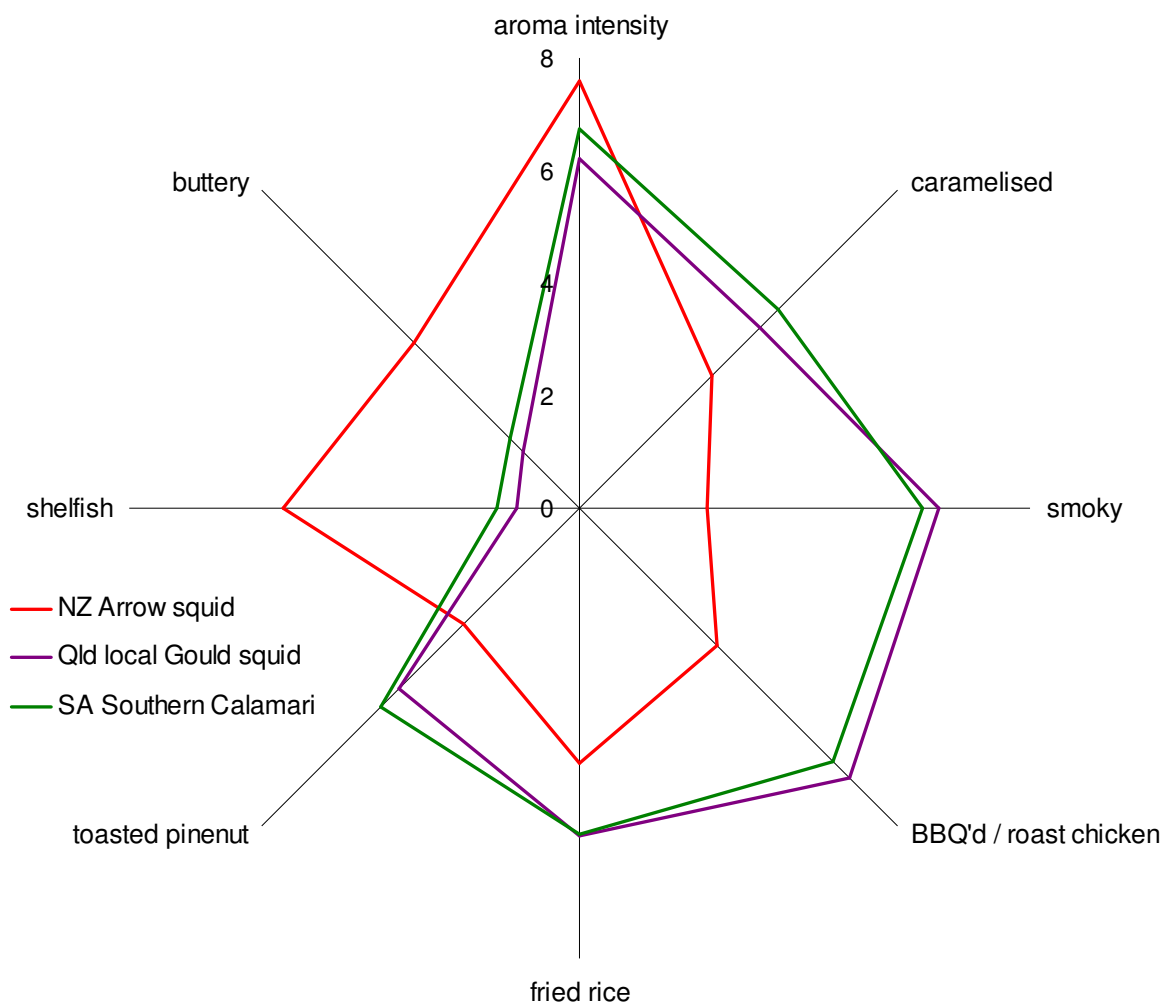
**Table 5 Sensory descriptions of Calamari**

sample	cooking method and presentation	Appearance, aroma, texture and flavour description summary (tentative)
New Zealand Arrow Squid	Triangle pieces, hot wok fry – served hot	<p>Ivory-cream in colour with a moist appearance.</p> <p>A strong aroma intensity of butter and shellfish, with a hint of fried rice</p> <p>A very soft and tender texture with a slippery, glutinous mouth feel.</p> <p>A relatively intense savoury and salty flavour with butter, shellfish and oceanic flavours. A hint of sweet nuttiness.</p> <p>A savoury, buttery and baked white fish-like persisting aftertaste with a mouth coating finish.</p>
Qld local Gould's Squid	Triangle pieces, hot wok fry – served hot	<p>Pinkish-white flesh colour with a moist appearance.</p> <p>A smoky, caramelised aroma of BBQ'd chicken or fried rice with toasted pine nut notes.</p> <p>A tender texture with is very crisp on the first bite and slippery in the mouth.</p> <p>A relatively intense flavour which is a balance of salty, sweet and savoury. Flavours of char grilled, fried rice and some nuttiness.</p> <p>A savoury persisting aftertaste with a mouth coating finish.</p>
SA Southern Calamari	Triangle pieces, hot wok fry – served hot	<p>Bluish-ivory/white flesh colour with a moist appearance.</p> <p>A smoky, caramelised aroma of BBQ'd chicken or fried rice with toasted pine nut notes.</p> <p>A firm but still tender texture which is crisp on the first bite.</p> <p>A milder but complex flavour which is predominantly savoury and char grilled with some fried rice, oceanic and nutty notes. Has a distinct hint of vegetative and bread crust flavours.</p> <p>A savoury persisting aftertaste with a mouth coating finish.</p>

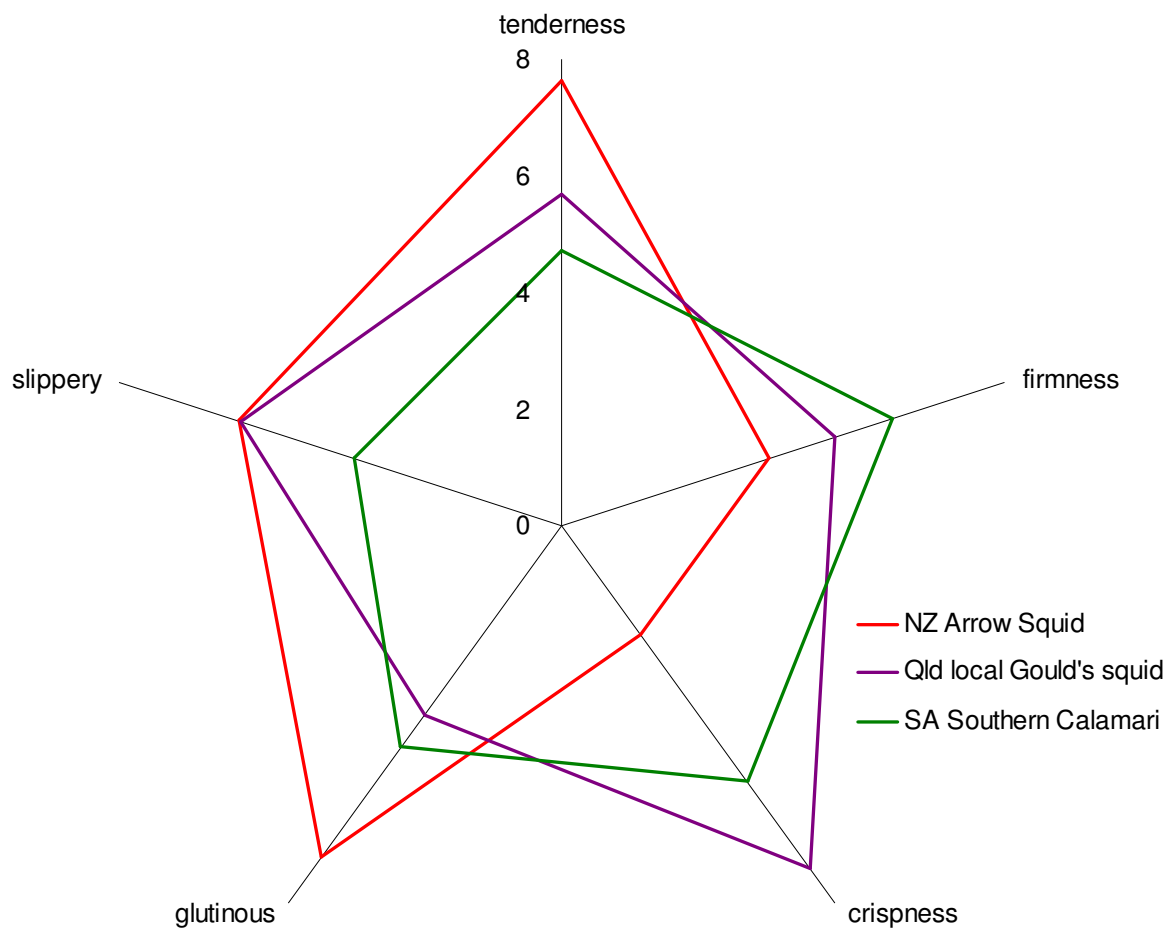
**Figure 9 Results from Calamari sensory analysis for appearance (n=3, 13 panellists)**



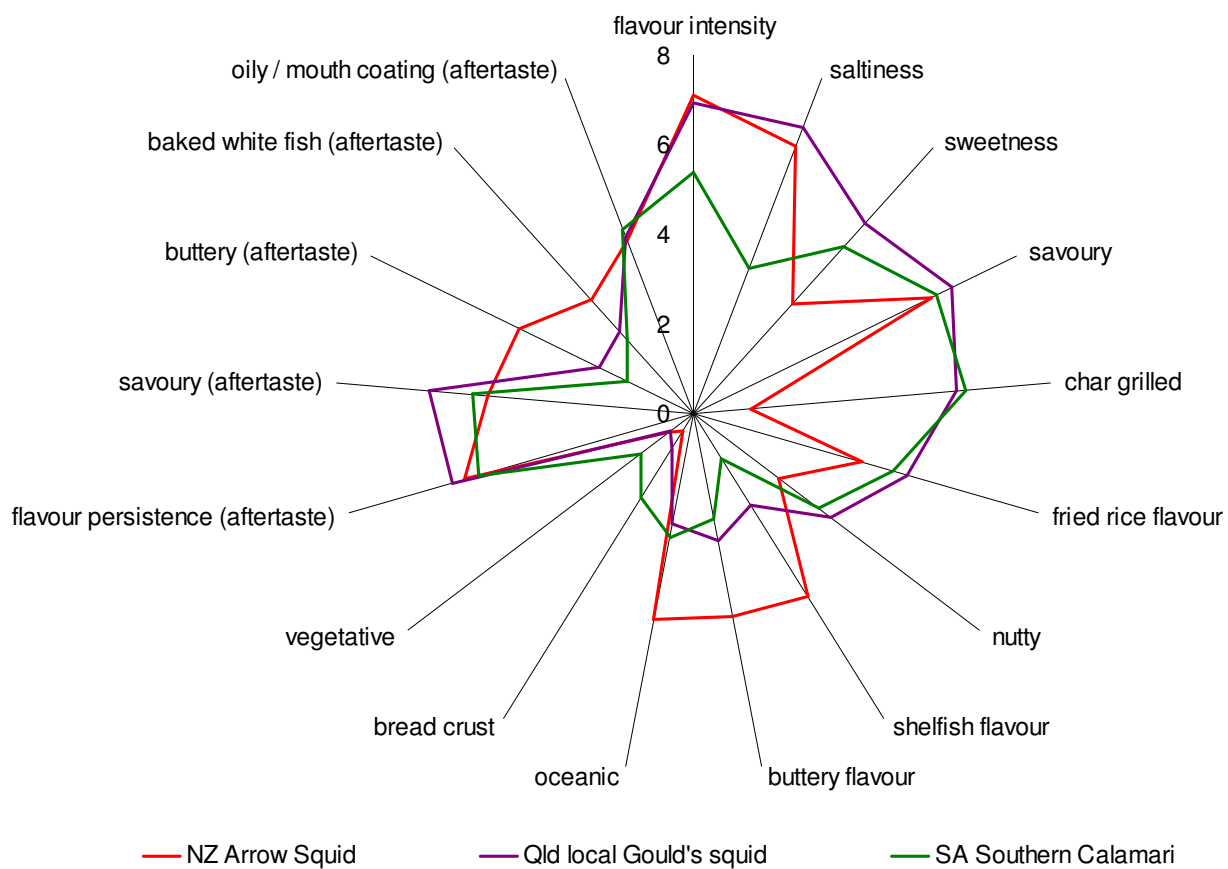
**Figure 10 Results from Calamari sensory analysis for aroma (n=3, 13 panellists)**



**Figure 11 Results from Calamari sensory analysis for texture (n=3, 13 panellists)**



**Figure 12 Results from Calamari sensory analysis for flavour and aftertaste (n=3, 13 panellists)**





### **Results from Prawn sensory evaluation**

The prawn samples evaluated are pictured in Photo 4 (left to right, Ocean King Prawns, Spencer Gulf Western King Prawns, farmed Black Tiger Prawn, Redspot King Prawn). The full product descriptions for each prawn type are given Table 6. The summarised data (average across panellists and replicated) are shown in Figure 13, Figure 14, Figure 15 and Figure 16.

The Eyre Peninsula Spencer Gulf Western King Prawns were different in appearance compared to the comparator prawns and had the most consistent colour (other than the farmed black Tiger Prawn). It had the highest aroma and flavour intensity and more ocean spray and fresh crustacean than the comparators. It was the juiciest prawn although had a similar flavour profile to the Redspot King Prawns and Qld Ocean King Eastern Prawns.

The farmed Black Tiger Prawn was much less intense in aroma and flavour with more boiled prawn broth (almost fish-meal like) and very crisp firm and springy.

### **Photo 4 Prawns**

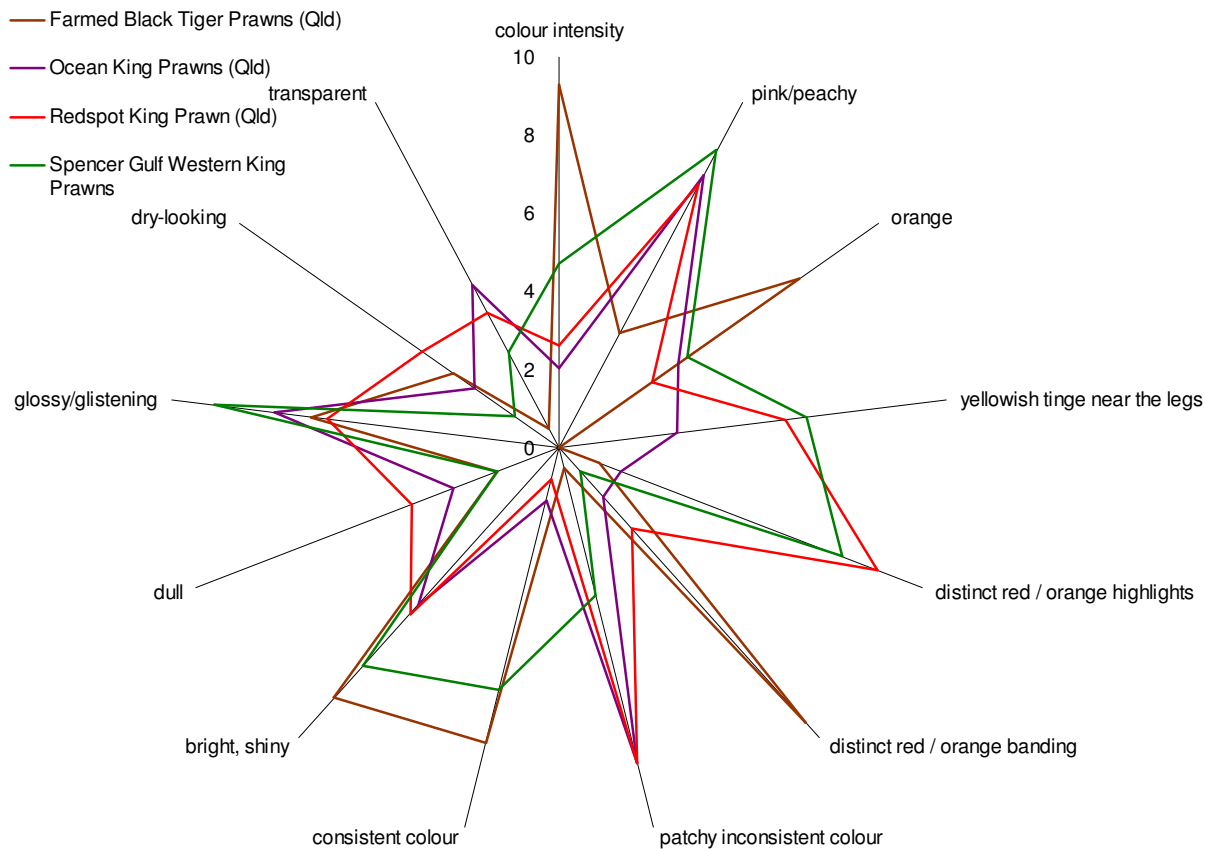


**Table 6 Sensory descriptions of Prawns**

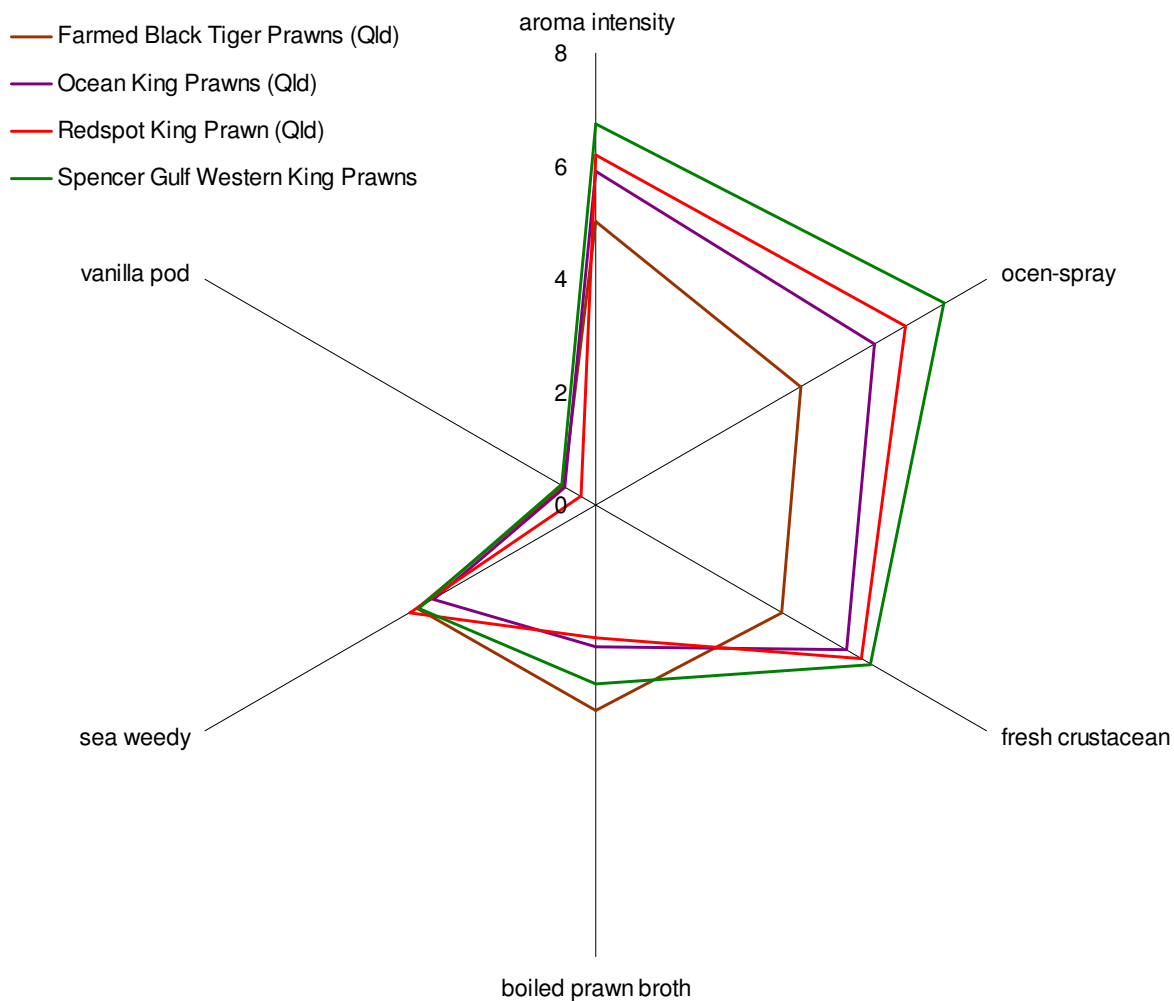
sample	cooking method and presentation	Appearance, aroma, texture and flavour description summary (tentative)
Ocean King Prawns (Qld)	Cooked cold, whole	A pink/peachy slightly patchy colour, glossy looking with an obvious transparency through the shell. A moderately intense aroma of fresh crustacean, ocean-spray and a hint of vanilla pod. Texture is quite firm with some springiness. Moderately juicy. A meaty prawn that is more chewy and structured in the mouth. An intense flavour that persists on the palate. Predominantly savoury, salty and sweet with fresh crustacean and green vegetable. A hint of acidity and iodine-like notes.

<b>sample</b>	<b>cooking method and presentation</b>	<b>Appearance, aroma, texture and flavour description summary (tentative)</b>
Spencer Gulf Western King Prawns (SA)	Cooked cold, whole	<p>An extremely glossy and glistening appearance. A vivid pinky/peachy slightly orange colour, with a yellow tinge and distinct red/orange highlights near the legs.</p> <p>Aroma is intense, ocean-spray, fresh crustacean, some sea weed notes and a hint of vanilla pod.</p> <p>An extremely juicy prawn, a firm, slightly crisp and springy texture. Chews easily in the mouth.</p> <p>An intense flavour dominated by savoury and fresh crustacean flavours with saltiness, sweetness and some crisp acidity. Green vegetable and iodine-like notes. These flavours persist in on the palate together with a hint of bread-crust-like bitterness on the aftertaste.</p>
Farmed Black Tiger Prawns (Qld)	Cooked cold, whole	<p>A bright and glossy appearance. A consistent and intense orange colour with distinct red/orange banding.</p> <p>A milder aroma, ocean-spray, fresh crustacean and boiled prawn, some sea weed notes.</p> <p>An extremely crisp firm and springy texture, relatively juicy and somewhat chewy in the mouth.</p> <p>A lower intensity flavour. Sweet and savoury, which persists on the palate, with a little salty. A boiled prawn broth flavour.</p>
Redspot King Prawn (Qld)	Cooked cold, whole	<p>A pale pink/peachy colour, with a yellow tinge and distinct red/orange highlights near the legs. An obvious red/orange spot on the body. Slightly drier looking and some transparency through the shell.</p> <p>A moderately intense aroma of ocean-spray, fresh crustacean and sea weedy.</p> <p>A less firm prawn slightly crisp and springy. Chews easily in the mouth.</p> <p>A moderately intense flavour, very sweet and salty, some savoury and fresh crustacean. A moderate flavour persistence.</p>

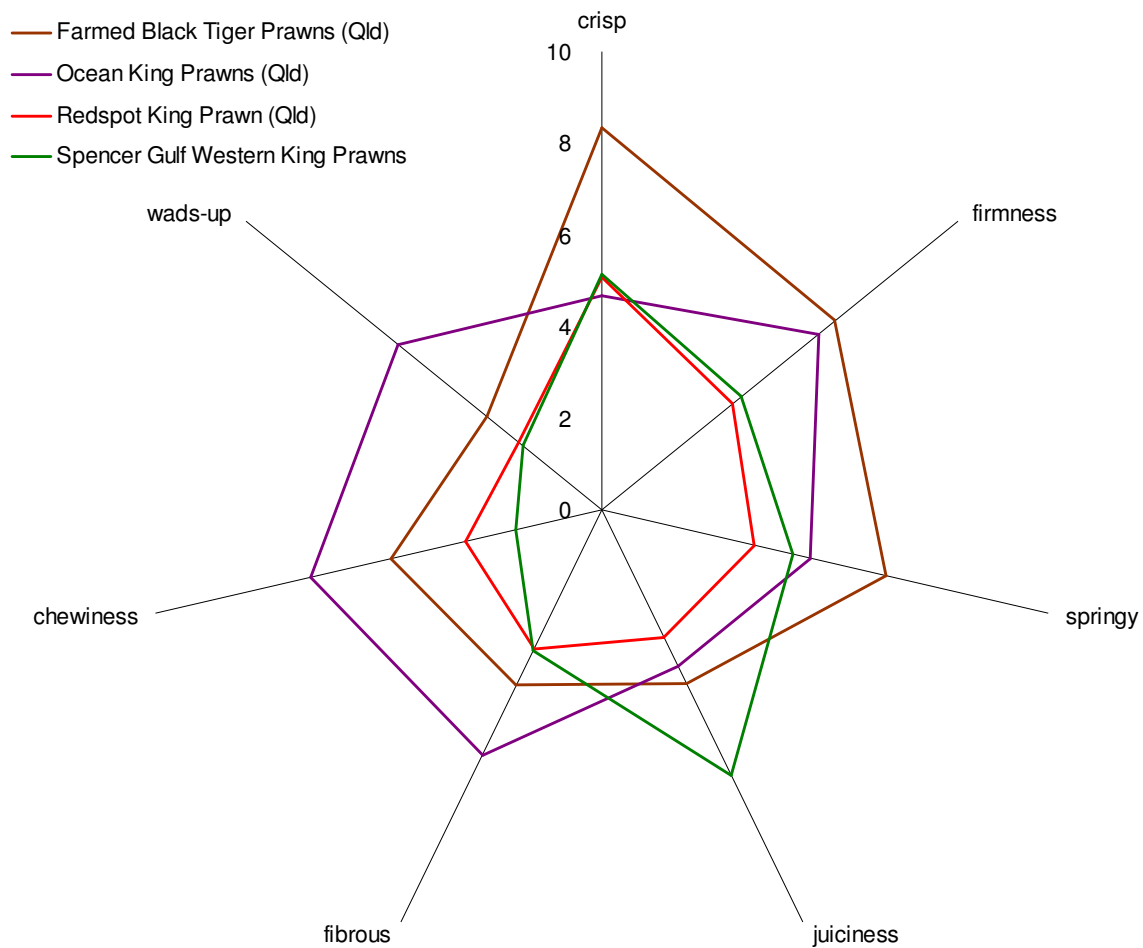
**Figure 13 Results from Prawn sensory analysis for appearance (n=3, 12 panellists)**



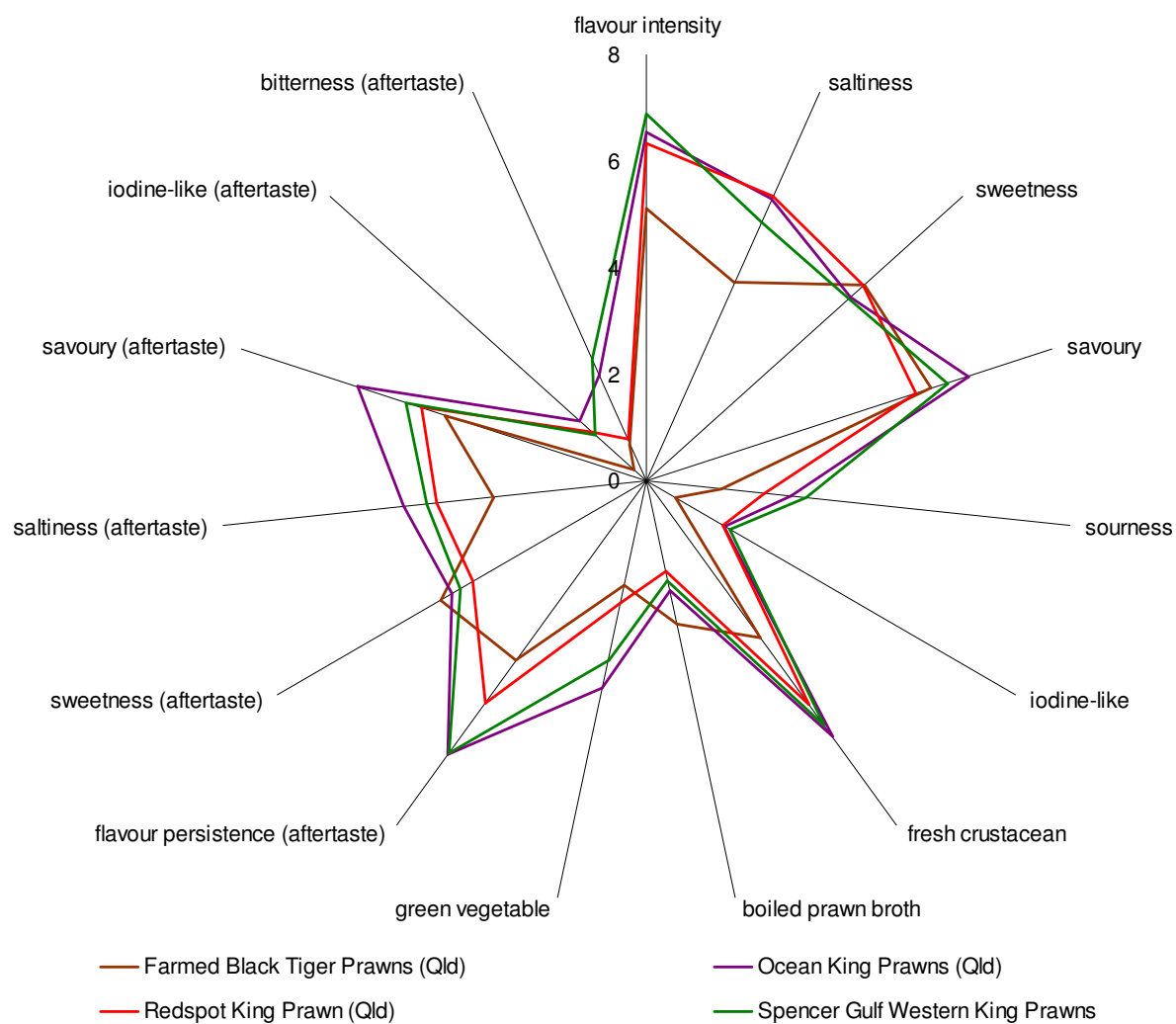
**Figure 14 Results from Prawn sensory analysis for aroma (n=3, 12 panellists)**



**Figure 15 Results from Prawn sensory analysis for texture (n=3, 12 panellists)**



**Figure 16 Results from Prawn sensory analysis for flavour and aftertaste (n=3, 12 panellists)**



### **Results from 'white' fish sensory evaluation**

The 'white' fish samples evaluated are pictured in Photo 5 and the full product descriptions are given Table 7. The summarised data (average across panellists and replicated) are shown in Figure 17, Figure 18, Figure 19 and Figure 20.

The Eyre Peninsula King George Whiting was higher in clean ocean aroma compared to the WA Yellowfin Whiting with more iodine-like character as a flavour and more vegetative flavours and aromas. It was also more metallic on the palate. Otherwise very similar in complexity and intensity and generally similar in profile to the WA Yellowfin Whiting.

The Eyre Peninsula Snapper was the most firm, chewy and least melt-in-mouth compared to the other products. It was similar to the Goldband Snapper in profile in terms of roasted white meat aroma, savoury and roasted flavours. The Goldband Snapper was the most juicy and melt-in-mouth.

Although Goldband Snapper is not a closely related species to Snapper, it is certainly a closely related competitor in terms of consumer choice in the seafood retail market. At the time of the 'white fish' tastings, Goldband snapper was also readily available as a fresh product, for these reasons it was chosen as a suitable comparator to Snapper.

**Photo 5 Whiting and Snapper**

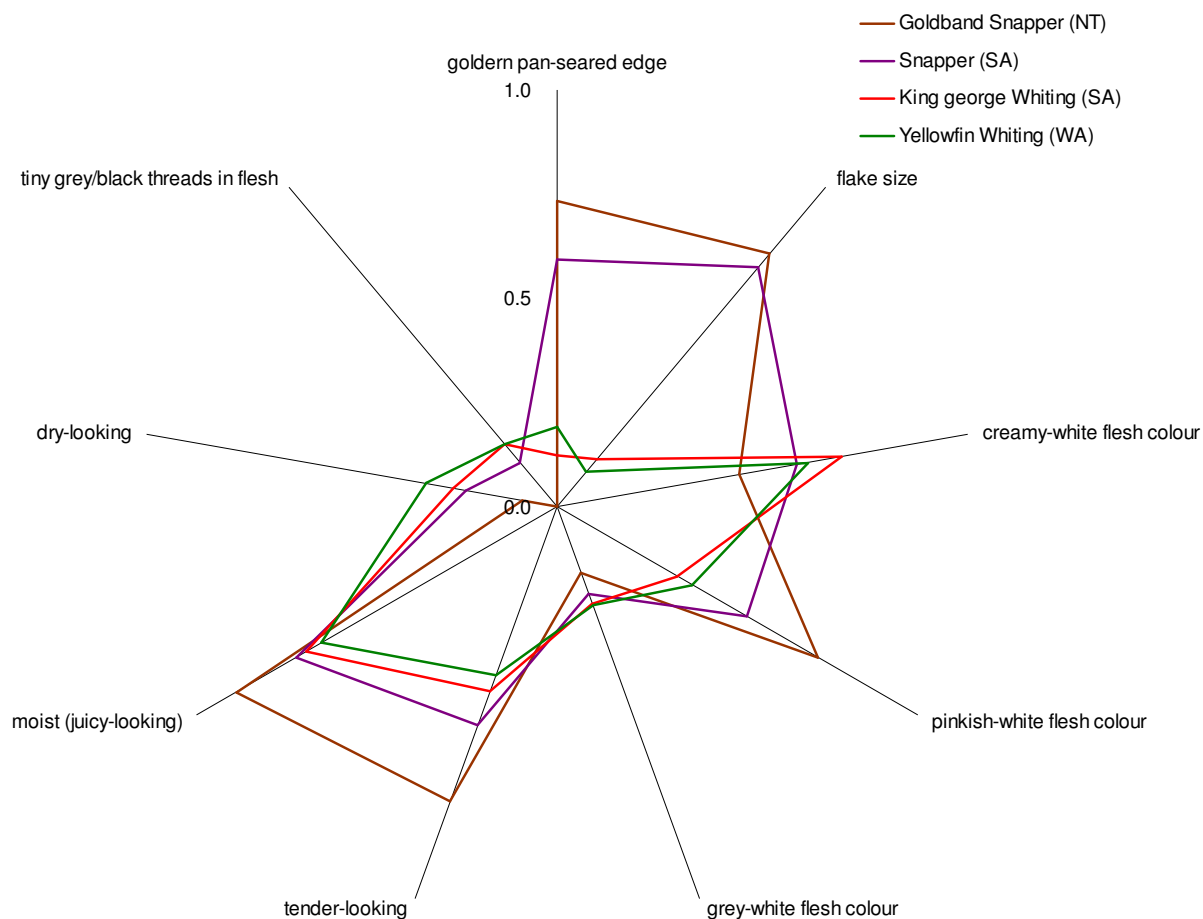


**Table 7 Sensory descriptions of ‘white’ fish**

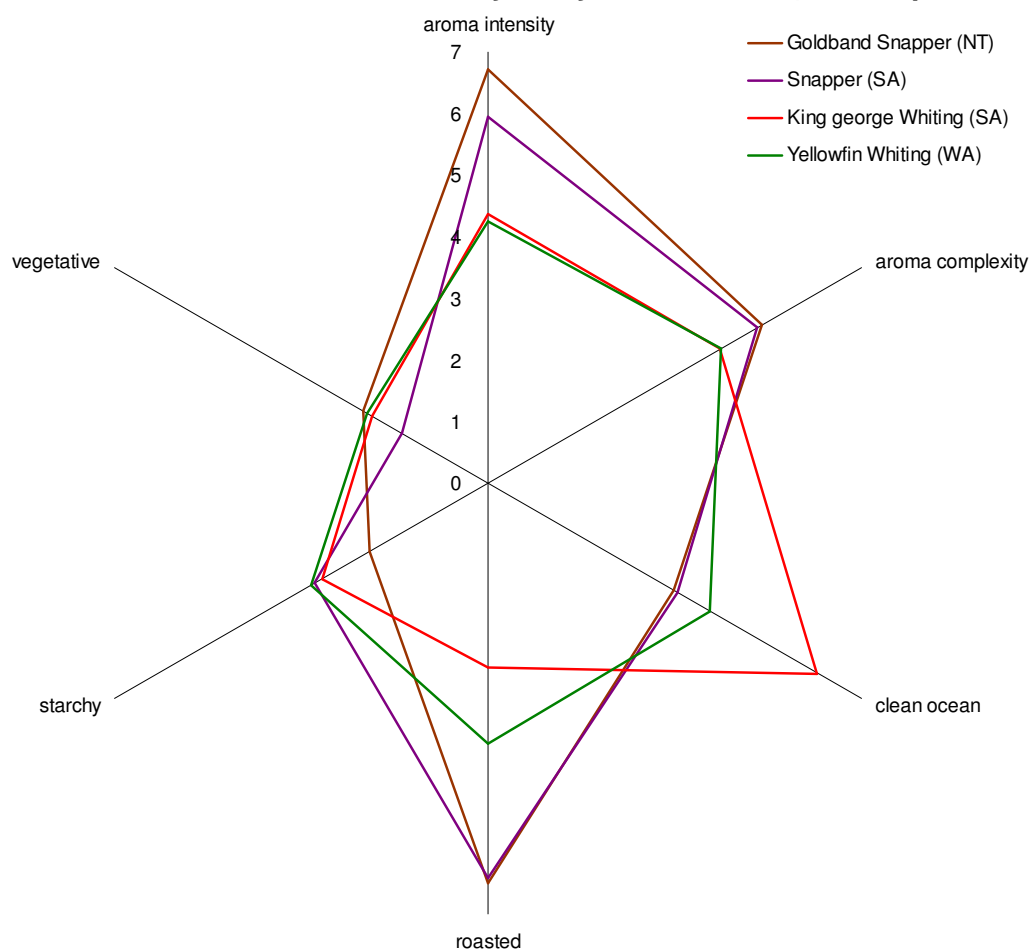
<b>sample</b>	<b>cooking method and presentation</b>	<b>Appearance, aroma, texture and flavour description summary (tentative)</b>
Goldband Snapper	Pan fried fillets	Very moist and tender looking, pinkish-white flesh colour. A large flake-size with a golden pan-seared edge. Intense and complex aroma of roast chicken skin and clean ocean with a slight vegetative note. Extremely juicy and melt-in-mouth texture. An intense savoury flavour of roasted white meat which persists on the palate.
Snapper (SA)	Pan fried fillets	Moist and tender appearance, creamy-white with a slight pinkish flesh colour. A large flake-size with a golden pan-seared edge. A milder but complex aroma of roasted white meat and clean ocean. A firmer texture that is chewy and juicy. An intense savoury roasted flavour with some oceanic sweetness. Flavours persist on the palate.
King George Whiting (SA)	Pan fried fillets	Moist and tender looking. Creamy-white fillet with tiny grey-black threads through flesh. A very fine flake-size with a slight golden pan-seared edge. A complex aroma dominated by clean ocean, some starchy vegetative notes like mushy peas and roasted nuts. A flaky/crumbly texture which melts-in-mouth. A complex sweet ocean and savoury flavour with clean iodine-like notes, egg white, buttery and vegetative. A savoury and slightly metallic flavour lingers on the palate.
Yellowfin Whiting (WA)	Pan fried fillets	Tender looking. Creamy-grey-white fillet with tiny grey-black threads through flesh. A very fine flake-size. A milder but complex aroma, roasted potato, some clean ocean and starchy notes like steamed rice. A flaky/crumbly texture which melts-in-mouth. Oceanic sweetness, savoury and salty flavour with hints of iodine and butter. Some savoury flavours linger.



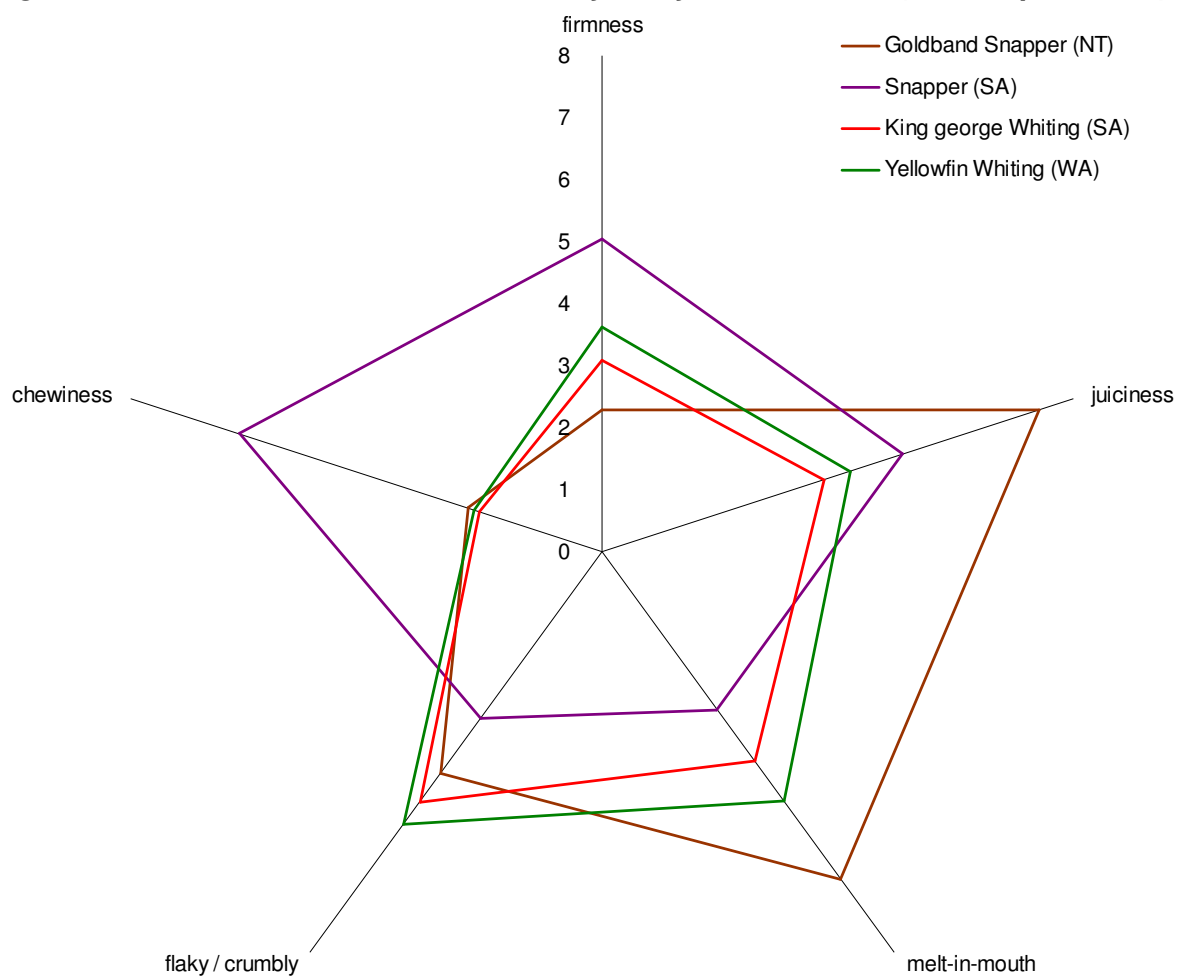
**Figure 17 Results from 'white' fish sensory analysis for appearance (n=3, 12 panellists)**



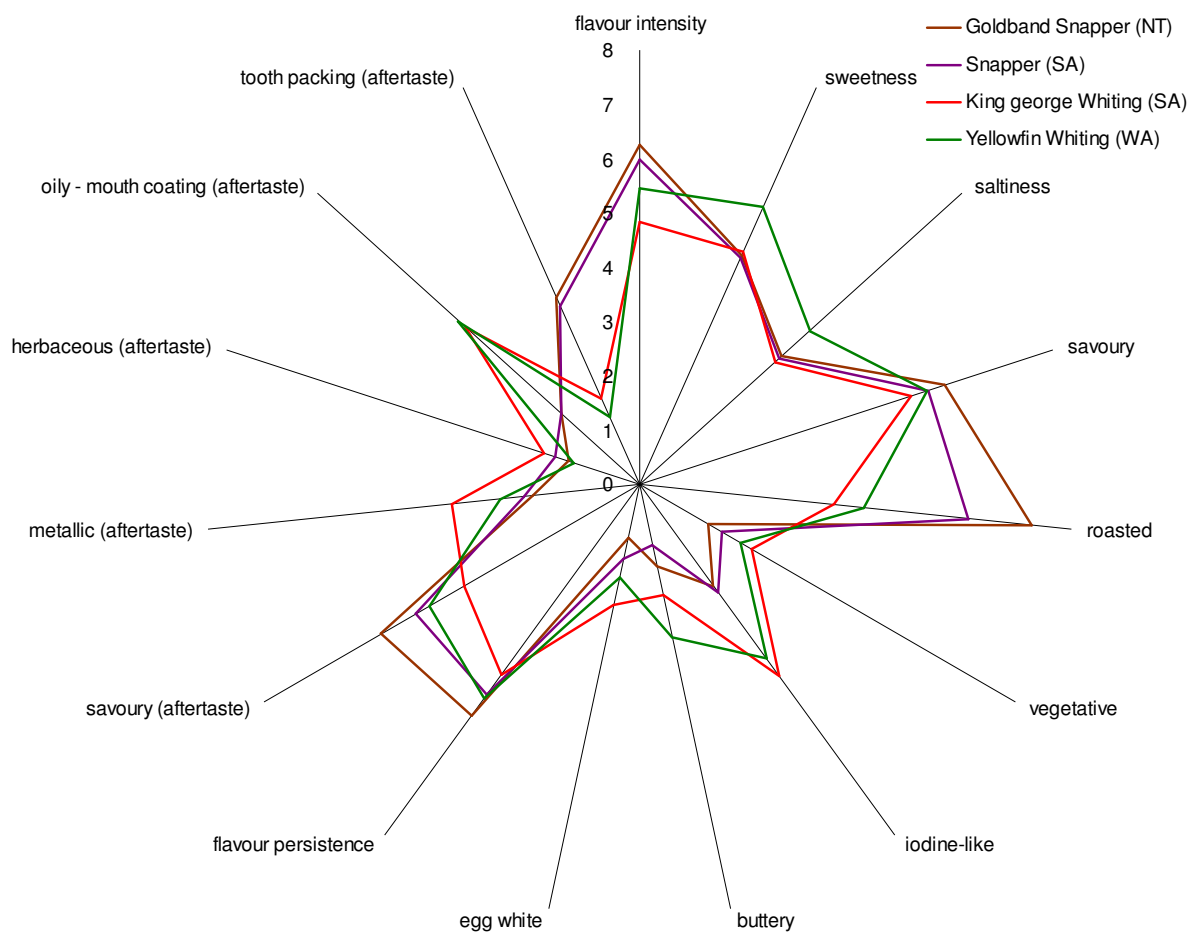
**Figure 18 Results from 'white' fish sensory analysis for aroma (n=3, 12 panellists)**



**Figure 19 Results from 'white' fish sensory analysis for texture (n=3, 12 panellists)**



**Figure 20 Results from 'white' fish sensory analysis for flavour and aftertaste (n=3, 12 panellists)**

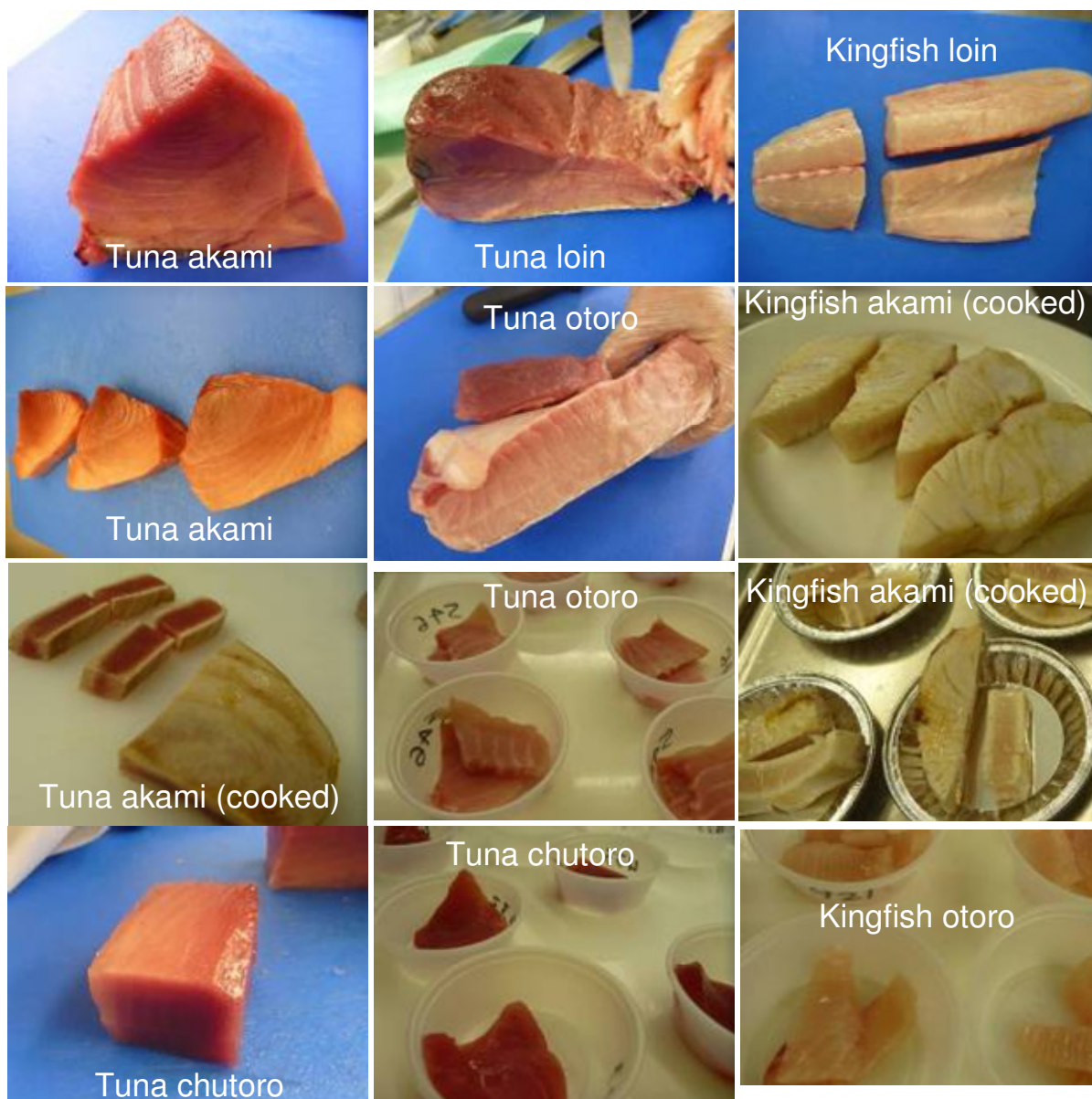


### **Results from 'oily' fish sensory evaluation**

The 'oily' fish samples evaluated are pictured in Photo 6 and the full product descriptions are given Table 8. The summarised data (average across panellists and replicated) are shown in Figure 21, Figure 22, Figure 23 and Figure 24.

Not surprisingly the Southern Bluefin Tuna, Yellowtail Kingfish and Atlantic Salmon were vastly different from one another in terms of appearance, texture and flavour in both sashimi and cooked form.

**Photo 6 Southern Bluefin Tuna and Yellowtail Kingfish**



In general, cooked sample for all species exhibited intense aromas while sashimi samples exhibited no aroma. The exception was the Southern Bluefin Tuna chutoro which has a very low intensity clean ocean aroma.

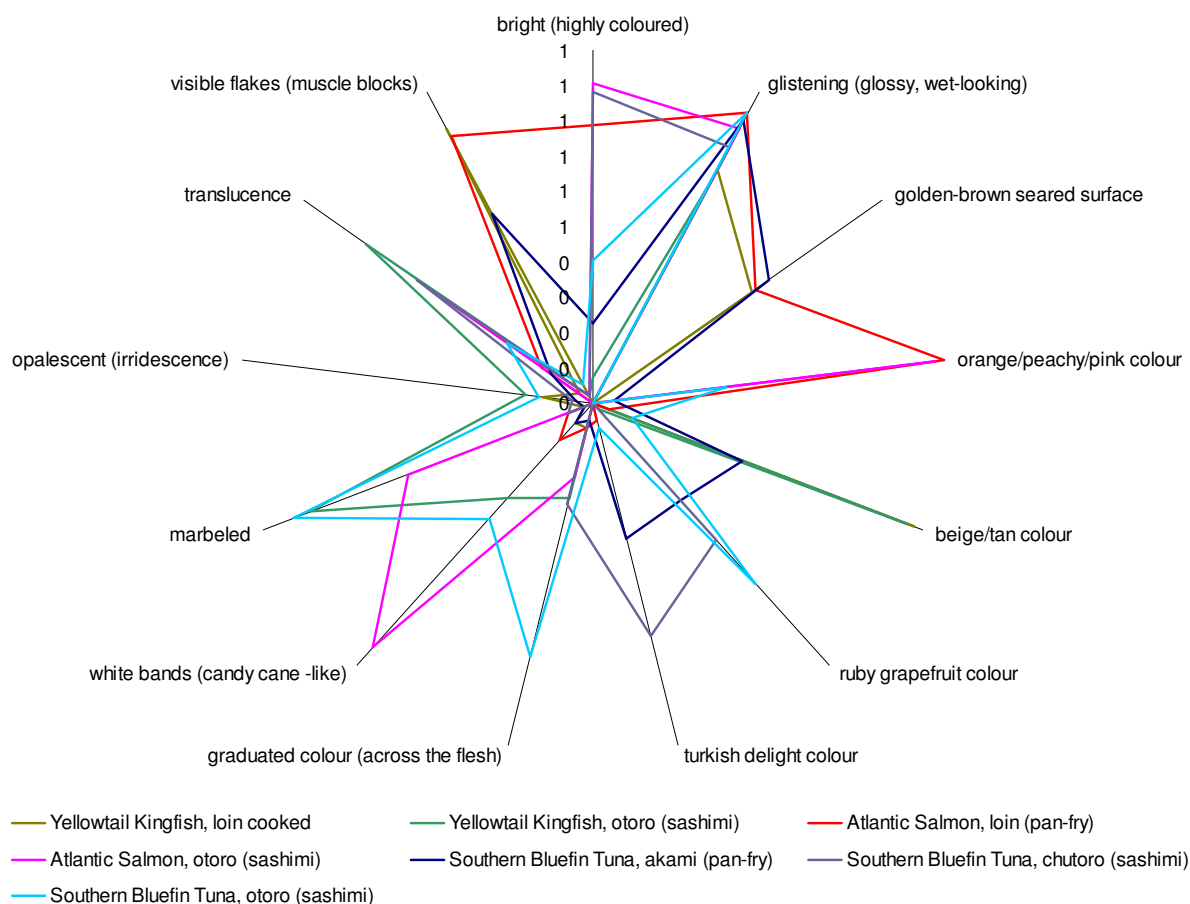
Great care was taken not to overcook the samples as the texture changed vastly (more dry and chewy) and flavours also changed. When overcooked the panel would describe the samples as similar to 'canned' product.

**Table 8 Sensory descriptions of 'oily' fish**

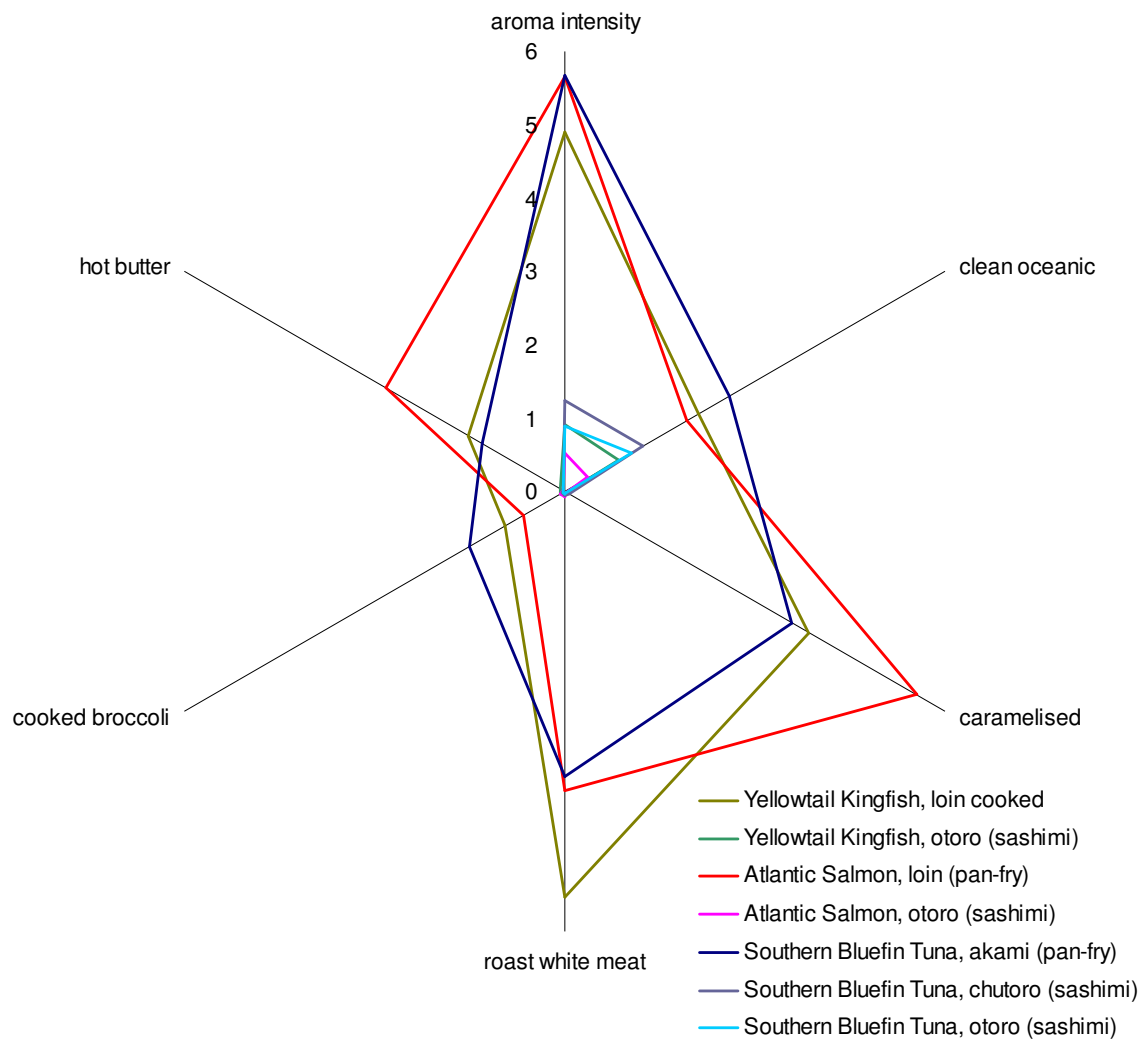
<b>sample</b>	<b>cooking method and presentation</b>	<b>Appearance, aroma, texture and flavour description summary (tentative)</b>
Yellowtail Kingfish loin	Pan-sear	An intense caramelised aroma of roasted white meat, some clean ocean notes. A glistening appearance, beige/tan colour flesh with visible flakes. Juicy with fibres persisting in the mouth, juicy and tooth packing. Flavour of baked fresh white fish, savoury, sweet with some tartness and caramelised flavours. A persisting savoury and slightly tart aftertaste.
Southern Bluefin Tuna akami	Pan-sear	An intense caramelised aroma of roast white meat with some cooked broccoli notes. A glistening Turkish delight colour flesh with visible flakes. Extremely juicy, fatty in the mouth and tender. Some fibres persisting in the mouth. Very intense flavours, tart, savoury, sweet and salty, baked fresh white fish. Persisting flavour of tartness and savoury with an oily-mouth coating
Atlantic Salmon loin	Pan-sear	An intense caramelised aroma with hot butter. A glistening, bright orange-pink colour flesh with visible flakes. Extremely tender and melt-in-mouth, juicy and fatty. A strong caramelised meaty flavour, sweet, savoury, some baked white fish notes and an avocado-like nuttiness. Savoury flavours persist on the palate with an oily-mouth-coating.
Yellowtail Kingfish otoro	Sashimi	No odour. A glistening, marbled, translucent flesh which is beige/tan in colour. Crisp to bite, tender with flakes-persisting, with some mouth-coating fattiness. A delicate fresh oyster flavour, some savoury flavours and rendered fattiness. Slightly savoury and oily-mouth coating lingers.
Southern Bluefin Tuna chutoro	Sashimi	A very slight clean ocean aroma. A bright, glistening, translucent, Turkish delight colour flesh. Extremely tender and melt-in-mouth. Intense tart flavour, some fresh oyster and savoury flavours. Tartness and fresh oyster flavour persists on the palate.

sample	cooking method and presentation	Appearance, aroma, texture and flavour description summary (tentative)
Southern Bluefin Tuna otoro	Sashimi	No odour. A glistening, marbled flesh which is graduated from pale to intense ruby grapefruit colour. Extremely tender and melt-in-mouth, gelatinous and slippery with a mouth-coating fattiness. An intense flavour of fresh oyster, savoury and a little tartness, some avocado-nuttiness and herbaceous flavours. Fresh oyster and savoury flavours persists on the palate with an oily mouth coating.
Atlantic Salmon otoro	Sashimi	No odour. A bright, glistening, translucent, marbled, orange-pink flesh with distinct white bands. Tender but crisp to bite, melt-in-mouth with a mouth-coating fattiness. Flavour of avocado-like nuttiness with rendered fat. A clean oily-mouth coating lingers.

**Figure 21 Results from ‘oily’ fish sensory analysis for appearance (n=3, 14 panellists)**

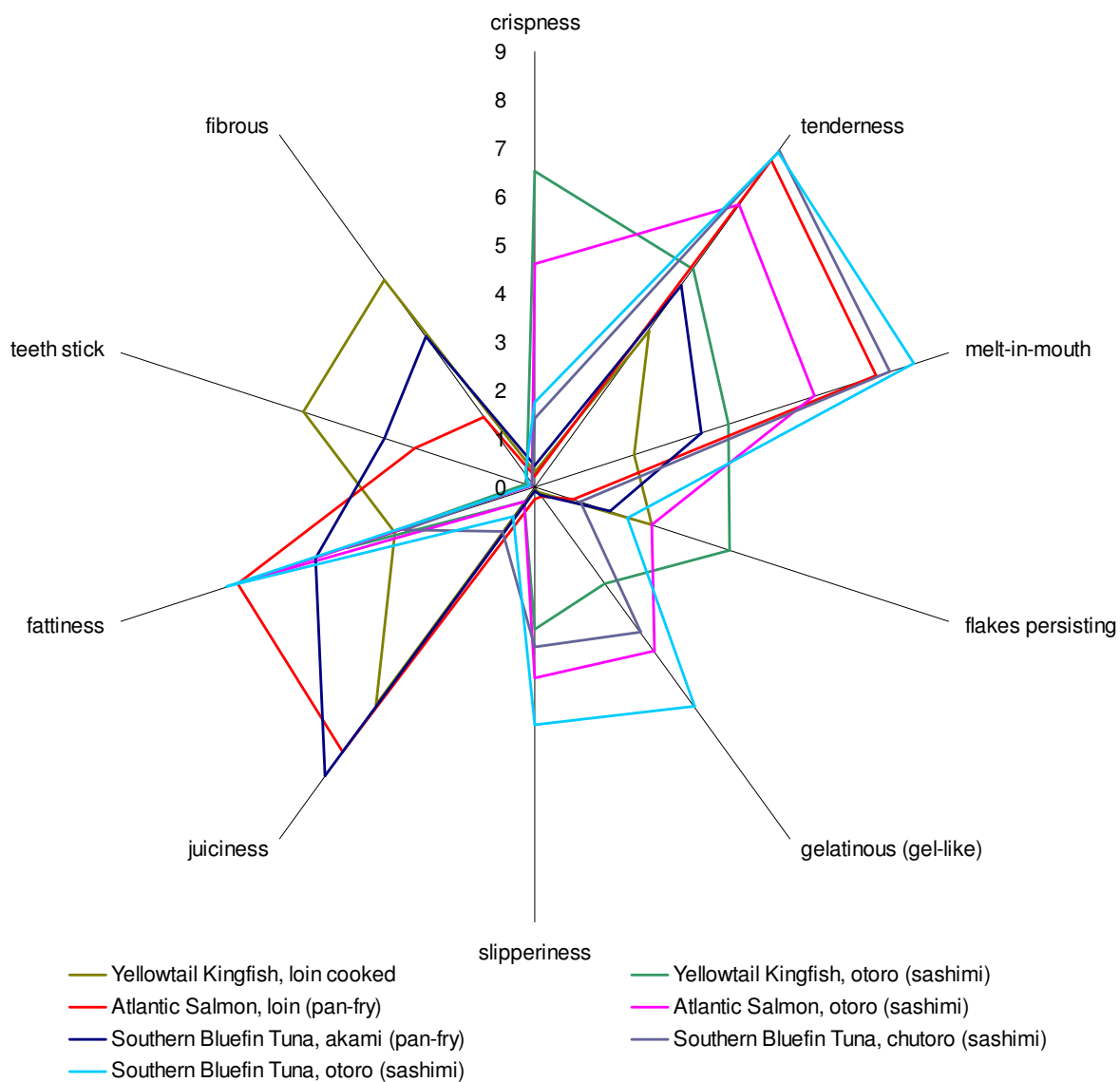


**Figure 22 Results from 'oily' fish sensory analysis for aroma (n=3, 14 panellists)**

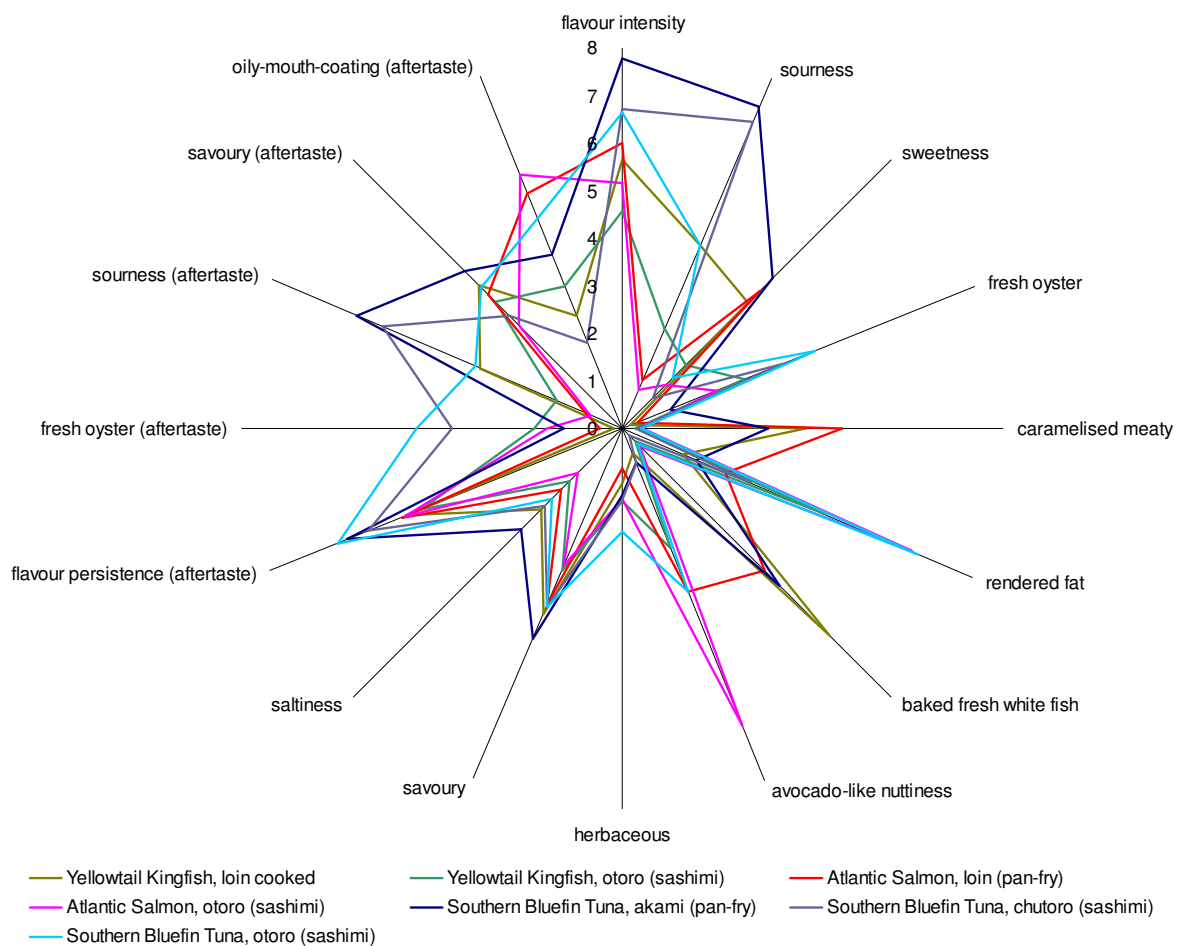




**Figure 23 Results from 'oily' fish sensory analysis for texture (n=3, 14 panellists)**



**Figure 24 Results from 'oily' fish sensory analysis for flavour and aftertaste (n=3, 14 panellists)**



### **Results from Oyster sensory evaluation**

The oyster samples evaluated are pictured in Photo 7 and Photo 8 (from top right: Pacific Oyster (Tas), Pacific Oyster (SA, diploid), Native Oyster (SA) center, Pacific Oyster (SA, triploid), Sydney Rock Oyster (NSW)). Full product descriptions are given Table 9. The summarised data (average across panellists and replicated) are shown in Figure 25, Figure 26, Figure 27 and Figure 28.

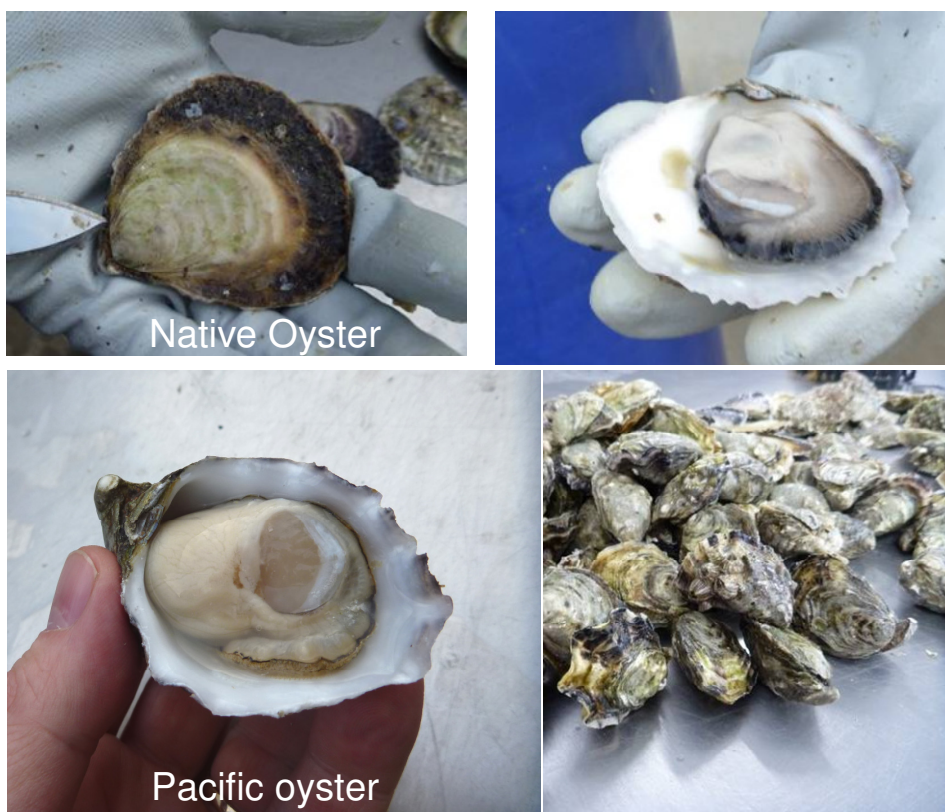
The Eyre Peninsula Pacific Oysters (diploid and triploid) and Tasmanian Pacific Oyster were somewhat similar in comparison to the Sydney Rock and Native Oysters. The Eyre Peninsula diploid (standard) was generally more intense in flavour and much brighter in appearance and crisper, plumper. The triploid (spawnless) Pacific Oyster was more burst-in-mouth and more salty then sweet compared to the diploid being more sweet then salty.

The Tasmanian Pacific was more tidal rock pool in aroma compared to fresh clean ocean aroma found in the Pacific's from Eyre Peninsula. The Tasmanian Pacific was also distinct in having some cucumber and fishy notes.

The Eyre Peninsula Native was the most complex and most intense in flavour. It exhibited a distinct slight tartness and hazelnut flavours.

The Sydney Rock Oysters were not in peak condition due to seasonality. They were flat and sunken with very green bitter and metallic flavours that persisted. Seasonality of Sydney Rock Oysters is not synchronised with Pacific Oysters. As discussed previously, the timing of the oyster tastings was deliberately chosen to optimise for seasonality of the Eyre Peninsula oysters. This should be considered when interpreting the results from the textural data particularly.

### **Photo 7 Native and Pacific Oysters**



**Photo 8 Oysters presented to the panel**

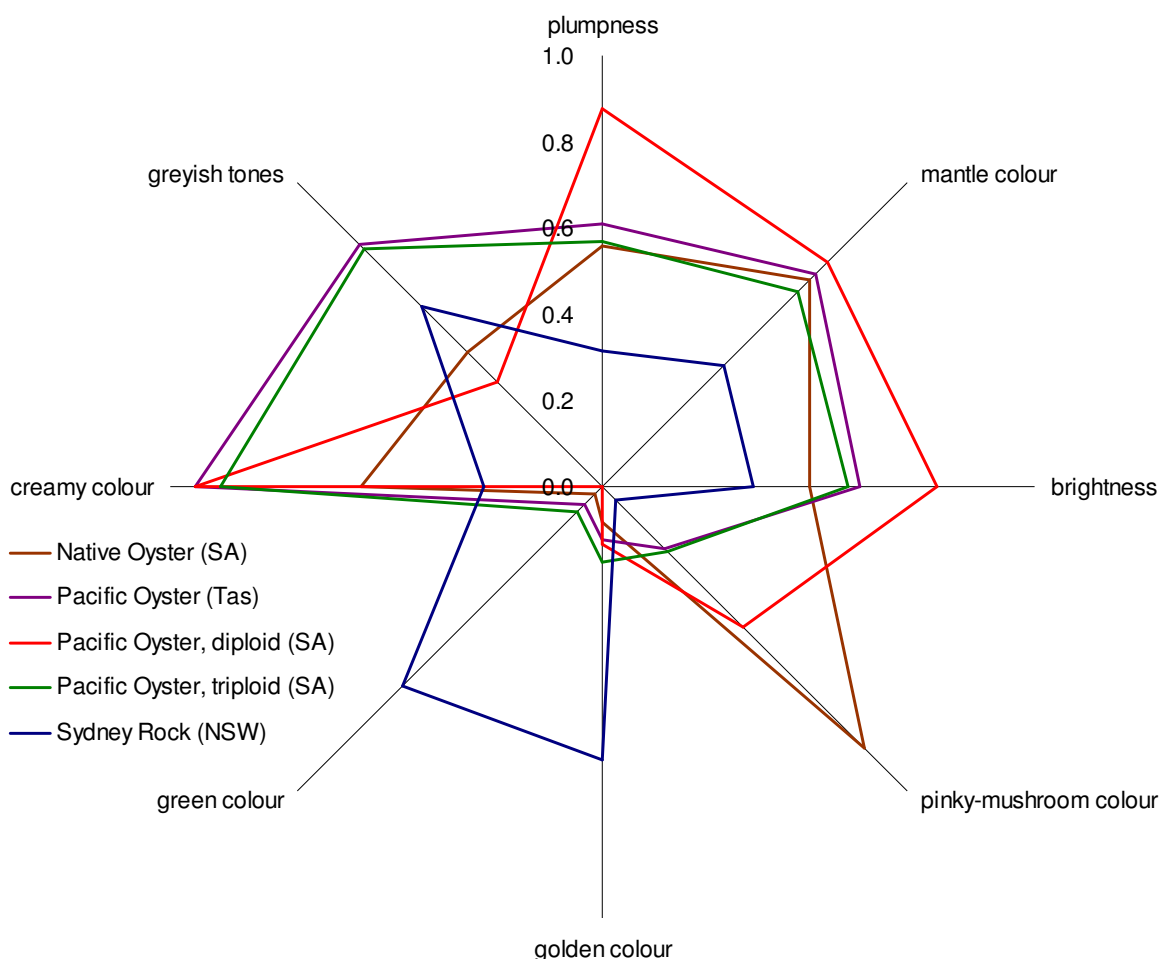


**Table 9 Sensory descriptions of oysters**

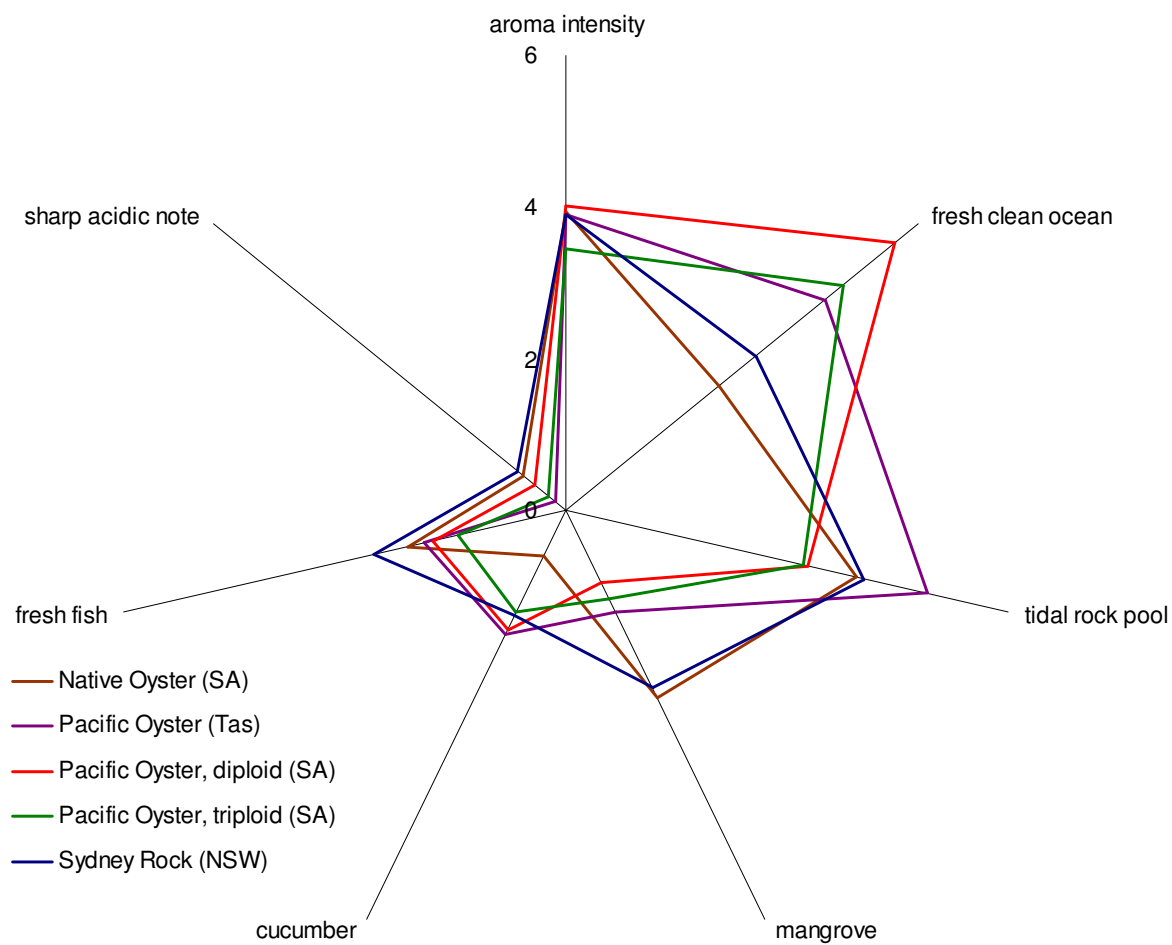
sample	cooking method and presentation	Appearance, aroma, texture and flavour description summary (tentative)
Native Oyster (Angasi Oyster, SA)	Freshly shucked, natural	<p>A pinky-mushroom colour with a dark mantle. Flat but plump appearance.</p> <p>Tidal rock pool, mangrove and fresh fish.</p> <p>A firmer crisp texture which is juicy and chewy.</p> <p>Intense and complex flavour. Savoury with a green bitterness, mangrove, hazelnut and asparagus. Some salty and a slight tartness.</p> <p>Persisting flavours of savoury, salty, a green bitterness and metallic.</p>
Pacific Oyster (Tas)	Freshly shucked, natural	<p>Creamy colour with greyish tones and a dark mantle.</p> <p>Plump and long in appearance.</p> <p>Aroma of tidal rock pool with a hint of cucumber and fresh fish.</p> <p>Very juicy, burst-in-mouth and chewy.</p> <p>Lacks complexity. Salty and sweet ocean with some savoury flavours. A little green bitterness, asparagus and mangrove.</p> <p>Some flavour persistence with a little green melon aftertaste.</p>
Pacific Oyster, diploid (SA)	Freshly shucked, natural	<p>A bright creamy colour with a pinky-mushroom tinge and very dark mantle. Very plump and squat appearance.</p> <p>An aroma of fresh clean ocean with a little cucumber and fresh fish.</p> <p>Very crisp and firm oyster that bursts-in-mouth. Juicy and consistent.</p> <p>Intensely sweet ocean, salty and savoury with a hint of asparagus.</p> <p>A clean finish with sweetness and savoury lingering.</p>

sample	cooking method and presentation	Appearance, aroma, texture and flavour description summary (tentative)
Pacific Oyster, triploid (SA)	Freshly shucked, natural	Creamy colour with greyish tones and a dark mantle. Plump in appearance. Fresh clean ocean, some cucumber and fresh fish Very juicy and burst-in-mouth with a consistent texture. Intensely salty, sweet and savoury with a hint of green bitterness and asparagus. A clean finish with lingering saltiness.
Sydney Rock Oyster (NSW)	Freshly shucked, natural	Golden-greenish colour with slightly dull greyish tones. Tidal rock pool, mangrove and fresh fish with a hint of cucumber. A soft consistent texture which is slippery in the mouth. Complex flavours of green bitterness and mangrove. Savoury and salty with some tartness. A bitter metallic flavour persists on the palate.

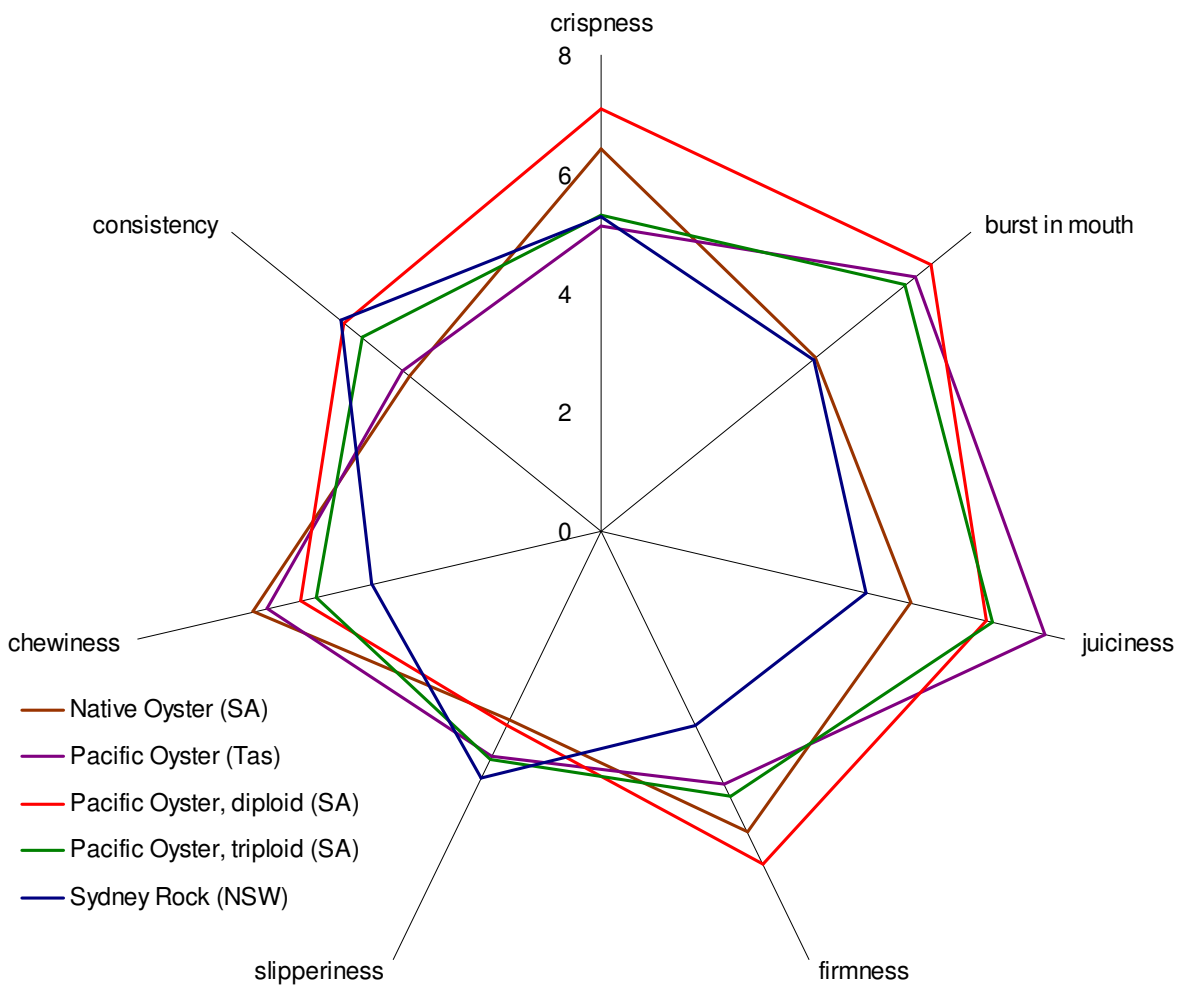
**Figure 25 Results from oysters sensory analysis for appearance (n=4, 14 panellists)**



**Figure 26 Results from oysters sensory analysis for aroma (n=4, 13 panellists)**

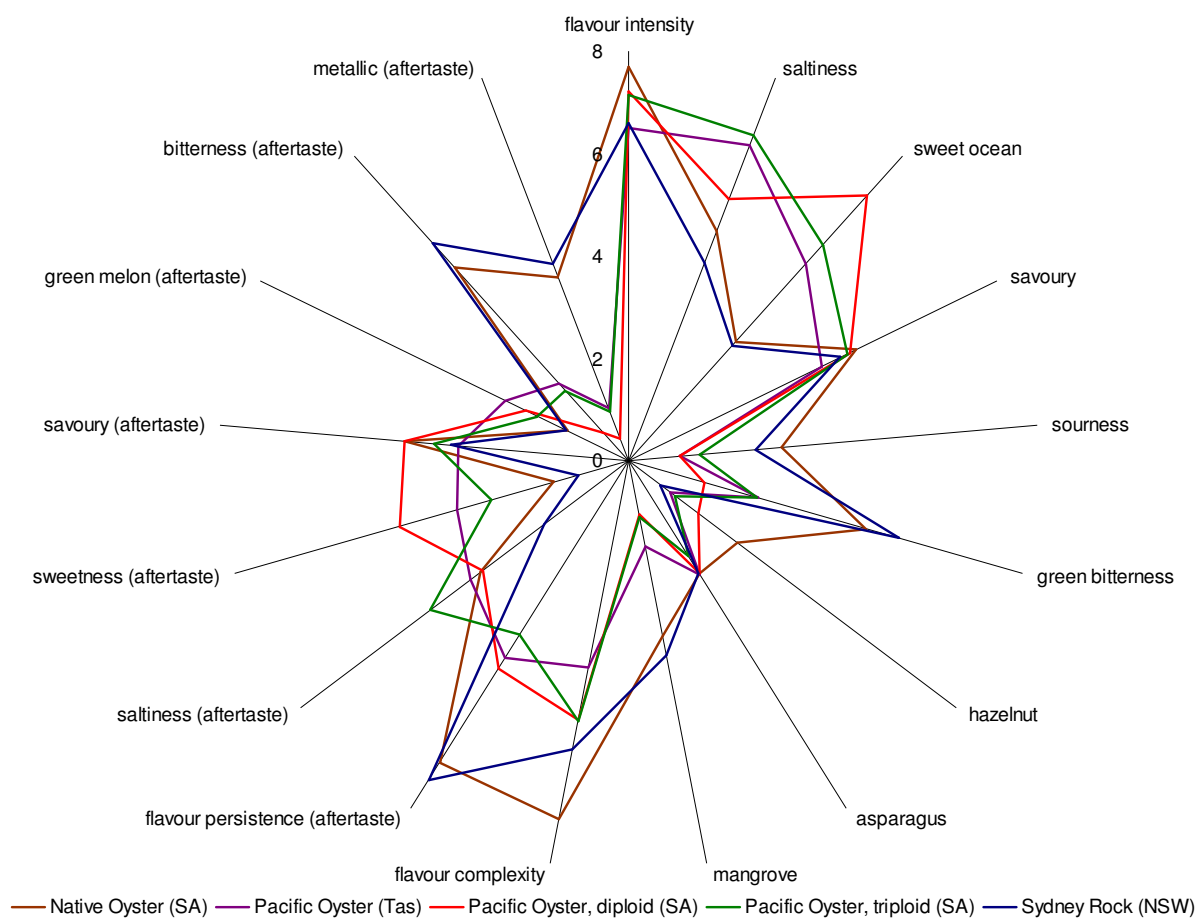


**Figure 27 Results from oysters sensory analysis for texture (n=4, 13 panellists)**





**Figure 28 Results from oysters sensory analysis for flavour and aftertaste (n=4, 13 panellists)**





### **Results from Mussel sensory evaluation**

The mussel samples evaluated are pictured in Photo 9 and the full product descriptions are given Table 10. The summarised data (average across panellists and replicated) are shown in Figure 29, Figure 30 and Figure 31.

It was intended to evaluate the male and female mussels separately for the mussel sensory trial, however, this proved impossible for the Blue Mussel samples as the ratios between male and female changed dramatically and unpredictably over the tasting session. The Green mussels were assessed as distinct male and female samples as there were sufficient quantities of both sexes represented in all samples obtained.

The Tasmanian Blue Mussels exhibited a very narrow colour range from pale orange to slightly more intense orange. In comparison, the Eyre Peninsula Blue Mussels ranged dramatically from ivory to burnt orange and purple.

Initial tasting sessions involved separating the male and female mussels to consider taste differences. During the course of the training, the panel indicated that for the Blue Mussel the females were a more intense flavour but similar in profile to the male mussels and that the difference between the two samples (Tasmanian and Eyre Peninsula) was more important. When overcooked (significant shrinkage occurs), it was noted that the female Blue Mussels became more elastic while the male Blue Mussels became pasty in texture. If cooked 'eldante' the texture differences between male and female were indistinguishable.

All the mussels were very complex in aroma and flavour and extremely intense compared to any other seafood product assessed by the panel in this project.

It is noted that the textural differences observed between mussels should be considered with the fact that seasonality can drastically influence texture. Further, seasonality is not synchronised between different geographical locations. As discussed previously, the timing of the mussel tastings was deliberately chosen to optimise for seasonality of the Blue Mussels from Eyre Peninsula.

It should also be noted that while all Blue Mussels were assessed as fresh product, the Green Mussels from New Zealand were only available as frozen product. Again textural data should be considered with this in mind, as freezing mussels can have an influence on mussel texture.

### **Photo 9 Blue Mussels**



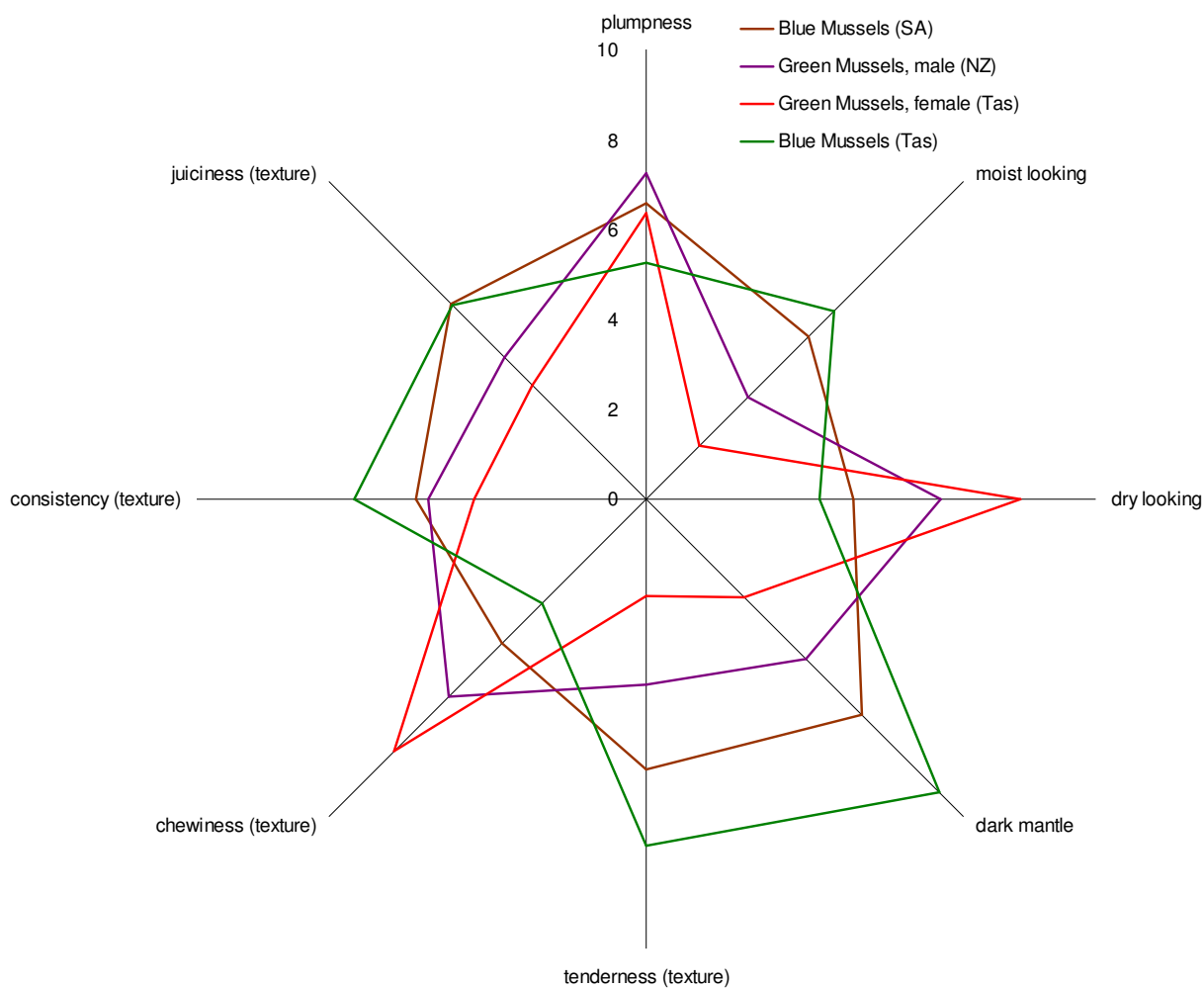
The Blue Mussels from Eyre Peninsula and Tasmania were somewhat similar to each other but notably different to the New Zealand Green Mussels.

The Eyre Peninsula Blue Mussels were plumper and more vibrantly coloured with the highest flavour intensity and highest clean ocean and roast meaty aroma with slight buttery. The Tasmanian Blue Mussels by comparison were more boiled potato and starchy with sweet steamed carrot and slightly nutty flavour.

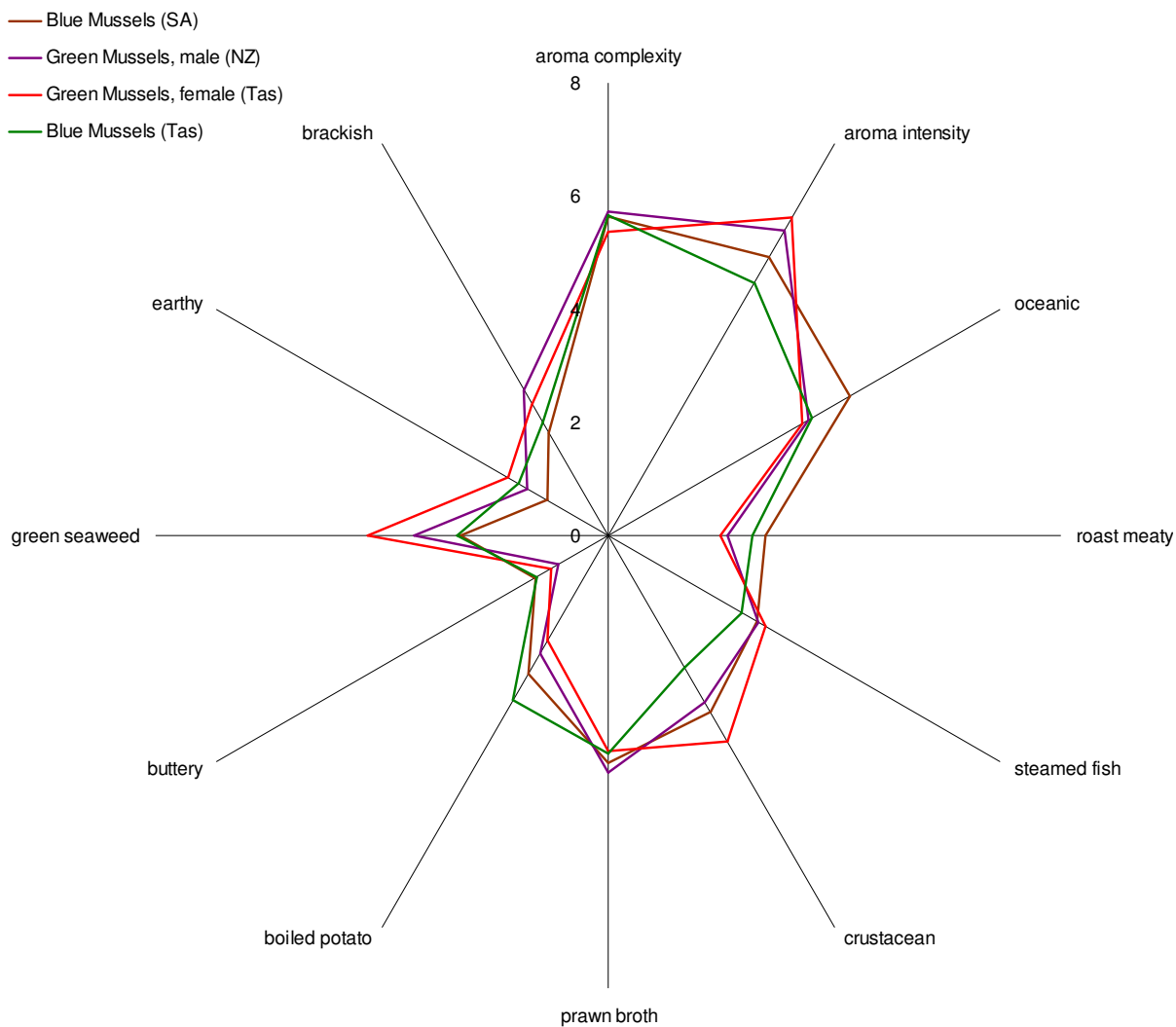
**Table 10 Sensory descriptions of mussels**

<b>sample</b>	<b>cooking method and presentation</b>	<b>Appearance, aroma, texture and flavour description summary (tentative)</b>
Blue Mussels (SA)	Steamed whole served in shell	Very plump and moist in appearance. Colours range from ivory to bright orange and vivid purple with a dark mantle. Complex and moderately intense aroma. A very clean oceanic aroma, crustacean, potato and roast meaty. Extremely tender and juicy with a little chewiness. Intensely flavoursome. Very savoury, salty, sweet, roast meaty and crustacean. A little steamed vegetable and a hint of butter. Savoury flavours persist on the palate.
Blue Mussels (Tas)	Steamed whole served in shell	Moist in appearance. Colours range from pale orange to orange with a very dark mantle. Complex aroma. Oceanic, prawn broth and boiled potato, some steamed fish and roast meaty. Extremely tender, juicy and consistent in texture. Flavoursome, predominantly savoury and sweet steamed carrot. Some meaty and crustacean flavours. Some flavour persistence and a sweetness that lingers.
Green Mussels – male (NZ)	Steamed whole served in shell (cut in halves)	Very plump and somewhat dry looking. An off-white/beige colour. Complex aroma. Oceanic, prawn broth and green sea weedy with some steamed fish and brackish aromas. Somewhat chewy in texture. Flavoursome. Savoury and some salty, steamed carrot and roast meaty. A hint of bitter grassiness.
Green Mussels – female (NZ)	Steamed whole served in shell (cut in halves)	Plump and very dry looking. A bright orange colour. Intense and complex aroma. Dominantly green seaweed, crustacean and oceanic. Some earthy and brackish notes. Very chewy, fairly dry and inconsistent in texture. Flavoursome. Savoury and some salty. Sweeter than the male. Crustacean and grassy. A little steamed carrot and roast meat. A hint of nuttiness and a brackish flavour. Flavours persist on palate.

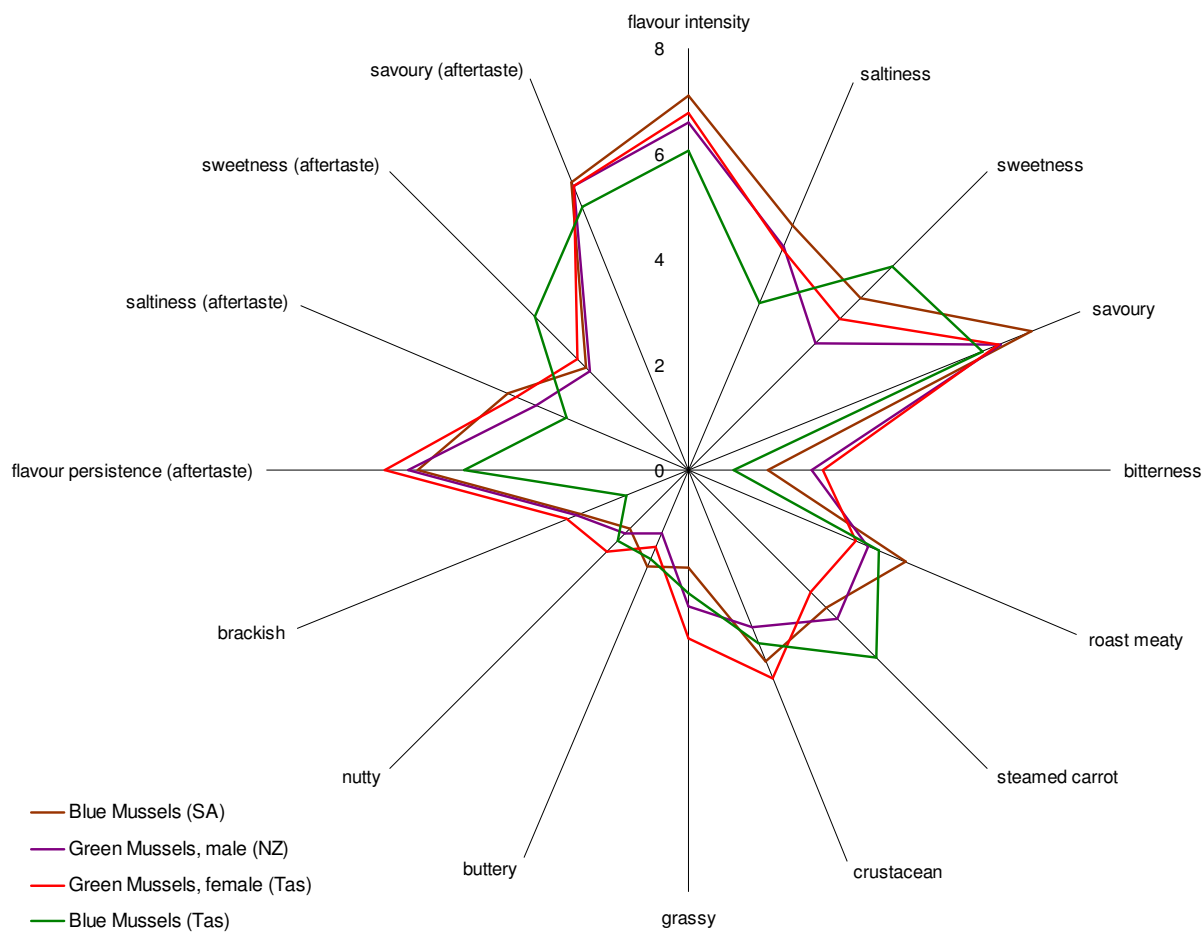
**Figure 29 Results from mussels sensory analysis for appearance and texture (n=3, 10 panellists)**



**Figure 30 Results from mussels sensory analysis for aroma (n=3, 10 panellists)**



**Figure 31 Results from mussels sensory analysis for flavour and aftertaste (n=3, 10 panellists)**



## **BENEFITS AND ADOPTION**

To ensure the adoption of the information tools developed in this project, two formal workshops were planned and executed as part of this project. The purpose of the workshops was to train local industry, both producers and end users, on how to apply the seafood flavour wheel and to understand the process taken to develop the product descriptions.

The first workshop was held in Port Lincoln on the 8<sup>th</sup> November (2 hours) and targeted the local industry from Eyre Peninsula. Around 30 people attended and were given a presentation on the project approach and methods used and were involved in a taste session of a range of species and comparators that had been included in the project. In addition the attendees were given a draft of the flavour wheel and product descriptions and were given the opportunity to provide feedback and suggestions on the relevance and usefulness of the material. Several producers provided specific feedback on particular product descriptions and these suggestions were incorporated.

Positive feedback was received for the project and the information tools developed. The workshop participants also indicated the benefits of being involved in the technical tastings and assessments of seafood products during the workshop. Several industry members indicated that product specific workshops involving similar tasting sessions alongside competitor/comparator products (for example, an oyster tasting workshop) would be beneficial for the local industry.

A second 'master class' workshop was held in Adelaide, SA, on the 5<sup>th</sup> December (3 hours) in conjunction with the "Eyre Peninsula Seafood Flavour Wheel" media launch. Invitees included FRDC's Executive Director Patrick Hone, local Eyre seafood industry members, seafood distributors, key local seafood chefs, local sommeliers and winemakers as well as food media. The master class showcased the species of the Eyre Peninsula alongside the flavour wheel and involved technical tastings of all of the Eyre Peninsula seafood species included in the project (except for Snapper due to product unavailability). The final "Eyre Peninsula Seafood Flavour Wheel" was used alongside tastings as a training tool and to demonstrate its use.

Participants discussed the benefits of the wheel in assisting seafood consumers as well as chefs in preparing menus. Feedback from participants also included suggestions of culinary uses and food and wine pairing.

The information tools developed in this project has benefited local industry who have been involved in tasting workshops associated with this project. Local industries now have an understanding of and language to assist them in describing the sensory properties of their products to their customers. Furthermore, industry now have tools to train their staff and clients to confidently describe the quality of local products to customers.

The local Eyre Peninsula seafood industry also intend to use the "Eyre Peninsula Seafood Flavour Wheel" as part of a comprehensive training program to train retailers and restaurateurs in seafood flavour. This will occur in part via Craig McCathies' new seafood training school / kitchen (Port Lincoln Fresh Fish Co.). Over 100 local Eyre Peninsula businesses as set to benefit through the ongoing extension of the "Eyre Peninsula Seafood Flavour Wheel" which will stimulate strong economic benefits (increased confidence, sales and price for premium product). Other than catchers and growers, the local Eyre Peninsula seafood industry comprises numerous sundry service providers including post harvest businesses (packaging, logistics, sales & marketing services).

Due to the media coverage to date (refer to Appendix 8 : Summary of Media coverage of the project, page 121) and predicted ongoing use of the information tools developed in this project there is and will be an increase in local and international consumer awareness of the seafood from the Eyre Peninsula region. This will also increase the identity and branding of the Eyre Peninsula for regional tourism.

### **FURTHER DEVELOPMENT**

Further extension activities are required to fully realise the benefits from the information tools developed in this project. Specifically, it is recommended that:

- Further master classes and industry training workshops should be held in key areas and for key markets. These would include product tastings and training using the 'Eyre Peninsula Seafood Flavour Wheel'.
- The 'Eyre Peninsula Seafood Flavour Wheel' will be made available electronically via the Seafood Frontier website and FRDC websites.
- The 'Eyre Peninsula Seafood Flavour Wheel' could be further produced as a fridge magnet (targeting commercial kitchens and retail fish shops)
- The product descriptions should be incorporated into existing product-by-product factsheets and regional story book along with region of origin, product details, seasonality, handling and storage, and other end-user information such as culinary use.
- Seafood and wine pairing should be undertaken and information included in relevant fact sheets. This would include 2-3 culinary suggestions per species and a matched wine/beverage type for each preparation method.

This project was intended to be a template that can be replicated for other important seafood producing regions of Australia. The success of this project reinforces that Australian seafood industries must continue with 'regional branding' of their product. By focusing on regional flavour, this marketing approach will secure Australian seafood regions in the minds and on the palates of consumers in a distinctly unique context. This will ensure that the Australian seafood brand remains competitive, focussed and cohesive in the future.

### **PLANNED OUTCOMES**

The information tools made available in this project and the workshops conducted as part of the project have assisted local industry to understand the basics of scientific sensory evaluation and have the ability to taste, recognise and describe the sensory qualities of their products to their customers.

The 'Eyre Peninsula Seafood Flavour Wheel' launch achieved a great deal of publicity locally and nationally and as such there is an increased awareness and dissemination of accurate sensory information among producers, distributors, end users, and consumers, for a range of key seafood species from the Eyre Peninsula region. This has raised consumer awareness not only of Eyre Peninsula seafood products, but also for the region and seasonality. This awareness will increase as the tools become available electronically via the seafood frontier website and from future use of the information products in marketing.

The Eyre Peninsula seafood region already approach marketing as a united industry and now have solidified a regional branding approach based on flavour profiling. This united approach will continue to increase consumer confidence nationally and internationally through the delivery of consistent and accurate messages.

The 'Eyre Peninsula Seafood Flavour Wheel' and species-specific descriptions, provide the basis of an objective sensory grading tool to ensure consistent premium product from harvest point for Eyre Peninsula seafood.



## **CONCLUSION**

This work provides a clear, useful means of characterising and describing the flavours of a range of seafood products for the seafood industry, chefs, end users and consumers. It also forms the basis of quality control targets for key Eyre Peninsula seafood products.

The results of this work have been communicated to the Seafood industry and end users to promote the uptake of tools developed in this project and stimulate an increase in awareness of the qualities associated with Eyre Peninsula seafood.

The 'Eyre Peninsula Seafood Flavour Wheel' and discrete product sensory descriptions are completely unique in the world. It is anticipated that extension of these tools to the national and international seafood markets and food service sectors will stimulate increased interest in seafood from Eyre Peninsula and Australia.

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## **APPENDIX 1: INTELLECTUAL PROPERTY**

The intellectual property arising from this trial is the Eyre Peninsula Seafood Flavour wheel (given in Appendix 7 : Eyre Peninsula Seafood Flavour wheel, page 119) which includes the discrete sensory descriptions of each of the 11 key species assessed in this project.

## APPENDIX 2: STAFF

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A 24-membered trained sensory panel was engaged in this project comprising staff of DAFF Qld, Biosecurity Queensland, The University of Queensland and CSIRO.

Technical support and assistance was provided by staff, students and visiting academics of DAFF Qld including Kerrie Abberton, Jimmy Baker, Lucia Quintana, Andrew Forest, Paul Exley, Carl Paulo, Francesca Sonni and Damien Pruneau.

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## **APPENDIX 3 : SUMMARY OF LITERATURE REVIEW**

### **Objectives of the literature review**

The target species of this review are Pacific and Native Oysters, Blue Mussels, Spencer Gulf Western King Prawns, Greenlip and Blacklip Abalone, Southern Rocklobster, Australian Sardines, Yellowtail Kingfish, Southern Bluefin Tuna, King George Whiting, Snapper, Southern Calamari.

The objectives of this review is to collect and collate the most typical sensory terms that have been used to describe the flavours, aromas and textures of the seafood species of interest. This information will be used as the basis of training and discussion in the ensuing descriptive sensory panels as they assess the seafood products involved in this project.

### **Sensory descriptions of seafood flavour**

A review of the literature revealed a shortage of information on specific descriptive sensory properties of the seafood products targeted by the present work. For certain species, such as abalone, and Pacific oyster, some descriptive studies have been conducted, and for other species, such as Southern Rocklobster and Native Oyster almost no information could be found. Generally speaking, many of the studies encountered which involved sensory analysis did not utilise descriptive techniques, rather applied acceptability rating (for example, flavour – acceptably, unacceptable).

Due to the lack of information on the specific species of interest, a broader search approach was taken to find examples of descriptive sensory information for varying species within the same genus.

### **Compositional basis of seafood flavour**

Comprehensive information was found relating to the chemical components in seafood that are responsible for perceived aroma and flavour qualities. A detailed review was published in 1998 of the chemical components responsible for flavours of fish meat [20] and shellfish [21], generally. In summary, the major components include volatile compounds (aroma), non-volatile compounds (taste) and compounds that are perceived as mouth feel.

While non-volatile components responsible for flavour and textural attributes are considered the most important quality determinant in fresh fish, it's the volatiles that are the most influential determinant for quality in shellfish [20].

In general, fresh shellfish are described as sweet, distinctly plant-like, metallic with varying degrees of fishy attributes. The fresh shellfish aroma is derived from unsaturated alcohols and aldehydes while cooked aromas are produced from alkylpyrazines and sulphur-containing compounds [21].

The taste of shellfish, derived from non volatile components, is derived from free amino acids, nucleotides, inorganic salts, and quaternary ammonium bases which produce individual tastes unique to each shellfish type. Umami substances such as 5'-ribonucleotides, adenosine monophosphate, inosine monophosphate, guanosine monophosphate and monosodium glutamate are distributed throughout all types of shellfish and are responsible for their umami (or savoury) flavour [21].

Fresh fish, on the other hand, are usually very mild in aroma with attributes of green, plant-like, melon-like and iodine-like (marine) odours. These odours arise from various carbonyl and alcohol compounds as well as bromophenols. Certain species have very characteristic fresh odours (for example salmon) [20].



**Figure 32 Previously reported sensory descriptions of target species (or closely related species)**

Target species	Species studied	Presentation format	Aroma, flavour, texture descriptions used	Reference
<b>Pacific Oysters</b>	<i>Crassostrea gigas</i>	natural	Aroma - iodized, seaweed, mud, fresh sea smell Flavour – iodized, seaweed, salty, hazelnut, fresh, clean, salty flavour – just like being rolled in the surf creamy texture Appearance - Darker mantel and whiter meat than the SRO. Pearly white inner shell and their “frilled” exterior.	[22-24]
<b>Native Oysters</b>	<i>Ostrea angasi</i>	natural (Similar to French belon oyster <i>ostrea edulis</i> )	Appearance - Flesh is usually a dull mushroom pinky brown with a chalky white in winter. Flavour - They taste a little smoky, earthy, like duck compared with chicken. Full-flavoured and textured, the Native Oyster is big, very rich and very flavourful, with an almost meaty flavour and texture.	[24, 25]
<b>Blue Mussels</b>	Mediterranean mussel ( <i>Mytilus galloprovincialis</i> )  Blue Mussel ( <i>Mytilus edulis</i> ) Blue Mussel ( <i>Mytilus edulis</i> ) Mediterranean mussel ( <i>Mytilus galloprovincialis</i> )	shucked, bysus removed presented on glass dish (raw)  'cooked' mussel extracts – olfactometric analysis 'cooked' mussels  'cooked' mussels	Aroma – intrinsic fresh odour, off-odour, putrid, offensive. Colour – bright orange, opaque, grey discolour. Texture – firm, elastic, tight, soft. Appearance – glossy, moist, smooth surface, dull. Aroma – buttery, caramel-like, boiled potato-like, mushroom-like, nutty, green / cucumber-like. Aroma – cooked crustaceous crab, boiled potato, seaside, buttery, sulfury, cooked fish, cooked mussel, milky, cooked shellfish, paper/rubber/grilled. Appearance – colour uniformity, surface lucidity; Odour – intensity, sea, green seaweed, brackish, herbaceous, woody, decomposing, dried fruit; flavour – sweet, sour, salty, bitter, umami, astringent; Texture – elasticity, resistance to bite, succulence, grit or sandy, uniformity of the whole sensation, Aftertaste – intensity, sea, green seaweed, brackish, wet wood, grassy, dried fruit, decomposing. (descriptions translated from Italian)	[26]  [27] [28] [29]

Target species	Species studied	Presentation format	Aroma, flavour, texture descriptions used	Reference
<b>Spencer Gulf Western King Prawns</b>	Gulf & Georgia white shrimp ( <i>P. setiferus</i> ), Gulf pink shrimp ( <i>P. monodon</i> ), Georgia & Gulf brown shrimp ( <i>P. aztecus</i> ), Gulf pink shrimp ( <i>P. duorarum</i> ), Burma black tiger shrimp ( <i>P. Monodon</i> ), Belise, Columbia, Honduras & Mexico white shrimp ( <i>P. vannamei</i> or <i>P. stylirostris</i> )	boiled in 2% salt water, chilled, deshelled, rinsed and presented in plastic cups at 10 °C	Aroma -ocean/seawater, cooked shrimp, old shrimp; Appearance: red/orange colour, brown colour, blotchiness, glossiness; Flavour: cooked shrimp. Flavour - bitter, salty, sour, sweet. Mouth feel - sliminess. Texture - Firmness, Juiciness, Chewiness, Crispness, Fibrous. Aftertaste - Iodine.	[14]
<b>Greenlip abalone</b>	<i>Haliotis laevis</i>	best cooked very quickly over a high heat (for just a few seconds) or very slowly over a low heat (for up to 6 hours, depending on size).	Low in oil with a subtle flavour and firm texture. Greenlip has a slightly stronger flavour than Blacklip.	
<b>Blacklip abalone</b>	<i>Haliotis rubra</i>		No sensory information found	
<b>Southern Rocklobster</b>	Southern Rocklobster ( <i>Jasus edwardsii</i> )	cooked in boiler to 74 °C internal temp, cooled, mid tail sections served on plate	Odour – seaweed, smooth, fresh, strong; Flavour – sweet, strong, metallic, bitter, sourness, bland, acid; Texture – firm, moist, melt in mouth, even, chewy, stringy, sticky, dry.	[10]
	large Rocklobster ( <i>Jasus edwardsii</i> )	raw flesh presented on a plate	Appearance – translucent, pink flesh; Flavour: overall lobster flavour, sweetness, metallic; Texture: crunch, chewy	[30]
	Norway lobster ( <i>Nephrops norvegicus</i> )	uncooked whole lobster presented	Odour, melanosis, colour in head, head-tail junction, parapods junction (very fresh to very spoiled)	[31]
	blue squat lobster ( <i>Cervimunida johni</i> )	thawed, boiled, cooled, IQF, thawed, tails presented at room temperature	Texture – hardness, cohesiveness, elasticity, chewiness	[32]

Target species	Species studied	Presentation format	Aroma, flavour, texture descriptions used	Reference
	Southern Rocklobster ( <i>Jasus novaehollandiae</i> Holthius)	cooked in a 3% salt solution to internal temp of 60-65°C, cooled in slush ice, cuticle removed, trimmed and served in foil covered glass jars	Flavour, flesh colour, toughness, moisture, acceptability	[33]
<b>Australian Sardines</b>	Sardines ( <i>Sardina pilchardus</i> Walbaum)	thawed raw	Colour, odour, taste, consumption value, texture firm.	[34]
	Sardine ( <i>sardinopos melanosticta</i> ) Among 15 other species of fish	boiled – broth presented for sensory evaluation	Aroma - fish oil, roasted soy sauce, sweet, grilled fish, green, fishy, canned tuna, sea breeze, fried chicken, cooked fish	[35]
	Sardine ( <i>Sardina pilchardus</i> )	raw whole sardine	'sensory' quality scored on a scale of 0-10 (10 being excellent)	[36]
	Sardine ( <i>Sardine mediterraneus</i> )	raw whole sardine	Graded by 'appearance', 'odours' and 'texture'	[37]
	Sardines ( <i>Sardina pilchardus</i> )	raw whole sardine	Rated on 0-9 point hedonic scales for 'appearance', 'odour' and 'taste'. From spoiled (1.0 - 3.9), good (4 - 6.9) to very good (7 - 9).	[38]
	Sardines ( <i>Sardina pilchardus</i> )	raw whole sardine	Global intensity, triethylamine, ammonia, lean fish, fat fish, freshwater fish, marine/iodine-like, dried fish, anchovy, pungent, pyrrolidion, fruity, grass note, milky, crustacean, potato, rancid, sour, acrid, cabbage note.	[39]
<b>Yellowtail kingfish</b>	<i>Seriola lalandi</i>	sashimi	sweet, rich, clean flavour, pleasant sea flavour pale pink flesh, firm texture, broad flaked flesh	[40]
<b>Southern Bluefin Tuna</b>	Southern Bluefin Tuna ( <i>Thunnus maccoyii</i> )	Assessed raw after cutting into separate cuts	Appearance: redness, brightness, transparency; Aroma: bad fishy odour; Flavour: sourness, umami; Texture: firmness, hardness, fattiness	[11]
<b>King George Whiting</b>	<i>Sillaginodes punctata</i>	whole (gilled and gutted), as trunks (headless), and in single and butterflied fillets	delicate, sweet, mild flavour (occasionally slightly 'peppery'), low oiliness and moist, medium-textured, flaky white flesh with fine bones, refined, pure flavour and delicate texture	[41]

Target species	Species studied	Presentation format	Aroma, flavour, texture descriptions used	Reference
<b>Snapper</b>	Mutton snapper ( <i>Lutjanus angalis</i> ), Red snapper ( <i>L. campechanus</i> ), Mangrove or gray snapper ( <i>L. griseus</i> ), Yellowtail snapper ( <i>Ocyurus chrysurus</i> )	Fillets cooked in plastic pouches in a water bath (poached)	Hardness, flakiness, chewiness, fibrousness, moistness, total flavor intensity, salty-briny, sour, gamey fish, fish oil, sweet, fresh fish, shellfish, mouth drying, nutty-buttery, stale fish.	[42]
	Australian snapper ( <i>Pagrus auratus</i> )	Filletted pieces (25 g) cooked in microwave in covered dishes, served hot.	Colour of flesh, texture, oiliness, flavour, off flavour, fresh taste, overall acceptability.	[12]
<b>Southern Calamari</b>	<i>Sepioteuthis australis</i>	Rings or scored hatch pattern	The flesh is translucent when raw and white when cooked. Mild, subtle flavour, low-medium oiliness, and is dry with firm texture. Mild, subtle flavour, low-medium oiliness, dry with a firm texture Mild flavour, firm texture	[43, 44]

## **APPENDIX 4 : EYRE PENINSULA SUPPLIER DETAILS AND SUMMARY OF PRODUCT SPECIFIC INFORMATION**

**Figure 33 Summary of target product suppliers, seasonality, product format and suitable comparator products**

Product	Supplier	Seasonality	Product cuts / format	Fresh/frozen	Possible comparators
Greenlip Abalone • Wild	Streaky Bay Marine Products	Jan-Feb	trimmed raw	Frozen IQF	squid & cuttlefish
Blacklip Abalone • Wild	Streaky Bay Marine Products	Jan-Feb	canned (boiled) par-boiled (sashimi)	canned frozen	
	Western Abalone		trimmed raw	frozen IQF	
Greenlip Abalone • Farmed	Western Abalone	Mar-Aug	trimmed raw brined in shell (sashimi)	frozen IQF frozen IQF	
Australian Sardines	Australian Southern Exporters	Feb-June, April best		fresh	
Southern Rocklobster	Southern Ocean Rocklobster Pty Ltd	Nov-May, best post-March or Feb/Mar	tail – cooked (boiled), claw meat	fresh-live	blue swimmer crab, mud crab, spanner crab, bug
Southern Calamari	Port Lincoln Fresh Fish co	May-Aug	cleaned tubes	frozen	cuttlefish and squid
Spencer Gulf Western King Prawns	Spencer Gulf and West Coast Prawn Fisherman's Association Inc.	Apr-May	whole cooked	frozen	banana prawn, bug, Endeavour prawn, tiger prawn, freshwater crayfish, school prawn
King George Whiting	Port Lincoln Fresh Fish co	May-Aug	fillet	fresh	garfish, flathead, dory, flounder
Snapper	Port Lincoln Fresh Fish co	<u>June</u> -Sept	fillet	fresh	Goldband Snapper, Nanagi red snapper – Bight red fish
Yellowtail Kingfish	Cleanseas Tuna Limited	June-Sept	whole side bone-in.	fresh or frozen	silver trevally, warehou, mackerel, tuna, marlin, morwong
Southern Bluefin Tuna	Sekol Farm Tuna Pty Ltd	Harvest May-Sept, best in <u>Aug</u> or Jun/July	Portions, akami for cooking, chutoro, otoro for sashimi	fresh or frozen?	Marlin, Swordfish, Mackerel, Atlantic salmon

Product	Supplier	Seasonality	Product cuts / format	Fresh/frozen	Possible comparators
Native Oysters	Pristine Oyster Farm	Apr-Aug, mid-Sept better than late, <u>August</u> best	Whole raw un-shucked	fresh	Sydney Rock Oyster Pacific's from other regions (i.e. Tas).
Diploid and spawnless Pacific Oysters	Pristine Oyster Farm Coffin Bay Oyster Farm	diploids May- <u>Sept</u> spawnless all year	Whole raw un-shucked, spawnless versus diploids	fresh	
Blue Mussels	South Australian Seafood's - Boston Bay Mussels	Jun-Sept	Whole in shell vacu-sealed pack. Steamed, male vs. female	fresh	cockle, pipi , mussels from Tas, NZ

## **APPENDIX 5 : SENSORY DESCRIPTIONS AND DEFINITIONS USED DURING EACH TRIAL**





## Attribute Definitions for Abalone Formal Sensory Assessments

The definitions for attributes selected for formal assessments are below. Those with a corresponding reference standard are indicated(\*).

<i>Attributes and Definitions</i>	
<b>Appearance</b>	
<b>White</b>	(ivory / pale)
<b>Off-white</b>	(grey, brownish)
<b>Brownish</b>	
<b>Greyish</b>	
<b>Consistent colour</b>	
<b>Green tinge on edge</b>	
<b>Brownish-red tinge on edge</b>	
<b>Aroma</b>	
<b>Aroma Intensity</b>	the relative level of aroma on the first smell
<b>Oceanic*</b>	an oceanic or marine-like odour reminiscent of clean fresh uncooked seafood
<b>Fried scallop*</b>	an aroma that represents a mixture of fried scallop together with baked potato or chips, caramelised
<b>Shellfish*</b>	the aroma of fresh cooked shellfish, lobster or bug-like almost crab-like
<b>Baked fish*</b>	the aroma of fresh cooked ocean-caught white fish similar to snapper
<b>Roast meaty*</b>	a roast meat aroma similar to roast pork
<b>Chicken*</b>	the aroma of chicken lunchmeat or cold roast chicken breast
<b>Shitake mushroom*</b>	The delicate aroma of steamed shitake mushroom
<b>Champignon*</b>	the aroma of canned champignons or canned vegetable
<b>Texture &amp; mouth feel</b>	
<b>Tenderness</b>	the level of tenderness when first chewed
<b>Chewy</b>	the level and persistence of chewiness, rubberiness when chewed over time
<b>Silky</b>	a silky, buttery, slippery feeling of the sample in the mouth
<b>Crisp</b>	a crisp and almost crunchy texture in the mouth
<b>Squeaky</b>	a squeaky sound and/or sensation of the sample against the teeth when chewed
<b>Spongy</b>	a soft spongy feel of the sample when chewed, like chewing a sponge
<b>Flavour</b>	
<b>Flavour intensity</b>	the relative level of flavour when tasted
<b>Saltiness</b>	a salty flavour
<b>Savoury</b>	a savoury, umami flavour with gravy-like richness almost caramelised
<b>Sweet-oceanic</b>	a clean sweet-seafood flavour similar to the sweetness perceived in prawn juice
<b>Fried scallop*</b>	an flavour that represents a mixture of fried scallop together with baked potato or chips, caramelised
<b>Shellfish*</b>	the flavour of fresh cooked shellfish, lobster or bug-like almost crab-like
<b>Baked fish*</b>	the flavour of fresh cooked ocean-caught white fish similar to snapper
<b>Roast meaty*</b>	a roast meat flavour similar to roast pork
<b>Chicken*</b>	the flavour of chicken lunchmeat or cold roast chicken breast
<b>Shitake mushroom*</b>	the delicate flavour of steamed shitake mushroom
<b>Champignon*</b>	the flavour of canned champignons or canned vegetable
<b>Aftertaste</b>	
<b>Savoury</b>	a savoury aftertaste, umami, with gravy-like richness almost caramelised
<b>Bitterness</b>	a bitter aftertaste



## Attribute definitions for Rocklobster formal sensory assessments

The definitions for attributes selected for formal assessments are below. Those with a corresponding reference standard are indicated(\*).

<i>Attributes and Definitions</i>	
<b>Appearance</b>	
<b>White</b>	a clean white colour to the flesh (not including outer 'skin')
<b>Ivory</b>	an off-white, pinkish colour to the flesh (not including outer 'skin')
<b>Glossy</b>	a glossy, moist looking flesh
<b>Flaky</b>	obvious flakes to the flesh structure
<b>Fibres</b>	the flesh has a stringy/fibrous appearance
<b>Aroma</b>	
<b>Aroma intensity</b>	the relative level of aroma on the first smell
<b>Aroma complexity</b>	the relative complexity of aroma where the sample has many different dimensions of odour characteristics
<b>Fresh oceanic*</b>	an clean, fresh ocean breeze odour similar to the smell of a clean fresh white ocean-caught fish
<b>Rock pool*</b>	the aroma of the ocean sand at low tide, a rock pool, with slight seaweed notes
<b>Crab-like*</b>	the aroma of fresh cooked crab, crustacean shell, shellfish-like
<b>Prawn broth*</b>	the aroma of cooked cold prawn broth, slight ammonia
<b>Cooked vegetable*</b>	the aroma of cooked vegetable, herbaceous, asparagus, root vegetable, slight canned sweet corn
<b>Roast potato*</b>	the aroma of breaking open a hot roasted potato
<b>Egg white*</b>	the aroma of under-cooked egg white
<b>Cooked egg yolk*</b>	a sulphurous odour like cooked egg, smoky, match flint, like a fresh water cray-fish
<b>Texture &amp; mouth feel</b>	
<b>Tenderness</b>	the level of tenderness when first chewed
<b>Crispness</b>	a crisp almost crunchy and springy texture on the first bite
<b>Moist</b>	the moistness of the flesh in-mouth, almost juicy
<b>Melt-in-mouth</b>	the disintegration of the flesh in-mouth upon chewing
<b>Fibres</b>	the stringiness of the sample experienced in-mouth
<b>Flavour</b>	
<b>Flavour intensity</b>	the relative level of flavour when tasted
<b>Sweet-oceanic</b>	a clean sweet-seafood flavour similar to the sweetness perceived in prawn juice
<b>Savoury</b>	an umami flavour, almost meaty, pork-like, slight salty
<b>Crab-like*</b>	flavour of fresh crab meat, sand crab
<b>Prawn broth*</b>	the cooked flavour of boiled prawn broth
<b>Cooked vegetable*</b>	flavour of blanched cabbage, root vegetable, almost canned corn or asparagus
<b>Broccoli*</b>	flavour of steamed broccoli flower heads
<b>Toasted bread crust*</b>	the slightly bitter flavour associated with toasted bread-crust
<b>Aftertaste</b>	
<b>Flavour persistence</b>	the persistence of flavour on the palate
<b>Savoury</b>	a persisting savoury flavour
<b>Bitter</b>	a not unpleasant bitterness like that of coffee or toasty bread-crust
<b>Metallic</b>	a persisting metallic almost iodine-like sensation in the mouth



## Attribute definitions for Calamari formal sensory assessments

The definitions for attributes selected for formal assessments are below. Those with a corresponding reference standard are indicated(\*).

<i>Attributes and Definitions</i>	
<b>Appearance</b>	
<b>Pinkish-white</b>	a white colour with a pinkish tinge
<b>Blue-white</b>	a white colour with a bluish tinge
<b>Ivory-creamy</b>	a creamy ivory off-white colour
<b>Moist</b>	a glistening moist appearance on the surface
<b>Translucent</b>	a slight translucence in the flesh
<b>Aroma</b>	
<b>Aroma intensity</b>	the relative level of aroma on the first smell
<b>Caramelised*</b>	a caramely, sweet caramelised odour like caramelised onions*
<b>Smoky*</b>	the smoky aroma of slightly burnt bacon or toast*
<b>BBQ'd roast chicken*</b>	the seared meaty aroma of barbecue roasted chicken*
<b>Fried rice*</b>	an oily aroma like fried rice or French fries*
<b>Toasted pine nut*</b>	a toasted nutty aroma like pine nuts toasted in a hot pan*
<b>Shellfishy*</b>	an aroma of shellfish and slight cooked prawn*
<b>Buttery*</b>	a buttery aroma
<b>Texture &amp; mouth feel</b>	
<b>Tenderness</b>	the level of tenderness when first chewed
<b>Firmness</b>	the relative level of firmness when chewed in the mouth
<b>Crispness</b>	a crisp almost crunchy and springy texture on the first bite
<b>Glutinous</b>	a glutinous feel and spongy sensation when chewed in the mouth
<b>Slippery</b>	a slippery sensation of the sample in the mouth
<b>Flavour</b>	
<b>Flavour intensity</b>	the relative level of flavour when tasted
<b>Saltiness</b>	a salty flavour
<b>Sweetness*</b>	a sweet caramelised flavour
<b>Savoury</b>	an umami flavour, almost meaty, pork-like, slight salty
<b>Char grilled</b>	a slightly burnt, smoky flavour of char grilled meat or vegetable
<b>Fried rice*</b>	a flavour like fried rice or the hot oil flavour associated with French fries
<b>Nutty*</b>	a nutty boiled peanut or toasted pine nut flavour
<b>Shellfishy*</b>	a flavour of shellfish and slight cooked prawn
<b>Buttery*</b>	a buttery flavour
<b>Oceanic</b>	an oceanic flavour like fresh caught ocean white fish
<b>Toasted bread crust</b>	the slightly bitter flavour associated with toasted bread-crust
<b>Herbaceous</b>	a vegetative, herbaceous flavour, slight green stick
<b>Aftertaste</b>	
<b>Flavour persistence</b>	the persistence of flavour on the palate
<b>Savoury</b>	a persisting savoury flavour
<b>Buttery</b>	a persisting buttery flavour
<b>Baked white fish</b>	a persisting baked white fish flavour
<b>Oily film / mouth-coating</b>	a oily / mouth coating sensation after swallowing



## Attribute Definitions for Prawn Formal Sensory Assessments

The definitions for attributes selected for formal assessments are below. Those with a corresponding reference standard are indicated(\*).

<i>Attributes and Definitions</i>	
<b>Appearance</b>	
<b>Colour intensity</b>	the intensity of colour from pale and washed-out to vibrantly coloured
<b>Pink</b>	a predominantly pink peachy or salmon colour
<b>Orange</b>	a predominantly orange colour
<b>Yellowish</b>	a yellowish tinge near the legs
<b>Distinct red/orange highlights</b>	the appearance of red/orange colour on the shell tips near legs
<b>Distinct red/orange banding</b>	the appearance of red/orange banding or stripes across the body
<b>Patchy</b>	a patchy inconsistent colouring
<b>Consistent</b>	a consistent colour overall
<b>Bright</b>	a bright, shiny, vibrant appearance
<b>Dull</b>	a dull, non-shiny shell, looks almost rough/emery to touch
<b>Glossy</b>	a glossy, moist-looking, glistening, shiny, smooth-looking shell
<b>Dry-looking</b>	a dry appearance
<b>Transparent</b>	a transparent or translucent appearance of the shell around the body
<b>Aroma</b>	
<b>Aroma intensity</b>	the relative level of aroma on the first smell
<b>Ocean-spray*</b>	an aroma of ocean-spray, sea water, briny, oceanic, fresh sea almost salty*
<b>Fresh crustacean*</b>	the aroma of fresh crustacean, shellfish, Moreton bay bug, Rocklobster-like*
<b>Boiled prawn broth*</b>	the aroma of boiled prawn broth, slightly fish-meal*
<b>Sea weedy*</b>	the aroma of sea weedy, weedy, algal*
<b>Vanilla pod*</b>	a hint of the complex aroma of a vanilla pod*
<b>Texture &amp; mouth feel</b>	
<b>Crisp</b>	a crisp almost crunchy and springy texture on the first bite
<b>Firmness</b>	the relative level of firmness when chewed in the mouth
<b>Springy</b>	a springiness experienced when first chewing
<b>Juiciness</b>	the relative amount of juice experiences in the mouth when chewing
<b>Fibrous</b>	a fibrous texture or stringiness of the flesh experienced when chewing
<b>Chewiness</b>	a persistent piece of flesh in the mouth requiring more chewing
<b>Wads-up</b>	the sample bolus 'wads-up' in the mouth after chewing and does not easily disintegrate
<b>Flavour</b>	
<b>Flavour intensity</b>	the relative level of flavour when tasted
<b>Saltiness</b>	a salty flavour
<b>Sweetness</b>	a sweet oceanic flavour
<b>Savoury</b>	an umami, savoury flavour
<b>Sourness</b>	a relatively low level acidity or sour flavour
<b>Iodine-like*</b>	the clean almost chemical flavour of iodine*
<b>Fresh crustacean*</b>	the flavour of fresh crustacean, shellfish, Moreton Bay bug, Rocklobster-like*
<b>Boiled prawn broth*</b>	the flavour of boiled prawn broth, slightly fish-meal*
<b>Green vegetable*</b>	the vegetative flavour of green vegetables, broccoli stubs, boiled root veg, cabbage, almost sulphurous*
<b>Aftertaste</b>	
<b>Flavour persistence</b>	the persistence of flavour on the palate
<b>Sweetness</b>	a persisting sweetness
<b>Saltiness</b>	a persisting saltiness
<b>Savoury</b>	a persisting savoury flavour
<b>Bitterness</b>	a persisting slightly bitter flavour
<b>Iodine-like</b>	a persisting sensation and flavour of iodine





## Attribute definitions for Whiting and Snapper formal sensory assessments

The definitions for attributes selected for formal assessments are below. Those with a corresponding reference standard are indicated(\*).

<i>Attributes and Definitions</i>	
<b>Aroma</b>	
<b>Aroma intensity</b>	the relative level of aroma on the first smell
<b>Aroma complexity</b>	the relative complexity of aroma where the sample has many different dimensions of odour characteristics
<b>Clean ocean*</b>	the fresh clean ocean aroma detected on the <i>first sniff</i> of the sample (which disappears on subsequent sniffs), almost a 'metallic' smell like iodine or swimming pool.
<b>Roasted*</b>	a roast chicken or roast potato aroma, like chicken skin, fried chips, caramelised, and reminiscent of baked fish-like
<b>Starchy*</b>	a starchy odour like steamed rice or mashed potato
<b>Vegetative*</b>	a vegetative aroma like green mushy peas, fried asparagus, herbaceous
<b>Appearance (assess internal flesh attributes by prying open with fork)</b>	
<b>Golden pan seared edge</b>	The colour of the pan seared edge of the sample from light to very dark/golden brown
<b>Flake size</b>	The relative size of the flakes from fine to large/petaled
<b>Creamy-white flesh</b>	The internal flesh is a creamy-white colour
<b>Greyish-white flesh</b>	The internal flesh is a creamy-white colour
<b>Pinkish-white flesh</b>	The internal flesh is a pinkish-white colour
<b>Tender-looking</b>	The sample looks tender as though it will melt in the mouth when tasted
<b>Moist</b>	The sample looks wet or moist and juicy
<b>Dry-looking</b>	The sample looks dry
<b>Grey/black threads</b>	There are tiny grey/black threads obvious through the flesh
<b>Texture and mouth feel</b>	
<b>Firmness</b>	the relative level of firmness when chewed in the mouth
<b>Juiciness</b>	the relative amount of juice experiences in the mouth when chewing
<b>Melt-in-mouth</b>	the disintegration of the flesh in-mouth upon chewing
<b>Flaky / crumbly</b>	The sample breaks apart into flakes when chewed in the mouth
<b>Chewiness</b>	a persistent piece of flesh in the mouth requiring more chewing
<b>Flavour</b>	
<b>Flavour intensity</b>	the relative level of flavour when tasted
<b>Flavour complexity</b>	(low to high)
<b>Sweetness</b>	a sweet oceanic flavour
<b>Saltiness</b>	a salty flavour
<b>Savoury</b>	an umami, savoury flavour
<b>Roasted*</b>	The flavour of roast chicken or potato, like chicken skin, fried chips, caramelised, and reminiscent of baked fish-like
<b>Vegetative*</b>	a vegetative aroma like green mushy peas, fried asparagus, herbaceous.
<b>Iodine-like*</b>	a clean marine, fresh sea or iodine-like flavour in the mouth, almost metallic
<b>Buttery*</b>	a rich buttery flavour
<b>Egg white*</b>	a poached egg-white flavour
<b>Aftertaste</b>	
<b>Flavour persistence</b>	the persistence of flavour on the palate
<b>Savoury</b>	a persisting savoury flavour
<b>Metallic</b>	a persisting metallic sensation which is iodine-like
<b>Herbaceous</b>	a persisting herbaceous flavour on the palate after swallowing
<b>Oily mouth-coating</b>	an oily mouth-coating mouth feel that remains on the palate after swallowing
<b>Tooth packing</b>	the sample sticks to the teeth after chewing and swallowing



## Attribute Definitions for Kingfish and Tuna Formal Sensory Assessments

The definitions for attributes selected for formal assessments are below. Those with a corresponding reference standard are indicated(\*). Attributes in brown coloured font relate typically to *cooked samples* while those in green font relate to *sashimi* samples.

Attributes and Definitions	
<b>Aroma</b>	
<b>Aroma intensity</b>	the relative level of aroma on the first smell
<b>Clean oceanic*</b>	a fresh clean ocean aroma like a freshly shucked oyster, almost a 'metallic' smell like iodine, rock pool, seaside.
<b>Caramelised*</b>	the caramelised aroma of fried, roasted, seared, or rendered fat, slight roast potato-like
<b>Roast white meat*</b>	the aroma of cooked white meat like roast chicken breast or roast pork meat
<b>Cooked broccoli*</b>	the vegetative aroma of broccoli
<b>Hot butter*</b>	the aroma of hot butter in a pan
<b>Appearance</b>	
<b>Bright</b>	a bright, highly coloured appearance
<b>Glistening</b>	a glossy, wet-looking sheen glistening on the sample surface
<b>Golden-brown seared cooked surface</b>	the browned, seared colour on the cooked surface
<b>Orange/peachy/pink colour</b>	a flesh colour that is orange/peachy/pink
<b>Beige/tan colour</b>	a flesh colour that is beige or tan
<b>Ruby grapefruit colour</b>	a flesh colour that is like ruby grapefruit flesh
<b>Turkish delight colour</b>	a flesh colour that is similar to Turkish delight
<b>Graduated colour</b>	a graduated two-tone colour change across flesh
<b>White bands</b>	the appearance of candy cane-like white bands, highly contrasted
<b>Marbled</b>	a white marbled appearance within the flesh
<b>Opalescent</b>	a play of colours like an opal, a oil-slick-like iridescence on sample surface
<b>Translucent</b>	a slightly translucent appearance of the flesh, slightly see-through
<b>Visible flakes</b>	the appearance of flakes or obvious muscle blocks in the sample
<b>Texture &amp; mouth feel</b>	
<b>Crispness</b>	a crisp almost crunchiness in the flesh on first bite, 'kori kori'
<b>Tenderness*</b>	the relative degree of tenderness, how freely the sample gives when chewing through
<b>Melt-in-mouth</b>	how easily the sample disintegrates or melts in the mouth low, 'toro toro'
<b>Flakes persisting</b>	the sample structure persists on chewing, becomes lumpy or flaky
<b>Gelatinous</b>	a gel-like texture of the sample in the mouth
<b>Slipperiness</b>	the slippery texture experienced with the sample in the mouth
<b>Juiciness*</b>	the relative degree of juice coming from the sample
<b>Fattiness*</b>	a fatty, oily, buttery mouth-coating sensation of the sample in the mouth
<b>Tooth packing</b>	where the sample sticks slightly in the teeth upon chewing
<b>Fibrous</b>	an experience of slightly fibrous sample structure in the mouth upon chewing
<b>Flavour</b>	
<b>Flavour intensity</b>	the relative intensity of flavour on the palate
<b>Sourness</b>	a sour flavour, clean acidity, slight tartness, almost lemon-like at high intensity
<b>Sweet oceanic*</b>	a sweet flavour, like fresh sea breeze, iodine, pleasant sea, slightly metallic
<b>Fresh oyster*</b>	on the front of the palate a fresh-oyster-like flavour
<b>Caramelised meaty*</b>	a caramelised meaty flavour like fried, seared beef, roast pork-like
<b>Rendered fattiness*</b>	a rich fattiness, like just-seared wagu, buttery, 'jyu jyu'
<b>Baked fresh white fish*</b>	a flavour of baked fresh white fish
<b>Avocado-like nuttiness*</b>	a flavour like Hass avocado and creamy like macadamia oil
<b>Herbaceous*</b>	a herbaceous, vegetative flavour like fresh peas
<b>Savoury*</b>	a savoury, umami flavour coming later on the palate
<b>Saltiness</b>	a salty flavour

<i>Attributes and Definitions</i>	
<b>Aftertaste</b>	
<b>Flavour persistence</b>	the persistence of flavour on the palate
<b>Fresh oyster</b>	a fresh-oyster-like flavour persisting
<b>Sourness</b>	a sour flavour, clean acidity, slight tartness, almost lemon-like at high intensity
<b>Savoury</b>	a savoury, umami flavour persisting on the palate
<b>Oily mouth-coating</b>	a fatty, oily, buttery mouth-coating sensation persisting in the mouth

### Japanese texture terms (used as a resource during training for Southern Bluefin Tuna and Yellowtail Kingfish)

*Atsu atsu* – steaming hot, almost too hot to eat, like ramen

*Beta beta* – cloyingly sticky, like a dessert wine

*Fuwa fuwa* – fluffy like a marshmallow

*Gabu gabu* – drinking wholeheartedly

*Hoka hoka* – hot, just the right temperature, like a bowl of rice

*Hoku hoku* – steamy, like fluffy baked sweet potatoes

*Jyu jyu* – juicy meat being grilled

*Kori kori* – crunchy like pickled cucumbers

*Koto koto* – sound of a bubbling pot

*Mochi mochi* – chewy, like *mochi* (rice taffy)

*Neba neba* – slimy and sticky, like natto

*Nuru nuru* – slimy and slippery, like okra

*Paku paku* – eating wholeheartedly

*Pari pari* – thin and crispy, like potato chips or nori

*Piri piri* – something that is spicy, like too much wasabi

*Puri puri* – resistant, like fresh shrimp

*Puru puru* – wiggly, like sesame tofu

*Saku saku* – delicate and crispy, like tempura

*Shari shari* – sound of ice being shaved

*Shiko shiko* – chewy, like udon noodles

*Shuwa shuwa* – fizzy and frizzante, like sparkling wine

*Ton ton* – the sound of a knife rhythmically hitting the cutting board

*Toro toro* – melt in your mouth, like fatty tuna

*Tsubu tsubu* – chunky bits, like the pulp in freshly squeezed orange juice

*Tsuru tsuru* – the sound of slurping noodles

## Attribute Definitions for Oyster Formal Sensory Assessments

The definitions for attributes selected for formal assessments are below. Those with a corresponding reference standard are indicated(\*).

<i>Attributes and Definitions</i>	
<b>Aroma</b>	
<b>Aroma intensity</b>	the relative level of aroma on the first smell
<b>Fresh clean ocean*</b>	a fresh clean ocean aroma, clean sea, like the lid of a freshly shucked oyster, slightly iodine *
<b>Tidal rock pool*</b>	the aroma of the beach at low tide, a slight seaweed aroma, ocean rocks *
<b>Mangrove*</b>	the aroma of mangrove, muddiness, some weediness and slightly sulphurous *
<b>Cucumber*</b>	a clean fresh herbaceous aroma of freshly cut cucumber *
<b>Fresh fish*</b>	a savoury note like very fresh (just caught) fish (not cooked) *
<b>Sharp acidic note*</b>	a vinegar-like, sharp acidic note, balsamic *
<b>Appearance</b>	
<b>Plumpness</b>	the main body of the oyster is plump and pert, sitting up in its shell
<b>Mantle colour</b>	the colour and contract of the mantle from pale to very dark
<b>Brightness</b>	a brightness or vibrancy in the colour
<b>Pinky-mushroom</b>	a colour like that of the underside of a mushroom
<b>Golden</b>	a golden yellow, turmeric-stained colour body
<b>Green</b>	a greenish body colour
<b>Creamy</b>	a creamy body colour
<b>Greyish tones</b>	a greyish tinge to the body colour
<b>Texture &amp; mouth feel</b>	
<b>Crispness</b>	a crisp almost crunchiness on the first bite
<b>Burst in mouth</b>	bursts in the mouth on the first bite
<b>Slippery</b>	a slippery, sliminess in the mouth
<b>Firmness</b>	the relative degree of firmness in the sample from soft to firm
<b>Juiciness</b>	the relative degree of juice or liquid released from the sample upon chewing
<b>Chewiness</b>	a persisting chewiness of mantle in the mouth
<b>Consistent</b>	the texture is the same across all parts
<b>Flavour</b>	
<b>Flavour intensity</b>	the relative intensity of flavour on the palate
<b>Saltiness</b>	a salty flavour
<b>Sweet ocean</b>	a sweet flavour like the sweetness found in seafood
<b>Savoury</b>	a savoury, umami flavour, a richness, almost caramelised
<b>Sourness</b>	a sour flavour, a clean acidity, tartness
<b>Green bitterness*</b>	a bitter green flavour like that in rocket or red lettuce *
<b>Hazelnut*</b>	a hazelnut-like nutty flavour *
<b>Asparagus*</b>	flavour of freshly-steamed asparagus stems, vegetative *
<b>Mangrove*</b>	a mangrove muddy, weedy, musty flavour *
<b>Flavour complexity</b>	a complex mixture and depth of multidimensional flavours
<b>Aftertaste</b>	
<b>Flavour persistence</b>	the persistence of flavour on the palate
<b>Saltiness</b>	a salty aftertaste
<b>Sweetness</b>	a sweet aftertaste like the sweetness found in seafood
<b>Savoury</b>	a savoury, umami aftertaste
<b>Green melon</b>	a clean green melon flavour on the aftertaste
<b>Green bitterness</b>	a bitter green aftertaste like that in rocket or lettuce
<b>Metallic</b>	a metallic aftertaste in the mouth, like licking a metal spoon



## Attribute Definitions for Mussel Formal Sensory Assessments

The definitions for attributes selected for formal assessments are below. Those with a corresponding reference standard are indicated(\*).

<i>Attributes and Definitions</i>	
<b>Aroma</b>	
<b>Aroma complexity</b>	a range of aromas present simultaneously
<b>Aroma intensity</b>	the relative level of aroma on the first smell
<b>Oceanic*</b>	a fresh clean ocean aroma, pleasant sea, seaside
<b>Roast meaty*</b>	a rich aroma of roasted or pan fried beef steak
<b>Steamed fish*</b>	a fresh clean steamed white fish aroma
<b>Crustacean*</b>	the aroma of cooking crustacean, crab-like or lobster-like
<b>Prawn broth*</b>	the aroma of cooked prawn broth or prawn shells
<b>Boiled potato*</b>	a starchy boiled mashed potato aroma almost rice-cracker like
<b>Buttery*</b>	the aroma of butter
<b>Green seaweed*</b>	a fresh green seaweed, grassy aroma
<b>Earthy*</b>	aroma of fresh earth, muddy
<b>Brackish*</b>	aroma of wet wood soaking in brackish waters, wet saw dust
<b>Appearance</b>	
<b>Plumpness</b>	the main body of the mussel is plump and pert, sitting up in its shell.
<b>Moist looking</b>	the mussel surface looks moist
<b>Dry looking</b>	the mussel surface looks dry
<b>Texture &amp; mouth feel</b>	
<b>Tenderness</b>	the level of tenderness in the sample.
<b>Chewiness</b>	a persisting chewiness of mantle in the mouth.
<b>Consistency</b>	The level of consistency upon chewing from inconsistent to very consistent/uniform
<b>Juiciness</b>	the relative degree of juice or liquid released from the sample upon chewing
<b>Flavour</b>	
<b>Flavour intensity</b>	the relative intensity of flavour on the palate
<b>Saltiness</b>	a salty flavour
<b>Sweetness</b>	a sweet flavour like the sweetness found in seafood
<b>Savoury</b>	a savoury, umami flavour, a richness
<b>Bitterness</b>	a bitter flavour on the palate
<b>Roast meaty*</b>	a rich roasted flavour of pan-fried beef steak, like the crispy bits in the pan after cooking
<b>Steamed carrot*</b>	a sweet steamed carrot, like root vegetables, swede
<b>Crustacean*</b>	the flavour of sweet claw meat in lobster or crab
<b>Grassy*</b>	a green grassy flavour, weedy when high intensity
<b>Buttery*</b>	a melted buttery flavour
<b>Nutty*</b>	an almond-like nutty flavour
<b>Brackish*</b>	a wet wood, brackish, earthy flavour on the palate
<b>Flavour complexity</b>	a complex mixture and depth of multidimensional flavours
<b>Aftertaste</b>	
<b>Flavour persistence</b>	the persistence of flavour on the palate
<b>Sweetness</b>	a sweet aftertaste like the sweetness found in seafood
<b>Saltiness</b>	a salty aftertaste
<b>Savoury</b>	a savoury, umami aftertaste





## **APPENDIX 6 : COMPOSITION OF SENSORY REFERENCE STANDARDS USED FOR EACH SENSORY TRIAL**



**Composition of sensory reference standards for the attributes selected for Abalone formal sensory assessment**

<b>Aroma / Flavour</b>	Composition
<b>Aroma Intensity</b>	-
<b>Oceanic</b>	Lid shell of a fresh oyster
<b>Fried scallop</b>	A lightly pan- fried scallop
<b>Shellfish</b>	Piece of cold cooked crab flesh and shell bashed
<b>Baked fish</b>	Lightly baked Goldband Snapper
<b>Roast meaty</b>	Pork fillet cooked in an oven
<b>Chicken</b>	Chicken loaf / lunchmeat
<b>Shitake mushroom</b>	Slices of steamed shitake mushroom
<b>Champignon</b>	¼ tspn canned corn juice, ½ champignon sliced

All standards freshly prepared into labelled plastic cups with lids.

**Composition of sensory reference standards for the attributes selected for Rocklobster formal sensory assessment**

<b>Aroma</b>	Composition
<b>Aroma intensity</b>	-
<b>Aroma complexity</b>	-
<b>Fresh oceanic</b>	20 g chunk of baked fresh snapper
<b>Rock pool</b>	1 tbspn of Beach sand and shell grit (from Wellington Pt, Qld) mixed together with ½ tea spoon seaweed (from Wellington Pt, Qld)
<b>Crab-like</b>	2 cm piece of spanner crab claw
<b>Prawn broth</b>	1 tbspn of prawn cooking water (3 banana prawns boiled in 2 cups water for 10 minutes)
<b>Cooked vegetable</b>	10 g steamed cabbage + 10 g boiled turnip
<b>Roast potato</b>	10 g of flesh of freshly baked potato
<b>Egg white</b>	1/3 of a semi-cooked poached egg white (yolk removed)
<b>Cooked egg yolk</b>	1 tspn of boiled egg yolk (no white)
<b>Flavour</b>	
<b>Flavour intensity</b>	-
<b>Sweet-oceanic</b>	-
<b>Savoury</b>	-
<b>Crab-like</b>	'as above'
<b>Prawn broth</b>	'as above'
<b>Cooked vegetable</b>	'as above'
<b>Broccoli</b>	Small broccoli flower head steamed till tender
<b>Toasted bread crust</b>	The darker toasted crust of a French breadstick (Woolworths brand French breadstick)

All standards freshly prepared into labelled plastic cups with lids.



**Composition of sensory reference standards for the attributes selected for Calamari formal sensory assessment**

<b>Aroma</b>	Composition
<b>Aroma intensity</b>	-
<b>Caramelised</b>	¼ brown onion caramelised in buttery and canola oil with 1 tspn brown sugar
<b>Smoky</b>	1 slice of a white baguette (Woolworths) toasted and slightly burnt on a hot dry pan
<b>BBQ'd roast chicken</b>	5cm <sup>3</sup> slice of chicken drumstick (with skin on) cooked on a hot pan (slight charring) with canola oil
<b>Fried rice</b>	¼ brown onion and ½ rasher bacon diced and browned in 1 tsp oil and 2 tsp butter, 1 cup of white steamed basmati rice added and fried for 4 min in a small pot. 1 tblspn of this mixture used for the reference standard.
<b>Toasted pine nut</b>	1 tblspn raw pine nuts toasted on a hot dry pan till almost charred on the outside – 1/2 crushed after toasting.
<b>Shellfishy</b>	Fresh prawn head
<b>Buttery</b>	A knob of butter (1 tspn)
<b>Flavour</b>	
<b>Flavour intensity</b>	-
<b>Saltiness</b>	-
<b>Sweetness</b>	'as above' for caramelised aroma
<b>Savoury</b>	-
<b>Char grilled</b>	'as above'
<b>Fried rice</b>	'as above'
<b>Nutty</b>	'as above'
<b>Shellfishy</b>	'as above'
<b>Buttery</b>	'as above'
<b>Oceanic</b>	-
<b>Toasted bread crust</b>	-
<b>Herbaceous</b>	-

All standards freshly prepared into labelled plastic cups with lids.



**Composition of sensory reference standards for the attributes selected for Prawn formal sensory assessment**

<b><i>Aroma</i></b>	Composition
<b>Aroma intensity</b>	-
<b>Ocean-spray</b>	Freshly shucked pacific oyster-lid
<b>Fresh crustacean</b>	A piece of thawed rock-lobster claw-meat
<b>Boiled prawn broth</b>	2 tsp of broth from boiled banana prawns (cold)
<b>Sea weedy</b>	One 1 cm piece of sea weed (collected from Wellington point)
<b>Vanilla pod</b>	1 cm length of vanilla pod (Nth Qld vanilla)
<b><i>Flavour</i></b>	
<b>Flavour intensity</b>	-
<b>Saltiness</b>	-
<b>Sweetness</b>	-
<b>Savoury</b>	-
<b>Iodine-like</b>	Small piece of iodine diluted in water
<b>Fresh crustacean</b>	'as above'
<b>Boiled prawn broth</b>	'as above'
<b>Green vegetable</b>	A 2 cm piece of boiled broccoli stub

All standards freshly prepared into labelled plastic cups with lids.





**Composition of sensory reference standards for the attributes selected for Whiting and Snapper formal sensory assessment**

<b>Aroma</b>	Composition
<b>Aroma intensity</b>	-
<b>Aroma complexity</b>	-
<b>Clean ocean</b>	One small crystal of iodine in 5 drops water
<b>Roasted</b>	Woolworths BBQ'd chicken meat and skin (~10g)
<b>Starchy</b>	Pot-steamed Arborio rice (~10g)
<b>Vegetative</b>	Warmed canned mushy peas, Windsor Farm Foods, Australia, 425 g can) (~10g)
<b>Flavour</b>	
<b>Flavour intensity</b>	-
<b>Flavour complexity</b>	-
<b>Sweetness</b>	-
<b>Saltiness</b>	-
<b>Savoury</b>	-
<b>Roasted</b>	'as above'
<b>Vegetative</b>	'as above'
<b>Iodine-like</b>	'as above' for clean ocean
<b>Buttery</b>	A 2 cm cube butter
<b>Egg white</b>	A 2 cm piece of poached egg white (poached in water)

All standards freshly prepared into labelled plastic cups with lids.



**Composition of sensory reference standards for attributes selected for Yellowtail Kingfish and Southern Bluefin Tuna formal sensory assessment**

<b>Aroma</b>	Composition
<b>Aroma intensity</b>	-
<b>Clean oceanic</b>	Freshly shucked oyster lid
<b>Caramelised</b>	Roasted pork belly
<b>Roast white meat</b>	Roasted chicken leg (thigh bone-in no skin)
<b>Cooked broccoli</b>	Cooked broccoli piece
<b>Hot butter</b>	Butter piece melted in the microwave
<b>Texture &amp; mouth feel</b>	
<b>Crispness</b>	-
<b>Firmness</b>	-
<b>Tenderness</b>	Piece of wagu steak
<b>Melt-in-mouth</b>	-
<b>Flakes persisting on chewing</b>	-
<b>Gelatinous</b>	-
<b>Slipperiness</b>	-
<b>Juiciness</b>	Piece of wagu steak
<b>Fattiness</b>	Piece of wagu steak
<b>Tooth packing</b>	-
<b>Fibrous</b>	-
<b>Turkish-delight centre</b>	-
<b>Flavour</b>	
<b>Flavour intensity</b>	-
<b>Sourness</b>	-
<b>Sweet oceanic</b>	Freshly shucked oyster lid
<b>Fresh oyster</b>	Fresh oyster in shell
<b>Caramelised meaty</b>	Roasted pork belly
<b>Rendered fattiness</b>	Wagu steak
<b>Baked fresh white fish</b>	-
<b>Avocado-like nuttiness</b>	Piece of Hass avocado
<b>Herbaceous</b>	Snow peas
<b>Savoury</b>	MSG solution
<b>Saltiness</b>	-

All standards freshly prepared into labelled plastic cups with lids.



## Composition of sensory reference standards for the attributes selected for Oyster sensory assessment

<b>Aroma</b>	Composition
<b>Aroma intensity</b>	-
<b>Fresh clean ocean</b>	Freshly shucked lid (only) of a pacific oyster (selected to have absolutely no 'oyster odour')
<b>Tidal rock pool</b>	Some 40 mm <sup>2</sup> fresh green seaweed (taken off the Tasmanian Pacific oyster shells) with ¼ tspn shell-grit mixed with beach sand (from Wellington Point, Qld)
<b>Mangrove</b>	Small piece (3 g) of mud containing mangrove roots (from the mangrove board walk at Wynnum, Qld)
<b>Cucumber</b>	Freshly cut 20 mm cut triangle of continental cucumber containing skin, flesh and seeds
<b>Fresh fish</b>	A 20 mm piece of extremely fresh whiting fillet (raw), skin and scales still on
<b>Sharp acidic note</b>	4 drops balsamic vinegar Modena Lupi brand (from Woolworths)
<b>Flavour</b>	
<b>Flavour intensity</b>	-
<b>Saltiness</b>	-
<b>Sweet ocean</b>	-
<b>Savoury</b>	-
<b>Sourness</b>	-
<b>Green bitterness</b>	Fresh rocket and/or purple lettuce
<b>Hazelnut</b>	2 whole and 1 smashed hazelnut, skin on (Sunbeam, premium natural nuts, 150 g pack)
<b>Asparagus</b>	Steamed asparagus piece (20 mm)
<b>Mangrove</b>	'as for aroma above'
<b>Flavour complexity</b>	-

All standards freshly prepared into labelled plastic cups with lids.



**Composition of sensory reference standards for the attributes selected for Mussels sensory assessment**

<b><i>Aroma</i></b>	Composition
<b>Aroma complexity</b>	-
<b>Aroma intensity</b>	-
<b>Oceanic</b>	A crystal of iodine in 5 drop water
<b>Roast meaty</b>	A slice 1cm x 2 cm of freshly pan seared scotch fillet steak.
<b>Steamed fish</b>	A baked/steamed piece of fresh whiting (wrapped in foil and places in 180C oven till just cooked through)
<b>Crustacean</b>	A 2 cm piece of Rocklobster claw plus an extra 2 cm piece of claw meat
<b>Prawn broth</b>	10 ml of boiled banana prawn water.
<b>Boiled potato</b>	A white chats potato boiled with skin on then 5 cm piece mashed into cup
<b>Buttery</b>	A small knob of butter
<b>Green seaweed</b>	Green seaweed taken collected from Tasmanian pacific oyster shells
<b>Earthy</b>	Some fresh earth, slightly moist (~5 g)
<b>Brackish</b>	A combination of ~2 g of hardwood saw dust with ~2 g of drift wood collected from the brackish waters at Boondall wetlands, Qld
<b><i>Flavour</i></b>	
<b>Flavour intensity</b>	-
<b>Saltiness</b>	-
<b>Sweetness</b>	-
<b>Savoury</b>	-
<b>Bitterness</b>	-
<b>Roast meaty</b>	'as above'
<b>Steamed carrot</b>	A 10 cm slice of boiled carrot
<b>Crustacean</b>	'as above'
<b>Grassy</b>	Some freshly cut grass
<b>Buttery</b>	'as above'
<b>Nutty</b>	Some slivered and whole almonds (skin on) crushed
<b>Brackish</b>	'as above'
<b>Flavour complexity</b>	-

All standards freshly prepared into labelled plastic cups with lids.





[illegible]

*Sensory descriptions for a selection  
of key seafood species from Eyre Peninsula,  
Australia's seafood frontier*

**Green-lip Abalone – farmed (wok-fry)**

White-ivory flesh. Fried scallop, some roasted meat and baked fish notes. Tender and silky in mouth. Savoury fried scallop and sweet ocean flavours that linger.

**Green-lip Abalone – wild (wok-fry)**

Off-white flesh with green lip. Fried scallop and pork, slight baked fish note. Tender, silky, a little chewy. Savoury, sweet ocean with a little shellfish. Flavours linger.

**Black-lip Abalone – wild, canned (heated)**

Off-white flesh. Champignon, white-meat with a hint of shellfish. Initially tender and spongy, remains chewy. Mild savoury, sweet ocean flavour, slight saltiness. Clean finish.

**Black-lip Abalone – wild (wok-fry)**

Off-white flesh with brown lip. Intensely fried scallop and roast pork with baked fish note. Tender and silky. Savoury flavours that linger.

**Blue Mussels (steamed)**

Plump and moist. Vibrant ivory to bright orange and purple. Clean ocean notes. Extremely tender and juicy. Complex and intensely savoury, salty and sweet, roast meaty and crustacean with steamed vegetable notes and a hint of butter.

**Southern Bluefin Tuna (pan-seared)**

Glistening Turkish delight appearance. Intense caramelised white meat, some cooked broccoli notes. Extremely juicy and tender, a mouth-coating fattiness. Tart, savoury, sweet and salty, flavour of baked fresh white fish. Flavours persist.

**Southern Bluefin Tuna – otoro (sashimi)**

A marbled, glistening ruby grapefruit colour. Odourless. Melt-in-mouth tenderness, slippery, gelatinous, a mouth-coating fattiness. Intense savoury flavours, some tartness, avocado nuttiness, fresh oyster and herbaceous. Lingering flavours.

**Southern Bluefin Tuna – chutoro (sashimi)**

Bright, glistening, Turkish delight appearance. Hint of clean ocean odour. Melt-in-mouth tender. Intense tartness, savoury and some fresh oyster flavours that persist.

**Southern Calamari (wok-fry)**

Moist, blue-white flesh. Smoky, caramelised notes with toasted pine nuts. Firm, tender and crisp. Complex flavours, savoury, char-grilled, oceanic and nutty with a hint of vegetative and bread crust. A mouth-coating savoury finish.

**Angasi Oyster (natural)**

Plump, flat, pinky-mushroom colour with dark mantle. Tidal rock pool, mangrove and fresh fish notes. Firm, crisp, juicy and chewy. Intense, complex savoury flavours, hazelnut and asparagus, rocket-like, slightly salty and tart. Flavours persist with a metallic finish.

**Pacific Oyster – (natural)**

Plump, bright, creamy with a hint of pink and a dark mantle. Fresh clean ocean with cucumber and fresh fish notes. Very crisp, juicy and bursts-in-mouth. Intensely sweet ocean, salty and savoury with a hint of asparagus. Sweet-savoury fingers.

**Pacific Oyster – spawnless (natural)**

Plump, creamy with greyish tones and dark mantle. Fresh clean ocean, cucumber and fresh fish notes. Very juicy, burst-in-mouth. Intense saltiness, sweet and savoury with a hint of rocket and asparagus. Clean finish with lingering saltiness.

**Spencer Gulf Prawns (chilled)**

Glossy pinky-peach orange with red highlights. Intense aroma of ocean-spray, fresh crustacean, a touch of fresh seaweed and a hint of vanilla pod. Extremely juicy, firm, crisp and springy. Intense savoury and fresh crustacean flavours, salty-sweet, green vegetable and iodine notes with slight tartness. Persisting savoury flavours with a bread-crust like finish.

**Southern Rock Lobster (chilled)**

Vivid white, glossy flakes. Crab-like and fresh ocean, some cooked vegetable. Slightly crisp, extremely tender, melt-in-mouth. Intensely sweet ocean, crab-like and savoury with a hint of toasted bread crust. Persisting flavours.

**Southern Rock Lobster (warmed)**

Vivid white flakes. Complex and intense aroma of fresh ocean, crab-like, roast potato and vegetable notes. Slightly crisp, melt-in-mouth tender. Intensely crab-like, sweet ocean, savoury, cooked broccoli, some toasted bread crust. Savoury flavour persists.

**Snapper (pan-fry)**

Moist, pinkish-white, large flakes. Roasted white meat and clean ocean notes. Firm, chewy and juicy. Intensely savoury, roasted with oceanic sweetness that persists.

**King George Whiting (pan-fry)**

Moist, creamy-white fillet with fine flakes. Clean ocean, starchy vegetable, mushy peas and roasted nut aroma. Crumbly, melt-in-mouth. Complex flavours, sweet ocean, savoury, clean iodine-like, egg white, buttery and vegetative. Savoury, slight metallic finish.

**Yellowtail Kingfish (pan-seared)**

Glistening, tan-coloured flesh. Intense aroma of caramelised white meat and clean ocean. Juicy flavour of baked white fresh fish, savoury, sweet and slight tartness persisting.

**Yellowtail Kingfish – otoro (sashimi)**

Translucent beige coloured and marbled appearance. Odourless. Crisp but tender with mouth coating fattiness. Delicate fresh oyster, savoury and rendered fat flavours.



**FURTHER INFORMATION**

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## **APPENDIX 8 : SUMMARY OF MEDIA COVERAGE OF THE PROJECT TO DATE**

Spelling it out: the sensory language of seafood. Rachel Lebihan. The Food Sage, Published online 11/12/2012 (<http://thefoodsage.com.au/2012/12/11/spelling-it-out-the-sensory-language-of-seafood/>)

Mapping seafood flavours. Verity Edwards. The Australian, 6/12/2012, p 7.

A lexicon creamy and rich. John Lethlean. The Australian, 6/12/2012, p 7.

Eyre Peninsula Wheels in an aid for tasting seafood. Brooke Neindorf. ABC rural radio, published online 6/12/2012 (<http://www.abc.net.au/rural/news/content/201212/s3648546.htm>)

Flavour notes for seafood launched in South Australia. Australian Food News – Thought for Food, published online 6/12/2012 (<http://www.ausfoodnews.com.au/2012/12/06/flavour-notes-for-seafood-launched-in-south-australia.html>)

Language of the Seas. Simon Wilkinson. The Advertiser, 5/12/12, p 15

A focus on seafood flavour – a regional branding approach. Queensland Seafood, 2012, 4, p 25

Scientists to savour SA seafood's sensory signatures. Julie Lloyd. UQ News, published online 3/8/2011 (<http://www.uq.edu.au/news/?article=23622>)

World may soon be your (specific) oyster, ABC News, published online 22/8/2012 (<http://www.abc.net.au/news/2012-08-22/flavour-chemist-helps-seafood-producers-define-taste-variations/4214680>)

Chemist works on the flavours of the Eyre Peninsula. Brooke Neindorf. ABC rural radio, published online 22/8/2012 (<http://www.abc.net.au/rural/news/content/201208/s3573168.htm>)

Taste testing seafood for better marketing. Brooke Neindorf. ABC rural radio, published online 22/08/2012

World your oyster. The Fiji Times, published online 23/8/2012. (<http://www.fijitimes.com/story.aspx?id=209886>)

Producers meet to discuss seafood brand. Bonnie Puckeridge. Port Lincoln Times, 30/8/2011, p 6.

Seafood trail worth following. Rachel Lebihan. The Australian Financial Review, 20/7/2012. ([http://www.afr.com/p/lifestyle/life\\_leisure/seafood\\_trail\\_worth\\_following\\_8AX5hyMZk7nHWO3k63LCMO](http://www.afr.com/p/lifestyle/life_leisure/seafood_trail_worth_following_8AX5hyMZk7nHWO3k63LCMO))

Chemist works on Fishy Taste. ABC rural radio, published online 3/11/2010 (<http://www.abc.net.au/rural/news/content/201011/s3055813.htm>)

Coffin Bay oyster farmer eyes world markets. Dos O'Sullivan. AustAsia Aquaculture, Spring 2010, p 3-8



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