Australian Seafood Compositional Profiles

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1. Non-Technical Summary

Project Number: 2008/905 Australian Seafood Compositional Profiles

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1.1 Project Objectives

1. Develop and implement a sampling and testing framework which provides baseline data on the nutritional composition of key Australian seafood species.
2. Ensure the baseline data collected includes the most relevant nutritional components to industry, including: proximate composition, fatty acids, water and fat-soluble vitamins, and key minerals.
3. Confirm the identity of the seafood species tested through DNA profiling.
4. Implement a rigorous review process to ensure the accuracy of the baseline data.
5. Provide a report for each Australian Seafood Cooperative Research Centre industry participant which includes summary data to support commercial activities.
6. Provide the full electronic data set to the ASCRC to support extension activities such as: the development of a web-based nutritional database, risk-benefit analysis, consumer advisories, nutritional benefit claims and trade access negotiations for Australian seafood.

1.2 Outcomes

It is envisaged that the compositional profiles dataset will support the following outcomes over the medium to long term:

1. The development of cost-effective risk-benefit assessments (due to availability of baseline data) and implementation of appropriate risk management policies.
2. The entry of Australian seafood into new markets and expanding presence in existing ones through the ability to demonstrate nutritional benefits of seafood products to customers and provision of risk-benefit analyses to regulatory agencies.
3. Increased seafood consumption rates through improved consumer awareness of the public health benefits of Australian seafood.
4. Increased profits to the ASCRC industry participants through objective demonstration of the nutritional benefits of Australian seafood and associated increased premiums for traded products.
5. The sampling and testing framework and data scrutiny approach developed through this project is able to support additional ASCRC projects and may create cost efficiencies for future projects.

1.3 Outputs

1. An Excel database containing reviewed/scrutinised data (~8,000 values) for key nutrients (proximates, total fatty acids, minerals and vitamins) in 21 different Australian seafood species.
2. An Excel database containing raw laboratory data and expanded fatty acid profile (~20,000 values) information for 21 different Australian seafood species (non-reviewed).
3. An Excel database which contains mercury and vitamin D results for a subset of the samples.
4. A series of reports for the ASCRC industry participants containing summary data (averages, standard deviations, box plots) for each seafood species tested.
5. A sample inventory (which indicates lab ID numbers and details of the sample matrix tested), raw electronic laboratory result reports and a laboratory notebook which provides details of the data scrutiny process.
6. A sampling and testing framework and protocols which can support future large data collection projects.
7. Statistical analysis methodologies (and code for the statistical software 'R') to underpin future data scrutiny efforts.

1.4 Acknowledgements

Food Standards Australia New Zealand is thanked for providing co-funding for the analysis of project samples for Vitamin D and mercury. Rod Ward and Darren Fisher are acknowledged for their assistance in receiving, processing and dispatching project samples. Rose Flint and Sam Rogers are gratefully acknowledged for their assistance and help with data management and reliability checks. The following companies are thanked for product donation and transport to Adelaide:

Southern Australian Seafoods
Southern Ocean Mariculture Pty Ltd
Coastal Seafarms Pty Ltd
Great Southern Waters Pty Ltd
Ab-Tas
Esperance Abalone Enterprises Pty Ltd
Pacific Shoji Pty Ltd
Tas Live Abalone Pty Lrd
Abalone Down Under
Red Dragon Seafoods
Van Diemen Aquaculture P/L
Huon Aquaculture
Tassal Limited
Petuna
Southern Barramundi Pty Lrd
Coral Sea Farm
Pacific Reef Fisheries Pty Ltd
GI Rural
Sunrise Seafood Pty Ltd
Australian Prawn Farms
Natural Oysters
Oyster Bay Oysters Pty Ltd
Hunter Valley Oysters
Zippel Enterprises Pty Ltd
Pacif Reef Fisheries Pty Ltd
Southern Cross Marine Culture Pty Ltd
M.W. & E.A. Sciacca & Sons
Camden Haven Oysters
Broadwater Oysters Pty Ltd
Pambula River Oysters

Marine Produce Australia
Good Fortune Bay
Humpty Doo Barramundi
Pejo Enterprises
Rapits & Sons Pty Ltd
Correia Fishing Co
North Queensland Trawler Supplies
Clarence River Fishermens Co-op
Mcash oysters Pty Ltd
Pristine Oyster Farm
Tasmanian Seafoods
Clean Seas Tuna Ltd
Great Southern Seafoods
Sydney Fish Market
SeaFarm Pty Limited

2. Introduction and Background

This study was prompted by a scarcity of robust nutritional data for key Australian seafood species. This report presents new information on the nutrient composition (key proximates, fatty acids, water and fat-soluble vitamins and minerals) of 21 species of Australian seafood. Generally, the study involved the collection of five samples of each species (which were confirmed through DNA profiling), followed by the analysis (undertaken in duplicate) of ~100 different nutrient components (~60 of which are individual fatty acids) in the edible portion of each sample.

The seafood species included in this study were chosen by the industry participants of the Australian Seafood Cooperative Research Centre and are all economically significant species for Australia. The nutritional components were selected following extensive consultation with industry and nutritional experts to ascertain the most relevant nutrients for seafood.

The sampling and analyses methods used were chosen following advice from a technical panel comprising experts from multiple agencies, and these methods were consistently applied throughout the study. A public health nutrition expert (Professor Heather Greenfield, University of Sydney) was also engaged as a consultant to the project and assisted in the development of a data reporting template for the laboratories to input data. This standardised approach was critical to the success of the project due to the large size of the dataset involved.

Following the data collection phase, a series of data scrutiny activities were undertaken to ensure the accuracy of the dataset:

- The contracting laboratories performed in house verification checks to ensure that duplicate analyses were within their in-house uncertainty of measurement criteria.
- Approximately 10% of samples had triplicate analyses undertaken on them to further verify data accuracy.
- Contracted laboratories were visited and a manual audit of hard copies of the analytical results undertaken (including data chromatograms). This covered ~10% of the results.
- Data scrutiny of a subset of raw laboratory results received was undertaken (manual review of all data was impractical due to the size of the dataset).
- Automated checking of the entire dataset was undertaken (through creating ‘code’ in the stats software R); this included a systematic check of all data for significant variance (~30%) between duplicates and checks for transposition errors.
- Specific samples that were ‘flagged’ by the above checks as potential ‘issues’ were selected for re-testing (~10% of samples were re-tested). This provided verification that initial tests were correct in most cases and replacement values for some data points.

Following data scrutiny, a series of reports were prepared for each industry sector involved in the project. These reports contain summary tables (mean and standard deviation values for each nutrient) and a series of box plots which give a visual indication of the data variability for each nutrient. Summary tables of the results can be found in Appendix 3. The industry sector reports and the full dataset can be found on the enclosed DVD.

Further data analysis is required to ascertain the potential for stakeholders to make ‘source’ and ‘good source’ claims for their products and to develop key nutrient messages relevant to consumers; this extension work is currently being undertaken by nutrition experts from Flinders University.

It is anticipated that this new nutritional information will support the following outcomes in the medium to long term:

1. Cost-effective risk-benefit assessments and appropriate risk management policies developed.
2. National and international labelling requirements for seafood and health benefit claims supported.
3. Entrance of Australian seafood into new markets and expanding presence in existing ones.
4. Evidence-based promotions to support increased seafood consumption rates in Australia.
5. Increased profit to the ASCRC industry participants through objective demonstration of the nutritional benefits of seafood.

2.1 Need

While some nutritional information is held by Food Standards Australia New Zealand (FSANZ), the National Residue Survey (NRS) and private companies, these existing data sets have significant shortcomings, including:

1. Only a small number of species have been tested.
2. The sampling and analytical methods used differ widely and generally lacked robust quality assurance protocols, which potentially invalidates comparisons between species or other protein sources.
3. The species of seafood tested was not confirmed through DNA profiling.

Additionally, nutritional data held by private companies to meet labelling requirements generally only included a limited number of analytes (e.g. energy, protein, fat, sodium) and information was lacking on the presence and concentration of many important vitamins, fatty acids and minerals. There was also a lack of comprehensive data of the positive and negatives aspects of seafood for the same samples.

The Seafood CRC participants identified a need for baseline nutritional information to enable them to meet customer-based and regulatory needs, to assist with risk-benefit assessments, to promote the public health benefits of seafood consumption, and to support response to market access threats.

2.2 Objectives

The major objectives of this work were to:

1. Develop and implement a sampling and testing framework which provides baseline data on the nutritional composition of key Australian seafood species.
2. Ensure the baseline data collected includes the most relevant nutritional components to industry.
3. Confirm the identity of species tested through DNA profiling.
4. Implement a rigorous review process to ensure the accuracy of the baseline data.
5. Provide a report for each Australian Seafood Cooperative Research Centre industry participant which includes summary data which can support commercial activities.
6. Provide the full electronic data set to the ASCRC to support the development of a web-based nutritional database.

3. Methods

3.1 Technical Panel and Public Health Nutrition Consultant

A technical panel was formed at the start of the project which included membership from Food Standards Australia New Zealand (FSANZ), Flinders University, Seafood Services Australia (SSA) and the South Australian Research and Development Institute (SARDI). The panel provided input and advice on test method selection, laboratory selection, data management and reporting. An expert public health nutritionist (Professor Heather Greenfield, University of Sydney) was also contracted for the duration of the project and provided advice/review of laboratory methods, data reporting formats and data scrutiny of a subset of raw laboratory results and aggregate values.

3.2 Sampling Framework

To assist in developing the sampling framework (survey design), a questionnaire (available on request) was circulated to all industry participants in the early stages of the project. The questionnaire assisted with the following design considerations:

1. Selection of species to include in the survey
2. Identification of companies that were able to provide product for the survey
3. Determining the nutrient components to test for
4. Identification of existing industry data sets.

Based on the advice received, the species listed in Table 1 were included in the survey. The project team consulted with FSANZ and the technical panel with regards to the number of samples of each species to collect. A minimum replication of five samples per species was recommended. All samples were collected and provided to SARDI by the industry participants as an 'in-kind' contribution to the project. In general five samples of each species was able to be obtained, in some cases logistic, technical and cost issues prevented supply of five samples, namely:

- Australian sardines. Five samples were supplied; however, DNA speciation subsequently demonstrated that they comprised two different species (*Sardinops sagax* and *Spratelloides robustus*).
- Five samples of each of Pacific and Sydney Rock oysters were provided; however, only two samples of native oysters were supplied.
- The wild abalone samples supplied to the project comprised three different species.
- The farmed abalone samples supplied comprised two different species.
- Five samples of farmed black tiger prawns were supplied, only two samples of farmed banana prawns were provided.
- Only four samples of ocean trout were supplied.

Samples were supplied between July 2010 and July 2011. Each sample supplied comprised ~2 kg flesh weight. Most samples were provided in raw frozen format. However, the farmed prawn and burrowing blackfish samples were provided as a cooked final product (Table 1). Following sample receipt at SARDI, the 'edible portion' (as defined by FSANZ) of the samples were prepared for testing by removing the 'non-edible' portions (i.e. bones, shells). In general the edible portion consisted of: skin-on fish fillets, shelled and peeled crustaceans and shucked shellfish. Following this sample preparation step, the samples were frozen to -80℃ and dispatched to AsureQuality, in Auckland, New Zealand via overnight courier.

Table 1. Common and scientific names of species included in the compositional profiles survey, number of samples collected and analysed, and product format of samples tested

Common Name	Scientific Name	Aquaculture or Wild	Number of Samples	Cooked or Raw	Portion Tested
Atlantic Salmon	*Salmo salar*	Aquaculture	n = 8	Raw	Skin-on fillet
Australian Sardine	*Sardinops sagax*	Wild	n = 2	Raw	Whole fish
Banana Prawn	*Fenneropenaeus merguiensis*	Aquaculture	n = 2	Cooked	Tail meat
Banana Prawn	*Fenneropenaeus merguiensis*	Wild	n = 5	Raw	Tail meat
Barramundi	*Lates calcarifer*	Aquaculture	n = 5	Raw	Skin-on fillet
Black Lip Abalone	*Haliotis rubra*	Wild	n =2	Raw	Foot/muscle
Black Lip Abalone	*Haliotis rubra*	Aquaculture	n = 2	Raw	Foot/muscle
Black Tiger Prawn	*Penaeus monodon*	Aquaculture	n = 5	Cooked	Tail meat
Blue Sprat	*Spratelloides robustus*	Wild	n = 3	Raw	Whole fish
Brown Lip Abalone	*Haliotis conicopora*	Wild	n = 1	Raw	Foot/muscle
Brown Tiger Prawn	*Penaeus esculentus*	Wild	n = 5	Raw	Tail meat
Burrowing Blackfish	*Actinopyga spinea*	Wild	n = 5	Cooked	Whole fish
Endeavour Prawn	*Metapanaeus endeavouri*	Wild	n = 5	Raw	Tail meat
Green Lip Abalone	*Haliotis laevigata*	Wild	n =2	Raw	Foot/muscle
Green Lip Abalone	*Haliotis laevigata*	Aquaculture	n = 3	Raw	Foot/muscle
Gummy Shark	*Mustelus antarcticus*	Wild	n = 5	Raw	Skin-off fillet
Native Oyster	*Ostrea angasi*	Aquaculture	n = 2	Raw	Whole oyster
Ocean Trout	*Oncorhynchus mykiss*	Aquaculture	n = 4	Raw	Skin-on fillet
Pacific Oyster	*Crassostrea gigas*	Aquaculture	n = 5	Raw	Whole oyster
School Prawn	*Metapenaeus macleayi*	Wild	n = 5	Raw	Tail meat and whole prawn
Southern Rock Lobster	*Jasus edwardsii*	Wild	n = 5	Raw	Tail meat
Sydney Rock Oyster	*Saccostrea glomerata*	Aquaculture	n = 5	Raw	Whole oyster
Western King Prawn	*Melicertus latisulcatus*	Wild	n = 5	Raw	Tail meat
Yellowtail Kingfish	*Seriola lalandi*	Aquaculture	n = 5	Raw	Skin-on fillet

3.3 Analyte and Method Selection

The nutrient components included in the test panel were selected after consultation with the industry participants (via the distribution of a questionnaire) and the technical expert panel. The nutrient components (~100 different components) included a range of: proximates, minerals, vitamins and fatty acids. For ease of reporting the fatty acids (saturated, polyunsaturated, monounsaturated and trans fatty acids) are recorded as total values in the summary reports, except for critical omega 3 fatty acids which form the basis of product nutrition claims and are therefore, recorded in full. These components (~41 components) are listed in Appendix 3 in individual excel spreadsheets.

Standard laboratory methods (e.g. AOAC or ISO methods) were used for most analyses ('in house' methods were used in cases where no standard method existed). All methods used were accredited to ISO 17025 by either International Accreditation New Zealand (IANZ) or the National Association of Testing Authorities (NATA). A list of analytes tested, lab method references and associated limits of detection and reporting are summarised in Appendix 4. More detailed information on methodology utilised is available on request. The laboratory method performance characteristics such as: recovery, precision, sensitivity, accuracy and measurement uncertainty, were evaluated for each analyte during the laboratory assessment and selection process and were considered by the expert panel to be appropriate for the proposed analyses undertaken.

3.4 Laboratory Selection

A Request for Tender (RfT) process was undertaken to select laboratories to provide testing services for the survey (the RfT evaluation criteria are available on request). Due to the wide scope of the testing requirements for the survey, four laboratories undertook the required analyses. The laboratories which undertook the analytical work for the project were:

1. AsureQuality (Auckland, New Zealand) – proximate composition, fatty acids, water and fat-soluble vitamins, minerals.
2. Hill Laboratories (Hamilton, New Zealand) – mercury (methyl and total).
3. National Institute of Water and Atmospheric Research (Wellington, New Zealand) – DNA species identification.
4. National Measurement Institute (Melbourne, Australia) – vitamin D.

3.5 Laboratory Analyses and Quality Assurance

Each sample was analysed for each nutrient component in duplicate. Duplicate analyses were undertaken to account for unknown method performance for some analyte:matrix combinations (due to the wide variety of matrices being tested), and this data assisted in assessing the validity of the analytical results in the data scrutiny phase. A sub-set (~10%) of all samples was tested in triplicate as a further check on method performance.

Negative (blanks) and positive controls were run with each batch of samples as follows. For each analyte group tested a minimum of one intra-laboratory check sample was included for every batch of samples analysed. Spiking of samples was undertaken to ensure appropriate recoveries and instrumental responses occurred at the rate of one in every ten samples. Matrix specific standard reference materials (SRMs) were also run with each batch of samples, the SRMs used were:

1. NIST 1946: Lake Superior Fish Tissue
2. NIST 1566b Oyster Tissue

3. NIST 1849 infant formula
4. NIST 2383 baby food composite

The triplicate and SRM quality assurance testing results are available on request.

3.6 Data Review Process

During the sampling and analytical testing phase of the project, the project team (with significant input from Professor Heather Greenfield and FSANZ), developed a data template for reporting the laboratory results. This assisted in ensuring that the laboratory reported data directly to the project team in a format which could be easily scrutinised and minimised transcription errors due to manually transcribing data into different formats.

Following the laboratory analyses, a series of data scrutiny activities were undertaken to ensure the accuracy of the dataset:

- The contracting laboratories performed in-house verification checks to ensure that duplicate analyses were within their in-house uncertainty of measurement criteria (these criteria can be provided on request).
- Contracted laboratories were visited (in September 2011) and a manual audit of hard copies of the analytical results undertaken (including data chromatograms); this covered ~10% of the results.
- Data scrutiny of a subset of raw laboratory results received was undertaken (manual review of all data was impractical due to the size of the dataset).
- Checking of the entire dataset was undertaken (using Microsoft Excel 2007 and the statistical software R); this included a systematic check of all data for significant variance (~30%) between duplicates. Samples were also identified as 'requiring follow up' if one duplicate was found to be less than the limit of detection and the other was not, or if one duplicate value was missing (blank cell).
- Checking was also used to assess the presence of potential transcription errors, through identification of multiple cells in a row or column containing identical values.
- Values that were flagged by any of the above checks were then manually assessed by the project team and a decision made as to whether follow up action was required or not. The rationale for these decisions was recorded in a dedicated laboratory book which can be viewed on request.
- When follow up action was required, the spurious result was referred to the testing laboratory, investigated to ensure that data reporting was correct and where appropriate, re-testing was undertaken. In total ~10% of samples were re-tested. This provided verification that initial tests were correct in most cases and replacement values for some data points.

To assess the reliability of the data, several logical checks were also performed using Microsoft Office Excel 2007 and R, includeding:

- Moisture, protein, total fat, carbohydrates and ash were summed to assess if these values totalled to 100 (as expected).
- Total fat values were compared with total fatty acid values to assess if total fat values exceeded total fatty acid content (as expected).
- Saturated, polyunsaturated, monounsaturated and trans fatty acids were summed to assess if the sum of these components was equal to the total fatty acid value (as expected).

3.7 Data Treatment and Conversion Factors

Data treatment was undertaken following either FSANZ conventions or the FAO recommendations in '*Food Composition Data: Production, Management and Use*' (H. Greenfield & D.A.T. Southgate, 2nd Edition, FAO Rome, 2003). In summary, the following approaches were taken with regards to data reporting:

1. All non-detected values were reported as less than (<) their Limit of Detection (LoD) value in the database.
2. All values are reported as 'per 100 g food'.
3. Raw laboratory results for minerals were converted from mg/kg units to mg/100 g by dividing results by 10.
4. Raw laboratory results reported as m/m% have been converted directly to mg/100 g with no conversion factor applied.
5. Protein content was calculated using nitrogen conversion factors (6.25) given in FSANZ Standard 1.2.8.
6. For the purpose of calculating a mean value in the industry summary reports, values that were reported as less that the LoD value were assigned a value of '0'.
7. For the purpose of reporting mean and standard deviation (SD) values in the industry summary reports, results were rounded and reported to three significant digits (except vitamin E which was reported to two significant digits) as per the recommendations of Greenfield and Southgate (2003).

4. Results and Discussion

4.1 Summary of Information Sources and Datasets Created

Throughout the course of the project a significant number of information sources and datasets have been developed. The following is a list of these data and information sources:

a) ***Sample inventory.*** The inventory contains species name, sample and laboratory ID numbers, details of where the company's samples were obtained, matrix and product format details.

b) ***Raw laboratory results.*** Raw data result sheets from AsureQuality, Hills, NMI and NIWA have been electronically stored.

c) ***Full dataset - 'un-scrutinised'.*** The unscrutinised dataset contains data as received from the testing laboratories. This dataset includes duplicate and triplicate analyses undertaken, individual fatty acid results and ash results.

d) ***Full dataset – 'reviewed and cleaned up'***. This dataset has been scrutinised as per Methods Section 3.6. The spurious values identified through the data scrutiny process have been investigated and in some cases the values replaced with re-test sample values. Total fatty acid results have been retained, but individual fatty acid results (except for ALA, DHA, DPA and EPA), nitrogen and ash values were removed to simplify the dataset and improve 'readability'. The reviewed dataset is provided on the attached DVD.

e) ***Laboratory notebook.*** This notebook contains information on detailed steps taken during the data scrutiny phase, including documentation and rationale for any changes made in relation to identification of spurious values.

f) ***Quality assurance data***. This includes triplicate test results, re-tested sample results and Standard Reference Material data. This data is retained in an Excel file and may assist any further data scrutiny efforts.

g) ***Mercury and vitamin D data***. The mercury and vitamin D data was generated through additional funding provided by FSANZ. Unfortunately the funding amount did not allow the testing of each project sample, however at least one sample of each species type has been tested for mercury and vitamin D. This data is held in a separate Excel file and can be provided when FSANZ/ASCRC agree disclosure. Due to the reduced number of samples tested this data may be difficult to directly integrate into the main dataset.

h) ***Data analysis files.*** A series of code written in the statistical software R has been developed to assist the following tasks: (1) automated analysis of duplicate variability; (2) automated assessment of transcription errors; (3) automated generation of mean and SD value tables; (4) automated generation of box plots for each species:analyte combination.

i) ***Summary tables and graphs.*** Average (mean) and SD values, and box plots for each nutrient component tested have been provided for each industry sector. This information is provided on the attached DVD.

4.2 Results of Data Reliability Checks

As discussed in the methods sections, several logical checks were performed on the data using Microsoft Office Excel 2007 and R, these were performed to assess the reliability of the dataset. The results of these checks are briefly discussed below:

a) Comparison of total fat and fatty acid values

As expected, the total fat values were found to exceed the total fatty acid values, except for one sample of ocean trout. Upon investigation, the values for total fat (29,350 mg/100g) and fatty acids (31,758 mg/100g) for the sample in question were not found to be significantly different (when the reported measurement uncertainty for these methods was taken into consideration). This indicates that fatty acid and fat values included in the dataset are reliable.

b) Sum of moisture, protein, total fat, carbohydrates and ash

The sum of the ash constituents theoretically should not exceed 100% of the weight of the samples tested (100 g). FAO guidance (Greenfield and Southgate 2003) suggests that the summation of the components of ash provides a useful reliability check on nutrition data and that *"summations falling within the range of 97 to 103 percent of analytical sample weight are generally acceptable".*This check was undertaken on all data and generally the data was found to sum to 100 and was within the acceptable range. Of the 96 samples tested in the survey, seven samples (one salmon, one ocean trout, one 'wild' prawn and four shark) had summed proximate values that were slightly outside the preferable range. The highest value obtained was 105.1% and four of the seven 'non compliant' values were only slightly higher than 103%. When measurement uncertainty is taken into consideration, these small aberrations are unlikely to be of significance. Overall, the check indicates that the proximate values for moisture, protein, total fat and carbohydrates in the dataset are consistent with the FAO recommendations.

c) Comparison of individual and total fatty acid values

The saturated, polyunsaturated, monounsaturated and trans fatty acid values were summed and compared to the 'total fatty acid' value reported. Generally it would be expected that these values would be the same. In most cases the check revealed that the sum of the individual fatty acids slightly exceeded the 'total fatty acid' value. Based on this finding the raw 'Gas Liquid Chromatographs' were requested and checked to ensure validity of the reported values. Reported values for individual fatty acids were found to match the raw analyses.

Discussions with the testing laboratory regarding this comparison revealed that the 'total fatty acid' value was calculated by the addition of known saturated, monounsaturated, polyunsaturated and trans fats. However, for the analyses undertaken in this project, less common fatty acid peaks in the chromatographs were also included in the saturated, monounsaturated, polyunsaturated and trans fats total values. This means that it would be expected that the sum of saturated, monounsaturated, polyunsaturated and trans fats would slightly exceed the 'total fatty acid' values reported (which represent the sum of a known sub-set).

In summary, the reliability check indicates that the fatty acid data is valid. However, it should be recognised that the 'sum of the parts does not equal the total reported' due to incorporation of less common fatty acids in the saturated, monounsaturated, polyunsaturated and trans fats total values.

4.3 Industry Sector Results

Appendix 3 contains a series of summary tables with the average (mean) results obtained for each species tested.

Thirteen ASCRC industry participants collaborated in the Seafood Compositional Profiles project. A series of individual reports have been prepared for each of the industry participants - these can be viewed on the attached DVD.

The industry reports contain mean and SD values, and box plots for each nutrient component tested. The summary reports do not contain nitrogen or ash values, as these were thought to be of limited interest to key stakeholders and can be easily deduced from the total values for protein and proximates (summed) in the dataset. For ease of viewing, individual fatty acid values have also been omitted from the summary data (note, key omega 3 values are included in the summary tables), this information is retained in the original dataset should specific analyses of this information be needed.

Of interest, the box plots demonstrate significant 'between sample' variation for some nutrient-species combinations. Further analytical testing would be required to ascertain the source of this variation e.g. to determine if the level of nutrients in samples vary in response to spatial, temporal or biological effects.

4.4 Comparison to National Reference Values

The Food Standards Code and Department of Health and Ageing Nutritional Guidelines have been scrutinised and an inventory of Australian national reference values for the nutrients included in study (where they exist) has been compiled (Appendix 5). Each nutrient summary table contains this reference list to allow stakeholders to easily compare the compositional profile of their products against critical nutrient limits. An initial comparison of the survey data against the reference values reveals:

- All species tested were compliant with Australian regulatory standards for cadmium, lead and mercury.
- Several species appear to contain nutritionally relevant quantities of important vitamins and minerals and omega 3 fatty acids.

Further data analysis is required to ascertain the potential for stakeholders to make 'source' and 'good source' claims for their products. This work is currently being undertaken by nutrition experts from Flinders University. This analytical extension work should be undertaken in conjunction with food nutrition and labelling experts at Food Standards Australia New Zealand to ensure that the advice meets with regulatory requirements.

5. Benefits and Adoption

5.1 Adoption

The information generated from this survey will be widely adopted and utilised. This is evidenced by numerous requests for access to the data from the Australian seafood industry, including representatives of the prawn (wild and farmed), abalone (wild), oyster and salmon industries.

5.2 Benefits

The project has resulted in the development of an extensive dataset containing information on a large range of nutrients in 21 different species of Australian seafood. This is a significant consolidated resource that will be able to be utilised by a wide range of stakeholders, including: medical professionals, industry associations, individual industry enterprises, food regulatory agencies, scientists and consumers. It is envisaged that the provision of the centralised dataset will support a range of activities that will result in two significant socio-economic benefits:

1. ***An overall improvement in the public health status of consumers***. This will be achieved through the development and implementation of appropriate risk management policies and improved consumer awareness of the public health benefits of Australian seafood.
2. ***Increased profit to the Australian seafood sector***. This will be achieved through increased market and customer demands through on-going demonstration of the health benefits of seafood and subsequent increased demand and higher retail prices.

6. Further Development

Further work and data analysis utilising the results from this survey is currently being undertaken by nutritional experts (Dr Jessica Grieger and Associate Professor Michelle Miller, Flinders University) to develop concise recommendations on key nutritional messages for consumers for each species (three to five messages are being developed for each species). It is anticipated this work will be finished within the next two to three months.

An extension project is also currently being scoped by the project team (including the ASCRC and Flinders University). The scope of the extension project is still under discussion, however ideas under consideration include:

1. Analysis of the data to determine the potential health claims (e.g. ‘source’ and ‘good source’ claims) that each industry participant could make.
2. Development of a small report for each industry participant that details the wording (compliant with national regulations) that could be used for potential health claims.
3. Publication of the data in peer reviewed journals to improve the regulatory and consumer acceptability of the dataset.
4. Development of an Australian seafood nutrient composition reference book.
5. Development of a series of pamphlets and posters which advertise the key consumer health benefits for several seafood species.
6. Provision of the nutritional data on a website (e.g. Seafood Services Australia or the ASCRC).
7. Provision of the nutritional data/health advisories to the Heart Foundation to facilitate clinician advisories for consumption of Australian seafood.
8. Presentation of the data and key industry and consumer messages at national and international fora and/or through industry workshops/master classes.

It is recommended that the current and proposed extension work be undertaken in conjunction with FSANZ nutrition and labelling experts to ensure robustness and accuracy of any recommendations. It is also suggested that FSANZ and the ASCRC agree to a data sharing arrangement to enable the Vitamin D and Mercury data to be incorporated into the proposed extension work.

7. Planned Outcomes

The compositional profiles dataset will support the following outcomes over the medium to long term:

7.1 Public Benefit Outcomes

- The development of cost-effective risk-benefit assessments (due to availability of baseline data) and implementation of appropriate risk management policies.
- Increased seafood consumption rates through improved consumer awareness of the benefits of Australian seafood and associated public health improvements.
- The sampling and testing framework and data scrutiny approach developed through this project is able to support additional ASCRC projects and may create cost efficiencies for future projects.

7.2 Private Benefit Outcomes

- Increased profits to the ASCRC industry participants through objective demonstration of the nutritional benefits of Australian seafood and associated increased premiums for traded products.
- The entry of Australian seafood into new markets and expanding presence in existing ones through the ability to demonstrate nutritional benefits of seafood products to customers and provision of risk-benefit analyses to regulatory agencies.

7.3 Linkages with CRC Milestone Outcomes

This project has provided baseline data to support the completion of the following ASCRC Outputs and Milestones:

2.4.2 Milestone

Two completed, internationally reviewed, integrated health benefit and risk assessments available for market access negotiations and for consumer risk advisories.

2.4.3 Milestone

Integrated health benefit and risk assessment methodology accepted internationally and available for use with standard-setting, market access negotiations and “clean and green” claims and for differentiating Australian product in premium price markets.

2.5 Output

Communication of consumer health benefits and risks.

8. Conclusion

This report presents new information on the nutrient composition (key proximates, fatty acids, water and fat-soluble vitamins and minerals) of 21 different species of Australian seafood. The study involved the collection of five samples of each species (confirmed through DNA profiling), followed by analysis (undertaken in duplicate) of ~100 different nutrient components in the edible portion of each sample. The resulting data was scrutinised by scientific experts and automated reliability checks were undertaken; together these indicate that the dataset is robust.

Highlights of the results from the survey include:

(a) all species tested were compliant with Australian regulatory standards for cadmium, lead and mercury;

(b) all species contained omega three fatty acids, with some potentially containing nutritionally beneficial levels; and

(c) several species appear to contain nutritionally relevant quantities of important vitamins and minerals.

Follow up work is currently underway to develop concise consumer recommendations on key nutritional messages for each species, and an extension project is being scoped to undertake further data analysis and develop a broad communication strategy for industry and consumers.

The data generated through this survey will assist industry to meet its labelling needs, domestically and internationally. The data will also support the assessment of the public health benefits of Australian seafood and promotion of this through public consumption advisories and health professionals. In the medium to long term it is anticipated that this survey will contribute to an overall improvement in the public health status of consumers and increased profit to the Australian seafood sector.

Appendix 1: Intellectual Property

The project has generated a significant amount of knowledge and data. Key data generated includes:

- A sample inventory
- Raw laboratory results
- Full dataset - ‘un-scrutinised’
- Dataset – reviewed and ‘cleaned up’
- Laboratory notebook
- Quality assurance data
- Mercury and vitamin D data (currently ownership resides with FSANZ)
- Data analysis files
- Summary tables and graphs

A description of each of these data sources and what they contain can be found in section 4.1 of this report.

Appendix 2: Staff

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Appendix 3: Data Summary Tables

The following pages contain a series of summary tables with the average (mean) results and standard deviations obtained for each species tested.

Nutrient Information for Oysters

Standard Names	Native Oyster, Pacific Oyster, Sydney Rock Oyster
Scientific Names	*Ostrea angasi, Crassostrea gigas* and *Saccostrea glomerata* (species identification confirmed through DNA sequencing).
Description	The whole oyster (excluding shell) was examined.
Sampling Details	Five separate samples of Pacific oysters and Sydney Rock oysters and two samples of native oysters were obtained from industry suppliers. All product was supplied in raw format. All analyses were undertaken in duplicate and the reported values are the average (mean) results from the analyses. Each sample that was tested comprised ~2 kg of flesh weight.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Nutrient Limits
		Native Oyster (n=2) (*Ostrea angasi*)		Pacific Oyster (n=5) (*Crassostrea gigas*)		Sydney Rock Oyster (n=5) (*Saccostrea glomerata*)		
Saturated Fatty Acids (Total)	mg/100 g	512	23	725	157	1010	215	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	220	34.3	396	98.6	321	39.6	
Polyunsaturated Fatty Acids (Total)	mg/100 g	769	57.6	1120	330	1540	219	
Trans Fatty Acids (Total)	mg/100 g	0	0	22.7	7.2	15.3	7.79	
Fatty Acids (Total)	mg/100 g	1440	0.35	2150	518	2760	446	
Alpha-Linolneic Acid (ALA)	mg/100 g	25.5	6.36	50.6	28.1	69	19.3	200
Docosahexaenoic Acid (DHA)	mg/100 g	143	9.55	274	139	304	53.7	30
Docosapentaenoic Acid (DPA)	mg/100 g	17.3	3.18	23	5.58	41.5	5.39	
Eicosapentaenoic Acid (EPA)	mg/100 g	201	38.5	313	91.6	394	30.5	30
Omega 3 (Total)	mg/100 g	427	68.6	747	272	964	131	
Omega 6 (Total)	mg/100 g	98.5	7.78	114	17.8	158	23.6	
Omega 9 (Total)	mg/100 g	55.3	6.01	112	33.5	112	28.1	
Total Cholesterol	mg/100 g	75.5	4.24	61.3	15	76.3	8.3	
Vitamin A (Retinol)	µg/100g	39.5	10.4	25.5	16.5	3.21	4.73	750
Vitamin E (Total d-α-tocopherol equivalents)	mg/100g	0.901	0.0711	1.15	0.187	0.944	0.276	10
Vitamin C (Total)	mg/100 g	0	0	1.17	2.63	0	0	40
Moisture	g/100 g	84.7	2.26	81.4	1.5	79.8	3.52	
Protein	g/100 g	7.3	1.48	10.9	1.08	10.6	1.25	50
Total Fat	g/100 g	1.5	0	2.25	0.54	2.89	0.47	70
Carbohydrates	g/100 g	3.63	0.0354	2.57	1.07	4.02	2.17	310
Energy (Calculated)	kJ/100 g	241	24.8	312	42.4	355	62.4	8700
Antimony	mg/100 g	NT	NT	NT	NT	NT	NT	
Boron	mg/100 g	0.508	0.11	0.522	0.0978	0.393	0.053	
Cadmium	mg/100 g	NT	NT	NT	NT	NT	NT	0.2

Nutrient	Unit	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Nutrient Limits
		Native Oyster (n=2) (*Ostrea angasi*)		Pacific Oyster (n=5) (*Crassostrea gigas*)		Sydney Rock Oyster (n=5) (*Saccostrea glomerata*)		
Calcium	mg/100 g	139	72.5	229	121	148	109	800
Chromium	mg/100 g	NT	NT	NT	NT	NT	NT	0.2
Copper	mg/100 g	0.778	0.88	1.08	0.925	1.27	0.544	3
Iodine	mg/100 g	0.162	0.0612	0.202	0.154	0.162	0.0254	0.15
Iron	mg/100 g	3.75	1.91	4.43	1.6	3.47	2	12
Lead	mg/100 g	NT	NT	NT	NT	NT	NT	0.2
Magnesium	mg/100 g	78	14.1	79.5	9.54	74.3	5.59	320
Manganese	mg/100 g	0.157	0.138	0.558	0.391	0.37	0.14	5
Molybdenum	mg/100 g	0.0136	0.0118	0.00638	0.00218	0.00706	0.00342	0.25
Nickel	mg/100 g	0	0	0	0	0	0	
Phosphorus	mg/100 g	115	7.07	174	33.6	183	42.8	1000
Potassium	mg/100 g	190	56.6	231	18.8	235	62.6	120/2800
Selenium	mg/100 g	0.0445	0.00707	0.0433	0.0251	0.0573	0.00641	0.07
Sodium	mg/100 g	585	134	541	110	491	28.2	120/2300
Sulphur	mg/100 g	355	84.9	394	31.5	320	21.5	
Tin	mg/100 g	0	0	0	0	0	0	
Zinc	mg/100 g	11.1	13.4	18	21.4	20.3	13.6	12

Nutrient Information for Atlantic Salmon

Standard Names	Atlantic Salmon
Scientific Names	*Salmo salar* (species identification confirmed through DNA sequencing).
Description	The edible flesh of the salmon was analysed (skin-on fillet).
Sampling Details	Eight separate samples of salmon were obtained from industry suppliers. All product was supplied in raw format. The reported values are the average (mean) results from the analysis (in duplicate) of the eight separate samples. Each sample that was tested comprised ~2 kg of salmon flesh.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Std. Dev.	Nutrient Limits
		Atlantic Salmon (n=8) *(Salmo salar)*		
Saturated Fatty Acids (Total)	mg/100 g	4080	353	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	7470	776	
Polyunsaturated Fatty Acids (Total)	mg/100 g	4990	426	
Trans Fatty Acids (Total)	mg/100 g	141	22.9	
Fatty Acids (Total)	mg/100 g	15900	1320	
Alpha-Linolneic Acid (ALA)	mg/100 g	182	16.4	200
Docosahexaenoic Acid (DHA)	mg/100 g	790	200	30
Docosapentaenoic Acid (DPA)	mg/100 g	372	60.7	
Eicosapentaenoic Acid (EPA)	mg/100 g	1030	115	30
Omega 3 (Total)	mg/100 g	2620	393	
Omega 6 (Total)	mg/100 g	1640	196	
Omega 9 (Total)	mg/100 g	5420	644	
Total Cholesterol	mg/100 g	63.2	3.93	
Vitamin A (Retinol)	µg/100g	18.7	50.7	750
Vitamin E (Total d-α-tocopherol eq.)	mg/100g	1.2	1.3	10
Vitamin C (Total)	mg/100 g	0.15	0.424	40
Moisture	g/100 g	62.3	0.983	
Protein	g/100 g	20.5	0.274	50
Total Fat	g/100 g	16.7	1.31	70
Carbohydrates	g/100 g	0.119	0.336	310
Energy (Calculated)	kJ/100 g	949	37.9	8700
Antimony	mg/100 g	0.00122	0.0011	
Boron	mg/100 g	0	0	
Cadmium	mg/100 g	0	0	
Calcium	mg/100 g	48.2	11.8	800
Chromium	mg/100 g	0.0223	0.0343	0.2
Copper	mg/100 g	0.0471	0.00398	3
Iodine	mg/100 g	0	0	0.15
Iron	mg/100 g	0.312	0.0606	12
Lead	mg/100 g	0	0	0.05
Magnesium	mg/100 g	28.4	1.29	320
Manganese	mg/100 g	0.0241	0.00473	5
Molybdenum	mg/100 g	0	0	0.25
Nickel	mg/100 g	0.0134	0.0101	
Phosphorus	mg/100 g	260	9.64	1000
Potassium	mg/100 g	366	20.8	120/2800
Selenium	mg/100 g	0.0237	0.00626	0.07
Sodium	mg/100 g	32.1	6	120/2300
Sulphur	mg/100 g	233	3.72	
Tin	mg/100 g	0	0	
Zinc	mg/100 g	0.459	0.0861	12

Nutrient Information for Burrowing Blackfish

Standard Names	Burrowing Blackfish (Sea Cucumber)
Scientific Names	*Actinopyga spinea* (species identification confirmed through DNA sequencing).
Description	The entire fish was examined.
Sampling Details	Five separate samples were obtained from industry suppliers. All product was supplied in cooked format. All analyses were undertaken in duplicate and the reported values are the average (mean) results from the analyses. Each sample that was tested comprised ~2 kg of fish.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Std. Dev.	Nutrient Limits
		Burrowing Blackfish (n=5) (*Actinopyga spinea*)		
Saturated Fatty Acids (Total)	mg/100 g	53.1	2.61	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	45.3	2.64	
Polyunsaturated Fatty Acids (Total)	mg/100 g	101	2.66	
Trans Fatty Acids (Total)	mg/100 g	0.6	0.418	
Fatty Acids (Total)	mg/100 g	192	0	
Alpha-Linolneic Acid (ALA)	mg/100 g	0.1	0.224	200
Docosahexaenoic Acid (DHA)	mg/100 g	10	0.707	30
Docosapentaenoic Acid (DPA)	mg/100 g	0.1	0.224	
Eicosapentaenoic Acid (EPA)	mg/100 g	1.2	0.274	30
Omega 3 (Total)	mg/100 g	36.8	2.8	
Omega 6 (Total)	mg/100 g	39.9	0.742	
Omega 9 (Total)	mg/100 g	23.4	3.11	
Total Cholesterol	mg/100 g	0	0	
Vitamin A (Retinol)	µg/100g	0	0	750
Vitamin E (Total d-α-tocopherol eq.)	mg/100g	0.087	0.05	10
Vitamin C (Total)	mg/100 g	0	0	40
Moisture	g/100 g	91.8	0.744	
Protein	g/100 g	7.99	0.796	50
Total Fat	g/100 g	0.2	0	70
Carbohydrates	g/100 g	0	0	310
Energy (Calculated)	kJ/100 g	136	11.9	8700
Antimony	mg/100 g	0	0	
Boron	mg/100 g	0.0099	0.0136	
Cadmium	mg/100 g	0.00788	0.00156	
Calcium	mg/100 g	96.7	28.6	800
Chromium	mg/100 g	0	0	0.2
Copper	mg/100 g	0.0297	0.00454	3
Iodine	mg/100 g	0.105	0.0155	0.15
Iron	mg/100 g	0.256	0.0905	12
Lead	mg/100 g	0	0	0.05
Magnesium	mg/100 g	23.7	1.79	320
Manganese	mg/100 g	0.00546	0.005	5
Molybdenum	mg/100 g	0.2	0.0255	0.25
Nickel	mg/100 g	0.0189	0.00238	
Phosphorus	mg/100 g	4.94	0.299	1000
Potassium	mg/100 g	1.17	0.104	120/2800
Selenium	mg/100 g	0.0011	0.00246	0.07
Sodium	mg/100 g	49.5	3.3	120/2300
Sulphur	mg/100 g	121	7.42	
Tin	mg/100 g	0	0	
Zinc	mg/100 g	0	0	12

Nutrient Information for Farmed Abalone

Standard Names	Blacklip and greenlip abalone
Scientific Names	*Haliotis rubra* and *Haliotis laevigata* (species identification confirmed through DNA sequencing).
Description	The muscular tissue (foot) of the abalone was examined.
Sampling Details	Five separate samples were obtained from industry suppliers. Three samples were confirmed to be greenlip abalone and two samples were confirmed to be blacklip abalone. All product was supplied in raw format. All analyses were undertaken in duplicate and the reported values are the average (mean) results from the analyses (n=3 greenlip abalone; n=2 blacklip abalone). Each sample that was tested comprised ~2 kg of flesh.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Nutrient Limits
		Farmed Black Lip Abalone (n=2) *(Haliotis rubra)*		Farmed Green Lip Abalone (n=3) *(Haliotis laevigata)*		
Saturated Fatty Acids (Total)	mg/100 g	239	64.7	248	26.7	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	155	52.3	174	36.3	
Polyunsaturated Fatty Acids (Total)	mg/100 g	375	129	322	11	
Trans Fatty Acids (Total)	mg/100 g	6.25	1.77	8.17	1.89	
Fatty Acids (Total)	mg/100 g	742	237	717	47.8	
Alpha-Linolneic Acid (ALA)	mg/100 g	6.25	3.18	6	0.5	200
Docosahexaenoic Acid (DHA)	mg/100 g	65.2	20.9	40.3	5.01	30
Docosapentaenoic Acid (DPA)	mg/100 g	68.5	8.49	41.7	9.31	
Eicosapentaenoic Acid (EPA)	mg/100 g	18	12.7	12.5	0.866	30
Omega 3 (Total)	mg/100 g	178	54.4	118	14	
Omega 6 (Total)	mg/100 g	83	33.9	92.3	12.4	
Omega 9 (Total)	mg/100 g	68.8	18	83.3	14.6	
Total Cholesterol	mg/100 g	136	28.3	139	4.91	
Vitamin A (Retinol)	µg/100g	0	0	0	0	750
Vitamin E (Total d-α-tocopherol equivalents)	mg/100g	0.94	0.04	0.44	0.17	10
Vitamin C (Total)	mg/100 g	0	0	0	0	40
Moisture	g/100 g	76.6	3.89	75.2	0.104	
Protein	g/100 g	16.2	1.7	17.1	1.35	50
Total Fat	g/100 g	0.775	0.247	0.75	0.05	70
Carbohydrates	g/100 g	4.47	2.02	4.03	1.19	310
Energy (Calculated)	kJ/100 g	381	72.1	387	36.5	8700
Antimony	mg/100 g	0	0	0	0	
Boron	mg/100 g	0.0862	0.0265	0.0855	0.0806	
Cadmium	mg/100 g	0.00812	0.00258	0.00702	0.00253	0.2

Nutrient	Unit	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Nutrient Limits
		Farmed Black Lip Abalone (n=2) *(Haliotis rubra)*		Farmed Green Lip Abalone (n=3) *(Haliotis laevigata)*		
Calcium	mg/100 g	29	5.66	57.8	50.5	800
Chromium	mg/100 g	0.392	0.0177	0.293	0.136	0.2
Copper	mg/100 g	0.31	0	0.253	0.146	3
Iodine	mg/100 g	0.0505	0.0127	0.202	0.0693	0.15
Iron	mg/100 g	2.33	2.22	2.6	1.34	12
Lead	mg/100 g	0.00115	0.00163	0.000817	0.00141	0.2
Magnesium	mg/100 g	68.8	1.06	64.7	27.8	320
Manganese	mg/100 g	0.0365	0.0212	0.0335	0.0118	5
Molybdenum	mg/100 g	0.00475	0.00332	0.00635	0.00403	0.25
Nickel	mg/100 g	0.15	0.0212	0.114	0.0372	
Phosphorus	mg/100 g	152	31.8	155	8.66	1000
Potassium	mg/100 g	250	56.6	260	45.8	120/2800
Selenium	mg/100 g	0.0205	0.00849	0.0223	0.00293	0.07
Sodium	mg/100 g	390	56.6	792	832	120/2300
Sulphur	mg/100 g	625	56.6	595	88.9	
Tin	mg/100 g	0	0	0	0	
Zinc	mg/100 g	1.05	0.212	1.48	1.32	12

Nutrient Information for Australian Wild Prawns

Standard Names	Banana Prawn, Tiger Prawn, Endeavour Prawn, School Prawn, King Prawn
Scientific Names	*Fenneropenaeus merguiensis, Penaeus esculentus, Metapanaeus endeavouri, Metapenaeus Macleayi, Melicertus latisulcatus* (species identification confirmed through DNA sequencing).
Description	The edible flesh of the Banana, Tiger, Endeavour and King Prawns was analysed (head, shell, viscera and vein was removed). Three different product formats of the School prawns were analysed: whole (shell and head on), flesh only (head, shell, viscera removed) and de-shelled (flesh and head analysed).
Sampling Details	Five samples of each of the five species were obtained from industry suppliers. All product was supplied as raw product. The reported values for each species are the average (mean) results from the analysis (in duplicate) of five separate samples. Each sample tested comprised ~2 kg of prawn flesh.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit (/100 g)	Average (mean)	SD	Average (mean)	SD	Average (mean)	SD	Average (mean)	SD	Average (mean)	SD	Nutrient Limits
		Wild Banana Prawn (n=5) *(Fenneropenaeus merguiensis)*		Wild Brown Tiger Prawn (n=5) *(Penaeus esculentus)*		Wild Endeavour Prawn (n=5) *(Metapanaeus endeavouri)*		Wild School Prawn (n=5) *(Metapenaeus Macleayi)*		Wild Western King Prawn (n=5) *(Melicertus latisulcatus)*		
Saturated Fatty Acids (Total)	mg	213	25.9	262	23.5	241	13.2	372	129	256	16.9	24000
Monounsaturated Fatty Acids (Total)	mg	130	4.41	207	22.2	146	7.52	255	114	211	18.3	
Polyunsaturated Fatty Acids (Total)	mg	257	12	448	38.4	361	16.3	490	132	383	20.7	
Trans Fatty Acids (Total)	mg	1.7	0.57	2.8	0.908	3.3	0.671	8	3.95	4.2	0.274	
Fatty Acids (Total)	mg	575	33.9	881	80.2	719	33.8	1070	359	814	47.8	
Alpha-Linolneic Acid (ALA)	mg	2.6	0.418	3.2	0.57	3.8	0.57	16.7	7.02	4.8	0.57	200
Docosahexaenoic Acid (DHA)	mg	76.7	3.37	126	8.7	81.9	4.02	116	24.3	118	8.67	30
Docosapentaenoic Acid (DPA)	mg	10.7	0.447	13.7	0.975	9.9	0.548	12.9	4.48	16.2	1.15	
Eicosapentaenoic Acid (EPA)	mg	63.4	3.73	125	14.1	69.6	4.14	82.6	15.1	102	6.16	30
Omega 3 (Total)	mg	155	8.05	276	25.7	171	8.48	239	55.6	246	14.7	
Omega 6 (Total)	mg	74	3.22	110	7.25	144	7.68	186	50.7	91	4.36	
Omega 9 (Total)	mg	46.1	2.56	84.9	6.33	56.5	2.98	73.7	31.1	76.8	5.82	
Total Cholesterol	mg	507	248	451	104	211	1.98	204	11	461	265	
Vitamin A (Retinol)	µg	0	0	4.64	0.186	0	0	2.91	4.14	0	0	750
Vitamin E (Total d-α-tocopherol equivalents)	mg	1	0.07	1.6	0.039	1.7	0.2	1.8	0.29	1.5	0.1	10
Vitamin C (Total)	mg	0	0	0	0	0	0	0	0	0	0	40
Moisture	g	85	0.242	73.8	0.483	75.1	0.236	78.6	0.793	73.8	0.362	
Protein	g	13.2	0.189	23.4	0.261	22.5	0.258	17.8	1.57	23.9	0.0975	50
Total Fat	g	0.6	0.0354	0.92	0.0837	0.75	0.0354	1.12	0.375	0.85	0.05	70

Nutrient	Unit (/100 g)	Average (mean)	SD	Average (mean)	SD	Average (mean)	SD	Average (mean)	SD	Average (mean)	SD	Nutrient Limits
		Wild Banana Prawn (n=5) *(Fenneropenaeus merguiensis)*		Wild Brown Tiger Prawn (n=5) *(Penaeus esculentus)*		Wild Endeavour Prawn (n=5) *(Metapanaeus endeavouri)*		Wild School Prawn (n=5) *(Metapenaeus Macleayi)*		Wild Western King Prawn (n=5) *(Melicertus latisulcatus)*		
Carbohydrates	g	0	0	0	0	0	0	0.03	0.0671	0	0	310
Energy (Calculated)	kJ	238	4.72	427	9.5	404	4.74	342	11.7	429	3.66	8700
Antimony	mg	0.00109	0.00166	0.00225	0.000209	0.00098	0.000909	0.00022	0.000492	0.00022	0.000492	
Boron	mg	0	0	0.0781	0.0306	0.142	0.012	0	0	0.104	0.0201	
Cadmium	mg	0.00377	0.000575	0.0401	0.0176	0.00664	0.000781	0.000151	0.000209	0.00743	0.00107	
Calcium	mg	19.9	1.24	163	70.3	59.5	3.22	583	336	45.2	7.38	800
Chromium	mg	0.0101	0.006	0	0	0.0097	0.00668	0	0	0.0056	0.00563	0.2
Copper	mg	0.205	0.0112	0.608	0.0902	0.644	0.0222	0.579	0.257	0.293	0.0192	3
Iodine	mg	0.0226	0.00102	0.0781	0.0383	0.0971	0.00838	0.0893	0.052	0.0501	0.00929	0.15
Iron	mg	0.142	0.016	0.272	0.0765	0.202	0.0259	2.77	1.24	0.027	0.0604	12
Lead	mg	0.00109	0.0011	0.00072	0.000619	0	0	0.00225	0.00175	0.0001	0.000224	
Magnesium	mgg	22.9	0.224	54	3.16	55.7	3.51	48.3	7.27	49.5	0.866	320
Manganese	mgg	0.00933	0.000789	0.0206	0.0061	0.013	0.00106	0.432	0.234	0.0102	0.00217	5
Molybdenum	mg	0.00084	0.00115	0.00354	0.000521	0.00297	0.00189	0	0	0	0	0.25
Nickel	mg	0	0	0.0026	0.00581	0	0	0	0	0	0	
Phosphorus	mg	331	2.24	327	13.5	282	13	280	42.3	326	8.94	1000
Potassium	mg	77.5	2.21	404	16.7	366	5.48	306	21.9	412	7.58	120/2800
Selenium	mg	0.0304	0.00323	0.0292	0.00501	0.0646	0.0069	0.025	0.001	0.0436	0.00516	0.07
Sodium	mg	509	5.48	273	16.8	332	22.8	114	5.48	268	13	120/2300
Sulphur	mg	167	6.71	364	14.7	283	11	241	17.5	399	18.2	
Tin	mg	0	0	0	0	0	0	0	0	0	0	
Zinc	mg	0.907	0.014	1.69	0.119	1.64	0.0548	1.54	0.182	1.49	0.0548	12

Nutrient Information for Gummy Shark

Standard Names	Gummy Shark
Scientific Names	*Mustelus antarcticus* (species identification confirmed through DNA sequencing).
Description	Skin-off fillet was examined.
Sampling Details	Five separate samples were obtained from industry suppliers. All product was supplied in raw format. All analyses were undertaken in duplicate and the reported values are the average (mean) results from the analyses. Each sample that was tested comprised ~2 kg of fish.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Standard Deviation	Nutrient Limits
		Gummy Shark (n=5) *(Mustelus antarcticus)*		
Saturated Fatty Acids (Total)	mg/100 g	135	12.4	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	99.3	40.5	
Polyunsaturated Fatty Acids (Total)	mg/100 g	186	26.5	
Trans Fatty Acids (Total)	mg/100 g	0	0	
Fatty Acids (Total)	mg/100 g	402	26	
Alpha-Linolneic Acid (ALA)	mg/100 g	0.2	0.274	200
Docosahexaenoic Acid (DHA)	mg/100 g	19.3	3.62	30
Docosapentaenoic Acid (DPA)	mg/100 g	9.1	1.43	
Eicosapentaenoic Acid (EPA)	mg/100 g	112	14.8	30
Omega 3 (Total)	mg/100 g	141	18.9	
Omega 6 (Total)	mg/100 g	32.1	7.51	
Omega 9 (Total)	mg/100 g	43.8	9.42	
Total Cholesterol	mg/100 g	61.1	24.1	
Vitamin A (Retinol)	µg/100g	0	0	750
Vitamin E (Total d-α-tocopherol equivalents)	mg/100g	0.29	0.029	10
Vitamin C (Total)	mg/100 g	0	0	40
Moisture	g/100 g	77.3	0.893	
Protein	g/100 g	24.6	1.61	50
Total Fat	g/100 g	0.42	0.0274	70
Carbohydrates	g/100 g	0	0	310
Energy (Calculated)	kJ/100 g	359	20.7	8700
Antimony	mg/100 g	0	0	
Boron	mg/100 g	0.213	0.0355	
Cadmium	mg/100 g	0.000775	0.000301	
Calcium	mg/100 g	9.62	2.83	800
Chromium	mg/100 g	0	0	0.2
Copper	mg/100 g	0.0334	0.00803	3
Iodine	mg/100 g	0.0312	0.00805	0.15
Iron	mg/100 g	0.158	0.0358	12
Lead	mg/100 g	0.00035	0.000783	0.05
Magnesium	mg/100 g	33.8	6.58	320
Manganese	mg/100 g	0.00172	0.00385	5
Molybdenum	mg/100 g	0	0	0.25
Nickel	mg/100 g	0	0	
Phosphorus	mg/100 g	208	25.1	1000
Potassium	mg/100 g	345	63.5	120/2800
Selenium	mg/100 g	0.0404	0.0141	0.07
Sodium	mg/100 g	180	92.1	120/2300
Sulphur	mg/100 g	194	6.52	
Tin	mg/100 g	0	0	
Zinc	mg/100 g	0.34	0.0583	12

Nutrient Information for Barramundi

Standard Names	Barramundi
Scientific Names	*Lates calcarifer* (species identification confirmed through DNA sequencing).
Description	Skin-on fillet was examined.
Sampling Details	Five separate samples were obtained from industry suppliers. All product was supplied in raw format. All analyses were undertaken in duplicate and the reported values are the average (mean) results from the analyses. Each sample that was tested comprised ~2 kg of fish.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Standard Deviation	Nutrient Limits
		Barramundi (n=5) *(Lates calcarifer)*		
Saturated Fatty Acids (Total)	mg/100 g	2240	1200	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	2910	1580	
Polyunsaturated Fatty Acids (Total)	mg/100 g	2130	1110	
Trans Fatty Acids (Total)	mg/100 g	79.1	43.6	
Fatty Acids (Total)	mg/100 g	7040	3750	
Alpha-Linolneic Acid (ALA)	mg/100 g	78.4	42	200
Docosahexaenoic Acid (DHA)	mg/100 g	401	219	30
Docosapentaenoic Acid (DPA)	mg/100 g	133	73.9	
Eicosapentaenoic Acid (EPA)	mg/100 g	370	181	30
Omega 3 (Total)	mg/100 g	1080	571	
Omega 6 (Total)	mg/100 g	758	392	
Omega 9 (Total)	mg/100 g	2040	1120	
Total Cholesterol	mg/100 g	85.9	11	
Vitamin A (Retinol)	µg/100g	19.4	21.4	750
Vitamin E (Total d-α-tocopherol equivalents)	mg/100g	2.6	1.1	10
Vitamin C (Total)	mg/100 g	0	0	40
Moisture	g/100 g	72	4.45	
Protein	g/100 g	19.5	0.393	50
Total Fat	g/100 g	7.36	3.92	70
Carbohydrates	g/100 g	0.25	0.394	310
Energy (Calculated)	kJ/100 g	605	153	8700
Antimony	mg/100 g	0.00225	0.000697	
Boron	mg/100 g	0	0	
Cadmium	mg/100 g	0	0	
Calcium	mg/100 g	18.5	10.1	800
Chromium	mg/100 g	0	0	0.2
Copper	mg/100 g	0.0309	0.0142	3
Iodine	mg/100 g	0.0023	0.00514	0.15
Iron	mg/100 g	0.315	0.0601	12
Lead	mg/100 g	0.00012	0.000268	0.05
Magnesium	mg/100 g	29.2	2.02	320
Manganese	mg/100 g	0.00897	0.0044	5
Molybdenum	mg/100 g	0	0	0.25
Nickel	mg/100 g	0.0232	0.00383	
Phosphorus	mg/100 g	170	11.2	1000
Potassium	mg/100 g	345	9.35	120/2800
Selenium	mg/100 g	0.0272	0.00466	0.07
Sodium	mg/100 g	55.5	5.26	120/2300
Sulphur	mg/100 g	231	8.22	
Tin	mg/100 g	0	0	
Zinc	mg/100 g	0.474	0.0569	12

Nutrient Information for Yellowtail Kingfish

Standard Names	Yellowtail Kingfish
Scientific Names	*Seriola lalandi* (species identification confirmed through DNA sequencing).
Description	Skin-on fillet was examined.
Sampling Details	Five separate samples were obtained from industry suppliers. All product was supplied in raw format. All analyses were undertaken in duplicate and the reported values are the average (mean) results from the analyses. Each sample that was tested comprised ~2 kg of fish.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Standard Deviation	Nutrient Limits
		Yellowtail Kingfish (n=5) *(Seriola lalandi)*		
Saturated Fatty Acids (Total)	mg/100 g	3290	551	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	4830	1330	
Polyunsaturated Fatty Acids (Total)	mg/100 g	4410	528	
Trans Fatty Acids (Total)	mg/100 g	129	19	
Fatty Acids (Total)	mg/100 g	12100	2280	
Alpha-Linolneic Acid (ALA)	mg/100 g	147	35	200
Docosahexaenoic Acid (DHA)	mg/100 g	994	129	30
Docosapentaenoic Acid (DPA)	mg/100 g	275	39	
Eicosapentaenoic Acid (EPA)	mg/100 g	873	67.6	30
Omega 3 (Total)	mg/100 g	2580	258	
Omega 6 (Total)	mg/100 g	1320	240	
Omega 9 (Total)	mg/100 g	3240	982	
Total Cholesterol	mg/100 g	69.6	3.15	
Vitamin A (Retinol)	µg/100g	21.6	5.95	750
Vitamin E (Total d-α-tocopherol equivalents)	mg/100g	3.3	0.22	10
Vitamin C (Total)	mg/100 g	0	0	40
Moisture	g/100 g	63.1	2.14	
Protein	g/100 g	22.9	0.76	50
Total Fat	g/100 g	12.7	2.39	70
Carbohydrates	g/100 g	0.33	0.563	310
Energy (Calculated)	kJ/100 g	858	83.3	8700
Antimony	mg/100 g	0	0	
Boron	mg/100 g	0	0	
Cadmium	mg/100 g	0.000025	0.0000559	
Calcium	mg/100 g	117	31.8	800
Chromium	mg/100 g	0.0129	0.00831	0.2
Copper	mg/100 g	0.0558	0.00537	3
Iodine	mg/100 g	0.00846	0.00156	0.15
Iron	mg/100 g	0.471	0.061	12
Lead	mg/100 g	0.00097	0.00133	0.05
Magnesium	mg/100 g	28.9	0.652	320
Manganese	mg/100 g	0.0185	0.00366	5
Molybdenum	mg/100 g	0	0	0.25
Nickel	mg/100 g	0.0097	0.00667	
Phosphorus	mg/100 g	277	15.7	1000
Potassium	mg/100 g	388	17.2	120/2800
Selenium	mg/100 g	0.0313	0.0036	0.07
Sodium	mg/100 g	35.7	4.04	120/2300
Sulphur	mg/100 g	268	7.58	
Tin	mg/100 g	0	0	
Zinc	mg/100 g	0.726	0.0707	12

Nutrient Information for Southern Rocklobster

Standard Names	Southern Rocklobster
Scientific Names	*Jasus edwardsii* (species identification confirmed through DNA sequencing).
Description	Tail meat was examined.
Sampling Details	Five separate samples were obtained from industry suppliers. All product was supplied in raw format. All analyses were undertaken in duplicate and the reported values are the average (mean) results from the analyses. Each sample that was tested comprised ~2 kg of fish.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Standard Deviation	Nutrient Limits
		Southern Rocklobster (n=5) *(Jasus edwardsii)*		
Saturated Fatty Acids (Total)	mg/100 g	191	5.67	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	200	8.99	
Polyunsaturated Fatty Acids (Total)	mg/100 g	296	15.6	
Trans Fatty Acids (Total)	mg/100 g	3.2	0.274	
Fatty Acids (Total)	mg/100 g	660	21.5	
Alpha-Linolneic Acid (ALA)	mg/100 g	2.6	0.652	200
Docosahexaenoic Acid (DHA)	mg/100 g	93	3.52	30
Docosapentaenoic Acid (DPA)	mg/100 g	10.1	2.48	
Eicosapentaenoic Acid (EPA)	mg/100 g	51.8	4.98	30
Omega 3 (Total)	mg/100 g	165	6.39	
Omega 6 (Total)	mg/100 g	88.8	11.9	
Omega 9 (Total)	mg/100 g	109	8.13	
Total Cholesterol	mg/100 g	236	61.7	
Vitamin A (Retinol)	µg/100g	4.89	0.361	750
Vitamin E (Total d-α-tocopherol equivalents)	mg/100g	2	0.16	10
Vitamin C (Total)	mg/100 g	0	0	40
Moisture	g/100 g	78	0.235	
Protein	g/100 g	20.2	0.357	50
Total Fat	g/100 g	0.69	0.0224	70
Carbohydrates	g/100 g	0	0	310
Energy (Calculated)	kJ/100 g	358	5.04	8700
Antimony	mg/100 g	0	0	
Boron	mg/100 g	0.0533	0.0185	
Cadmium	mg/100 g	0.00072	0.000249	
Calcium	mg/100 g	56.7	12.5	800
Chromium	mg/100 g	0	0	0.2
Copper	mg/100 g	0.592	0.047	3
Iodine	mg/100 g	0.036	0.033	0.15
Iron	mg/100 g	0	0	12
Lead	mg/100 g	0	0	
Magnesium	mg/100 g	40.6	1.14	320
Manganese	mg/100 g	0.0297	0.00301	5
Molybdenum	mg/100 g	0	0	0.25
Nickel	mg/100 g	0	0	
Phosphorus	mg/100 g	288	13.5	1000
Potassium	mg/100 g	364	26.1	120/2800
Selenium	mg/100 g	0.0162	0.0149	0.07
Sodium	mg/100 g	283	44	120/2300
Sulphur	mg/100 g	263	2.74	
Tin	mg/100 g	0	0	
Zinc	mg/100 g	2	0.0791	12

Nutrient Information for Australian Farmed Prawns

Standard Names	Banana Prawn and Black Tiger Prawn
Scientific Names	*Fenneropenaeus merguiensis* and *Penaeus monodon* (species identification confirmed through DNA sequencing).
Description	The edible flesh of the prawns was analysed (head, shell, viscera and vein was removed).
Sampling Details	All product was supplied as cooked product. The reported values for each species are the average (mean) results from the analysis (in duplicate) of five separate samples (Black Tiger prawns) and two separate samples (Banana prawns). Each sample tested comprised ~2 kg of prawn flesh.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Nutrient Limits
		Farmed Banana Prawn (n=2) *(Fenneropenaeus merguiensis)*		Farmed Black Tiger Prawn (n=5) *(Penaeus monodon)*		
Saturated Fatty Acids (Total)	mg/100 g	283	0.354	365	73.8	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	180	9.55	251	57.4	
Polyunsaturated Fatty Acids (Total)	mg/100 g	460	25.1	469	51.1	
Trans Fatty Acids (Total)	mg/100 g	2.25	0.354	4.5	2.62	
Fatty Acids (Total)	mg/100 g	886	33.9	1040	167	
Alpha-Linolneic Acid (ALA)	mg/100 g	8.5	0.707	7.1	0.894	200
Docosahexaenoic Acid (DHA)	mg/100 g	83.8	5.3	110	13.7	30
Docosapentaenoic Acid (DPA)	mg/100 g	6.25	0.354	6.4	1.14	
Eicosapentaenoic Acid (EPA)	mg/100 g	130	7.07	116	3.35	30
Omega 3 (Total)	mg/100 g	231	13.1	244	18.5	
Omega 6 (Total)	mg/100 g	193	9.55	177	36.4	
Omega 9 (Total)	mg/100 g	123	5.66	144	23.7	
Total Cholesterol	mg/100 g	204	3.54	218	22.4	
Vitamin A (Retinol)	µg/100g	0	0	0	0	750
Vitamin E (Total d-α-tocopherol equivalents)	mg/100g	0.53	0.011	1.1	0.34	10
Vitamin C (Total)	mg/100 g	0	0	0	0	40
Moisture	g/100 g	73.4	1.1	76.3	2.22	
Protein	g/100 g	23.2	1.2	20.2	1.47	50
Total Fat	g/100 g	0.925	0.0354	1.06	0.116	70
Carbohydrates	g/100 g	0	0	0	0	310
Energy (Calculated)	kJ/100 g	423	25.1	361	42.4	8700
Antimony	mg/100 g	0.00288	0.000389	0.00164	0.00185	
Boron	mg/100 g	0.031	0.0438	0.187	0.0479	
Cadmium	mg/100 g	0.00111	0.000276	0.00157	0.00141	

Nutrient	Unit	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Nutrient Limits
		Farmed Banana Prawn (n=2) *(Fenneropenaeus merguiensis)*		Farmed Black Tiger Prawn (n=5) *(Penaeus monodon)*		
Calcium	mg/100 g	56.5	1.41	239	69.3	800
Chromium	mg/100 g	0	0	0	0	0.2
Copper	mg/100 g	0.975	0.177	1.81	0.463	3
Iodine	mg/100 g	0.0072	0.00113	0.0423	0.0209	0.15
Iron	mg/100 g	0.21	0.0141	1.28	0.799	12
Lead	mg/100 g	0.00188	0.00187	0.000248	0.000555	
Magnesium	mg/100 g	46	7.78	45.3	8.64	320
Manganese	mg/100 g	0.0255	0.000707	0.127	0.085	5
Molybdenum	mg/100 g	0	0	0.000389	0.000869	0.25
Nickel	mg/100 g	0	0	0	0	
Phosphorus	mg/100 g	228	53	214	33	1000
Potassium	mg/100 g	320	84.9	179	70.6	120/2800
Selenium	mg/100 g	0.0392	0.00247	0.025	0.00479	0.07
Sodium	mg/100 g	805	247	919	225	120/2300
Sulphur	mg/100 g	260	7.07	245	75.8	
Tin	mg/100 g	0	0	0.00081	0.00181	
Zinc	mg/100 g	1.55	0	1.95	0.292	12

Nutrient Information for Ocean Trout

Standard Names	Ocean trout
Scientific Names	*Oncorhynchus mykiss* (species identification confirmed through DNA sequencing).
Description	Skin on fish fillet was examined.
Sampling Details	Four separate samples were obtained from industry suppliers. All product was supplied in raw format. All analyses were undertaken in duplicate and the reported values are the average (mean) results from the analyses (n=4). Each sample that was tested comprised ~2 kg of flesh.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Standard Deviation	Nutrient Limits
		Ocean Trout (n=4) *Oncorhynchus mykiss*		
Saturated Fatty Acids (Total)	mg/100 g	6880	1260	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	11900	3200	
Polyunsaturated Fatty Acids (Total)	mg/100 g	6600	977	
Trans Fatty Acids (Total)	mg/100 g	150	64.9	
Fatty Acids (Total)	mg/100 g	24400	5180	
Alpha-Linolneic Acid (ALA)	mg/100 g	205	26.9	200
Docosahexaenoic Acid (DHA)	mg/100 g	1190	336	30
Docosapentaenoic Acid (DPA)	mg/100 g	420	50.5	
Eicosapentaenoic Acid (EPA)	mg/100 g	1910	281	30
Omega 3 (Total)	mg/100 g	3790	298	
Omega 6 (Total)	mg/100 g	1900	611	
Omega 9 (Total)	mg/100 g	8310	2360	
Total Cholesterol	mg/100 g	109	78.6	
Vitamin A (Retinol)	µg/100g	7.55	15.1	750
Vitamin E (Total d-α-tocopherol equivalents)	mg/100g	2.6	1.1	10
Vitamin C (Total)	mg/100 g	1.18	1.44	40
Moisture	g/100 g	54.3	5.55	
Protein	g/100 g	17.4	0.661	50
Total Fat	g/100 g	24.6	4.1	70
Carbohydrates	g/100 g	3.2	2.42	310
Energy (Calculated)	kJ/100 g	1250	166	8700
Antimony	mg/100 g	0.000488	0.000592	
Boron	mg/100 g	0.03	0.06	
Cadmium	mg/100 g	0.000562	0.00112	
Calcium	mg/100 g	73.2	103	800
Chromium	mg/100 g	0.119	0.134	0.2
Copper	mg/100 g	0.599	1.13	3
Iodine	mg/100 g	0.0145	0.0184	0.15
Iron	mg/100 g	0.346	0.173	12
Lead	mg/100 g	0.0005	0.001	0.05
Magnesium	mg/100 g	32	15.3	320
Manganese	mg/100 g	0.0226	0.0145	5
Molybdenum	mg/100 g	0.000538	0.00108	0.25
Nickel	mg/100 g	0.0271	0.00659	
Phosphorus	mg/100 g	221	9.46	1000
Potassium	mg/100 g	291	55.1	120/2800
Selenium	mg/100 g	0.0279	0.0142	0.07
Sodium	mg/100 g	247	445	120/2300
Sulphur	mg/100 g	230	26.8	
Tin	mg/100 g	0	0	
Zinc	mg/100 g	0.815	0.857	12

Nutrient Information for Australian Wild Abalone

Standard Names	Blacklip, brownlip and greenlip abalone
Scientific Names	*Haliotis rubra, Haliotis conicopora* and *Haliotis laevigata* (species identification confirmed through DNA sequencing).
Description	The muscular tissue (foot) of the abalone was examined.
Sampling Details	Five separate samples were obtained from industry suppliers. Two samples were greenlip abalone, two samples were blacklip abalone and one sample brownlip abalone. All product was supplied in raw format. All analyses were undertaken in duplicate and the reported values are the average (mean) results from the analyses. Each sample that was tested comprised ~2 kg of flesh.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Nutrient Limits
		Wild Black Lip Abalone (n=2) *(Haliotis rubra)*		Wild Brown Lip Abalone (n=1) *(Haliotis conicopora)*		Wild Green Lip Abalone (n=2) *(Haliotis laevigata)*		
Saturated Fatty Acids (Total)	mg/100 g	210	12	220	NA	182	31.8	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	144	9.9	128	NA	116	5.3	
Polyunsaturated Fatty Acids (Total)	mg/100 g	268	30.4	247	NA	198	42.1	
Trans Fatty Acids (Total)	mg/100 g	3	2.83	5.5	NA	2.75	1.77	
Fatty Acids (Total)	mg/100 g	598	33.9	574	NA	479	67.5	
Alpha-Linolneic Acid (ALA)	mg/100 g	13.8	3.89	1.5	NA	1.25	0.354	200
Docosahexaenoic Acid (DHA)	mg/100 g	37.2	7.42	27.5	NA	23.2	1.77	30
Docosapentaenoic Acid (DPA)	mg/100 g	52.2	4.6	45.5	NA	44.8	3.18	
Eicosapentaenoic Acid (EPA)	mg/100 g	1.25	0.354	0.5	NA	0.25	0.354	30
Omega 3 (Total)	mg/100 g	116	20.5	88	NA	77.8	11.7	
Omega 6 (Total)	mg/100 g	74.5	3.54	69	NA	56	9.19	
Omega 9 (Total)	mg/100 g	55.8	1.06	52	NA	38	4.24	
Total Cholesterol	mg/100 g	152	19.8	123	NA	174	77.1	
Vitamin A (Retinol)	µg/100g	0	0	0	NA	0	0	750
Vitamin E (Total d-α-tocopherol equivalents)	mg/100g	1	0.039	1.2	NA	1.8	0.31	10
Vitamin C (Total)	mg/100 g	0	0	0	NA	0	0	40
Moisture	g/100 g	75.6	2.23	78.8	NA	74	0.849	
Protein	g/100 g	19.4	0.177	17.8	NA	18.7	2.37	50
Total Fat	g/100 g	0.625	0.0354	0.6	NA	0.5	0.0707	70
Carbohydrates	g/100 g	2.68	2.09	1.5	NA	5.25	3.04	310
Energy (Calculated)	kJ/100 g	399	40	352	NA	425	8.84	8700
Antimony	mg/100 g	0	0	0	NA	0	0	
Boron	mg/100 g	0.132	0.0962	0.135	NA	0.141	0.0697	

Nutrient	Unit	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Nutrient Limits
		Wild Black Lip Abalone (n=2) *(Haliotis rubra)*		Wild Brown Lip Abalone (n=1) *(Haliotis conicopora)*		Wild Green Lip Abalone (n=2) *(Haliotis laevigata)*		
Cadmium	mg/100 g	0.0069	0.00862	0.028	NA	0.0322	0.0166	0.2
Calcium	mg/100 g	20.8	2.47	20	NA	19.2	1.06	800
Chromium	mg/100 g	0.142	0.181	0.265	NA	0.168	0.172	0.2
Copper	mg/100 g	0.187	0.167	0.0865	NA	0.0972	0.0392	3
Iodine	mg/100 g	0.08	0.0269	0.11	NA	0.19	0.0778	0.15
Iron	mg/100 g	1.78	0.389	4.65	NA	2.15	0.707	12
Lead	mg/100 g	0.000975	0.00138	0	NA	0	0	0.2
Magnesium	mg/100 g	54.2	1.77	45.5	NA	45.2	5.3	320
Manganese	mg/100 g	0.021	0.000707	0.016	NA	0.018	0.00566	5
Molybdenum	mg/100 g	0.0016	0.00226	0.0185	NA	0.0067	0.00453	0.25
Nickel	mg/100 g	0.235	0.0495	0.325	NA	0.14	0.0141	
Phosphorus	mg/100 g	150	28.3	110	NA	132	3.54	1000
Potassium	mg/100 g	285	70.7	210	NA	252	3.54	120/2800
Selenium	mg/100 g	0.00875	0.0053	0.0125	NA	0.00575	0.00813	0.07
Sodium	mg/100 g	268	46	280	NA	255	21.2	120/2300
Sulphur	mg/100 g	772	53	650	NA	672	3.54	
Tin	mg/100 g	0	0	0	NA	0	0	
Zinc	mg/100 g	1.12	0.106	0.74	NA	0.462	0.0247	12

Nutrient Information for Australian Sardines and Blue Sprat

Standard Names	Australian Sardines and Blue Sprat
Scientific Names	*Sardinops sagax* and *Spratelloides robustus* (species identification confirmed through DNA sequencing).
Description	The entire fish (including skin, bones and viscera) was examined.
Sampling Details	Five separate samples were obtained from industry suppliers. Upon DNA sequencing it was confirmed that the five samples comprised two different fish species: Three samples were confirmed to be blue sprat and two samples were confirmed to be Australian sardines. All product was supplied in raw format. All analyses were undertaken in duplicate and the reported values are the average (mean) results from the analyses (n=3 blue sprat; n=2 Australian sardines). Each sample that was tested comprised ~2 kg of fish.
Method References	Refer Appendix Four
Edible Portion	100%
Nitrogen Factor	6.25
Nutrient Limit Values – Information Source	a. 'Reference Values': Food Standards Code Standard 1.2.8 b. 'Recommended Daily Intake' (RDI) Values: Food Standards Code Standard 1.1.1 c. 'Adequate Intake' (AI) Values: Department of Health and Ageing

Nutrient	Unit	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Nutrient Limits
		Australian Sardine *Sardinops sagax*		Blue Sprat *Spratelloides robustus*		
Saturated Fatty Acids (Total)	mg/100 g	1310	103	698	512	24000
Monounsaturated Fatty Acids (Total)	mg/100 g	631	53	391	218	
Polyunsaturated Fatty Acids (Total)	mg/100 g	920	20.2	540	409	
Trans Fatty Acids (Total)	mg/100 g	9.75	1.06	4.67	2.93	
Fatty Acids (Total)	mg/100 g	2750	169	1560	1090	
Alpha-Linolneic Acid (ALA)	mg/100 g	35.5	0.71	14.8	20.9	200
Docosahexaenoic Acid (DHA)	mg/100 g	178	5.66	95.8	96.9	30
Docosapentaenoic Acid (DPA)	mg/100 g	21.8	1.77	17.2	8.69	
Eicosapentaenoic Acid (EPA)	mg/100 g	450	4.95	269	196	30
Omega 3 (Total)	mg/100 g	690	4.6	404	322	
Omega 6 (Total)	mg/100 g	94.3	4.6	62.7	37.3	
Omega 9 (Total)	mg/100 g	229	17	162	56.5	
Total Cholesterol	mg/100 g	129	2.83	138	1.76	
Vitamin A (Retinol)	µg/100g	106	2.12	91.4	33.9	750
Vitamin E (Total d-α-tocopherol equivalents)	mg/100g	0.46	0	0.38	0.14	10
Vitamin C (Total)	mg/100 g	0	0	0	0	40
Moisture	g/100 g	72.9	0.25	75	2.01	
Protein	g/100 g	19.8	0.25	18.7	0.86	50
Total Fat	g/100 g	2.88	0.18	1.63	1.14	70
Carbohydrates	g/100 g	0	0	0	0	310
Energy (Calculated)	kJ/100 g	438	8.13	375	60.3	8700
Antimony	mg/100 g	0	0	0	0	
Boron	mg/100 g	0.223	0.0106	0.225	0.0132	
Cadmium	mg/100 g	0.0145	0	0.0123	0.00189	

Nutrient	Unit	Average (mean)	Standard Deviation	Average (mean)	Standard Deviation	Nutrient Limits
		Australian Sardine *Sardinops sagax*		Blue Sprat *Spratelloides robustus*		
Calcium	mg/100 g	725	84.9	742	225	800
Chromium	mg/100 g	0	0	0	0	0.2
Copper	mg/100 g	0.12	0	0.112	0.00764	3
Iodine	mg/100 g	0.0758	0.00106	0.0465	0.0169	0.15
Iron	mg/100 g	3.95	0.0707	5.18	1.16	12
Lead	mg/100 g	0.0023	0.000212	0.00327	0.000425	0.05
Magnesium	mg/100 g	45.5	1.41	46.2	3.25	320
Manganese	mg/100 g	0.13	0.00707	0.159	0.0475	5
Molybdenum	mg/100 g	0.00433	0.000177	0.00313	0.000839	0.25
Nickel	mg/100 g	0	0	0.0035	0.00606	
Phosphorus	mg/100 g	575	49.5	587	108	1000
Potassium	mg/100 g	353	3.54	342	5.77	120/2800
Selenium	mg/100 g	0.097	0.0014	0.0828	0.0097	0.07
Sodium	mg/100 g	665	7.07	675	47.7	120/2300
Sulphur	mg/100 g	255	0	242	10.4	
Tin	mg/100 g	0	0	0	0	
Zinc	mg/100 g	3.1	0.0707	2.8	0.18	12

Appendix 4: Analytical Method Details

Nutritional Component	Units (per 100 g food)	Limit of Detection	Limit of Reporting	Method Reference
Total Saturated Fatty Acids (SFA)	mg/100 g	10	10	In-house based on JAOCS, 62(1985) GC method
Total Monounsaturated Fatty Acids (MUFA)	mg/100 g	10	10	In-house based on JAOCS, 62(1985) GC method
Total Polyunsaturated Fatty Acids (PUFA)	mg/100 g	10	10	In-house based on JAOCS, 62(1985) GC method
Total trans fatty acids	mg/100 g	10	10	In-house based on JAOCS, 62(1985) GC method
Total fatty acids	mg/100 g	10	10	Calculation from fatty acid profile
Alpha-Linolneic acid (ALA)	mg/100 g	10	10	In-house based on JAOCS, 62(1985) GC method
Docosahexaenoic acid (DHA)	mg/100 g	10	10	In-house based on JAOCS, 62(1985) GC method
Docosapentaenoic acid (DPA)	mg/100 g	10	10	In-house based on JAOCS, 62(1985) GC method
Eicosapentaenoic acid (EPA)	mg/100 g	10	10	In-house based on JAOCS, 62(1985) GC method
Omega 3 (Total)	mg/100 g	10	10	Calculation from fatty acid profile.
Omega 6 (Total)	mg/100 g	10	10	Calculation from fatty acid profile.
Omega 9 (Total)	mg/100 g	10	10	Calculation from fatty acid profile.
Cholesterol	mg/100 g	0.5	1	Based on AOAC 933.08, 970.50, 970.51
Vitamin A (Retinol)	ug/100g	3	15	COST 91 P23-32, G. Brubacher, W. Muller-Mulot (Modified), EN 12823-1:2000, AOAC 992.04 and 992.06
Vitamin E (Total as d-alpha-tocopherol equivalents)	mg/100g	0.67	0.67	COST '91, 97-106 (1986)
Vitamin C (Total)	mg/100 g	0.3	1	JAOAC, 75, 887-891 (1992)
Moisture	g/100 g	0.1	0.1	AOAC 950.46 (note LoD/LoR is in %m/m)
Protein	g/100 g	0.1	0.2	AOAC 988.05, 920.53, 955.04, 981.10, 920.87, 984.13, 920.103, 991.20, 930.33, 2001.11 as appropriate (modified).
Total Fat	g/100 g	0.1	0.1	A simple method for the isolation and purification of total lipids from animal tissues. Jordi Folch, M. Lees and G.H. Sloane Stanley, The Journal of Biological Chemistry, 499- 509, 1957.
Carbohydrates	g/100 g	0.1	0.1	Calculation. Carbohydrate = 100 - Fat - Protein - Moisture - Ash - Fibre - Unavailable carbohydrate (note LoD/LoR is in %m/m)
Energy (Calculated)	kJ/100 g	1	1	New Zealand (Australia New Zealand Food Standards

Nutritional Component	Units (per 100 g food)	Limit of Detection	Limit of Reporting	Method Reference
				Code) Food Standards 2002, Amendment No. 2. (note LoD/LoR is in %m/m).
Antimony	mg/100 g	0.0005	0.001	Wet oxidation ICP MS
Boron	mg/100 g	0.025	0.05	Wet oxidation ICP MS
Cadmium	mg/100 g	0.0001	0.0002	Wet oxidation ICP MS
Calcium	mg/100 g	0.11	0.28	Acid digest, ICP OES
Chromium	mg/100 g	0.0025	0.005	Wet oxidation ICP MS
Copper	mg/100 g	0.005	0.01	Wet oxidation ICP-OES
Iodine	mg/100 g	0.001	0.002	TMAH digest, ICP-MS
Iron	mg/100 g	0.01	0.062	Acid digest, ICP OES
Lead	mg/100 g	0.0005	0.001	Wet oxidation ICP MS
Magnesium	mg/100 g	0.04	0.074	Acid digest, ICP OES
Manganese	mg/100 g	0.0025	0.005	Acid digest, ICP OES
Molybdenum	mg/100 g	0.001	0.002	Wet oxidation ICP MS
Nickel	mg/100 g	0.005	0.01	Wet oxidation ICP MS
Phosphorus	mg/100 g	0.16	0.33	Acid digest, ICP OES
Potassium	mg/100 g	0.29	0.57	Acid digest, ICP OES
Selenium	mg/100 g	0.001	0.002	Wet oxidation ICP-MS
Sodium	mg/100 g	0.13	0.27	Acid digest, ICP OES
Sulphur	mg/100 g	0.5	1	Wet oxidation ICP-OES
Tin	mg/100 g	0.001	0.002	Wet oxidation ICP MS
Zinc	mg/100 g	0.075	0.15	Wet oxidation ICP-OES

Appendix 5: Nutrient Reference Values

Definitions

Recommended Daily Intake (RDI)	The average daily dietary intake level that is sufficient to meet the nutrient requirements of nearly all health individuals in a particular life stage and gender group
Adequate Intake (AI)	Used when RDI cannot be determined. Based on approximations from apparently healthy people.
Maximum Level (ML)	The maximum level of a specific contaminant or specified natural toxicant which is permitted to be present in a nominated food.
Reference Value	Used in Food Standards Code - refers to RDI.

	Units/100g food	Reference Value (fish)	Reference Value (crustacean)	Reference Value (mollusc)	Value Type	Source
Saturated Fatty Acids (Total)	mg/100 g	24000	24000	24000	Reference Value	Food Standards Code 1.2.8
Monounsaturated Fatty Acids (Total)	mg/100 g					
Polyunsaturated Fatty Acids (Total)	mg/100 g					
Trans Fatty Acids (Total)	mg/100 g					
Fatty Acids (Total)	mg/100 g					
Alpha-Linolneic Acid (ALA)	mg/100 g	200	200	200	Reference Value	Food Standards Code 1.2.8
Docosahexaenoic Acid (DHA)	mg/100 g	30	30	30	Reference Value	Food Standards Code 1.2.8
Docosapentaenoic Acid (DPA)	mg/100 g					
Eicosapentaenoic Acid (EPA)	mg/100 g	30	30	30	Reference Value	Food Standards Code 1.2.8
Omega 3 (Total)	mg/100 g					
Omega 6 (Total)	mg/100 g					
Omega 9 (Total)	mg/100 g					
Cholesterol	mg/100 g					
Vitamin A (Retinol)	ug/100g	750	750	750	RDI (general)	Food Standards Code 1.1.1
Vitamin E	mg/100g	10	10	10	RDI (general)	Food Standards Code 1.1.1
Vitamin C (Total)	mg/100 g	40	40	40	RDI (general)	Food Standards Code 1.1.1

	Units/100g food	Reference Value (fish)	Reference Value (crustacean)	Reference Value (mollusc)	Value Type	Source
Moisture	g/100 g					
Protein	g/100 g	50	50	50	Reference Value	Food Standards Code 1.2.8
Total Fat	g/100 g	70	70	70	Reference Value	Food Standards Code 1.2.8
Carbohydrates	g/100 g	310	310	310	Reference Value	Food Standards Code 1.2.8
Energy (Calculated)	kJ/100 g	8700	8700	8700	Reference Value	Food Standards Code 1.2.8
Antimony	mg/100 g					
Boron	mg/100 g					
Cadmium	mg/100 g			0.2	Maximum Level	Food Standards Code 1.4.1
Calcium	mg/100 g	800	800	800	RDI (general)	Food Standards Code 1.1.1
Chromium	mg/100 g	0.2	0.2	0.2	RDI (general)	Food Standards Code 1.1.1
Copper	mg/100 g	3	3	3	RDI (general)	Food Standards Code 1.1.1
Iodine	mg/100 g	0.15	0.15	0.15	RDI (general)	Food Standards Code 1.1.1
Iron	mg/100 g	12	12	12	RDI (general)	Food Standards Code 1.1.1
Lead	mg/100 g	0.05		0.2	Maximum Level	Food Standards Code 1.4.1
Magnesium	mg/100 g	320	320	320	RDI (general)	Food Standards Code 1.1.1
Manganese	mg/100 g	5	5	5	RDI (general)	Food Standards Code 1.1.1
Molybdenum	mg/100 g	0.25	0.25	0.25	RDI (general)	Food Standards Code 1.1.1
Nickel	mg/100 g					
Phosphorus	mg/100 g	1000	1000	1000	RDI (general)	Food Standards Code 1.1.1
Potassium	mg/100 g	120/2800	120/2800	120/2800	AI (19-30yr females)	DoHA
Selenium	mg/100 g	0.07	0.07	0.07	RDI (general)	Food Standards Code 1.1.1
Sodium	mg/100 g	120/2300	120/2300	120/2300	Reference Value	Food Standards Code 1.2.8
Sulphur	mg/100 g					
Tin	mg/100 g					
Zinc	mg/100 g	12	12	12	RDI (general)	Food Standards Code 1.1.1