

Preliminary Study on the Development of Value-added Products from an Under-utilised Shellfish Resource

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TAS MARINATED SEAFOOD
The Taste of Quality



**SEAFOOD SERVICES
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NON-TECHNICAL SUMMARY

The introduction of the Pacific oyster *Crassostrea gigas* into Tasmanian waters has led to a large population of feral Pacific oysters. This resource is to the most part under utilised and generally viewed as a pest. Harvesting these stocks would provide both social and environmental benefits. To achieve the maximum economic return to the community there is a need to develop value added products. The aim of this research was to investigate the level of interest among consumers for new products based on wild harvest Pacific oyster meat.

Funding, equipment, staff and resources for the project were supplied by The Fisheries Research and Development Corporation (Seafood Services Australia, D-Program), Tas Marinated Seafood and the Australian Maritime College.

Two products were developed ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’ and ‘Cold Smoked Pacific Oyster Dip with Bacon’. Market acceptability trials for the sample products were held at Beauty Point, Launceston and Hobart during 2000. The surveys included a series of questions designed to help identify the consumer’s demographics and preferences with regard to purchasing, preparation and outlets. The purpose of these questions was to provide data for statistical analysis to identify potential target markets.

Both products were well received by the respondents with mean scores of 6.57 for ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’ and 6.34 ‘Cold Smoked Pacific Oyster Dip with Bacon’ on a seven point Hedonic scale. Given the favorable response to the new products there is an opportunity to advance the products to the commercialisation phase of development or develop other new products. The main factors affecting the purchase of oysters were found to be quality and taste and these key words could be used in any ensuing marketing campaign.

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1.0 INTRODUCTION

The introduction of the Pacific oyster *Crassostrea gigas* into Tasmanian waters has led to a large population of feral Pacific oysters. This resource is to the most part under utilised and generally viewed as a pest. Harvesting this resource would provide both social and environmental benefits. To achieve the maximum economic benefit for the community from the utilisation of wild harvest Pacific oysters there is a need to develop value-added products. With this in mind the aim of this report is to investigate the level of interest among consumers, for new products using wild harvest Pacific oyster meat.

1.1 The General Biology of Pacific oysters *Crassostrea gigas*

Oysters belong to the family Ostreidae, of this family there are three genera *Ostrea*, *Crassostrea* and *Pycnodonta*. The basis of classification for many species is the shape and external view of the shell.



Plate 1 External Dorsal View of Pacific oyster (*Crassostrea gigas*)

Pacific oysters are filter feeders extracting microscopic particles including bacteria, viruses and single celled algae from the surrounding water. The simple digestive system is efficient and the polysaccharide glycogen is the storage form of carbohydrate for oysters. The glycogen is the basis for future egg and sperm development. Pacific oysters spawn in response to water temperatures between 18° to 24°C for several days. Each

oyster is capable of producing many hundreds of thousands of eggs. An individual may change sex repeatedly over its lifetime. Pacific oysters are generally batch spawners, but may serial spawn over a period of several days. The larvae settle out onto suitable substrate between 15 and 30 days after spawning. (Quayle 1980; Mitchell, Jones and Crawford 2000)

Pacific oysters can tolerate large variations in water temperature, salinity, dissolved oxygen and pH levels (Table 1). It should be noted that oysters have been reported to survive limited time exposure to temperatures of below 0°C, (Quinn, A. 2000, pers. comm.) given that Pacific oysters are grown in areas with winter temperatures well below freezing this appears to be well justified. Mitchell, Jones and Crawford (2000) report tolerance to variations in salinity, when in heavy flood conditions oysters have been reported to survive for up to 30 days.

Table 1 Pacific Oyster Tolerance Ranges and Optimum Levels for pH, Temperature, Salinity and Dissolved Oxygen

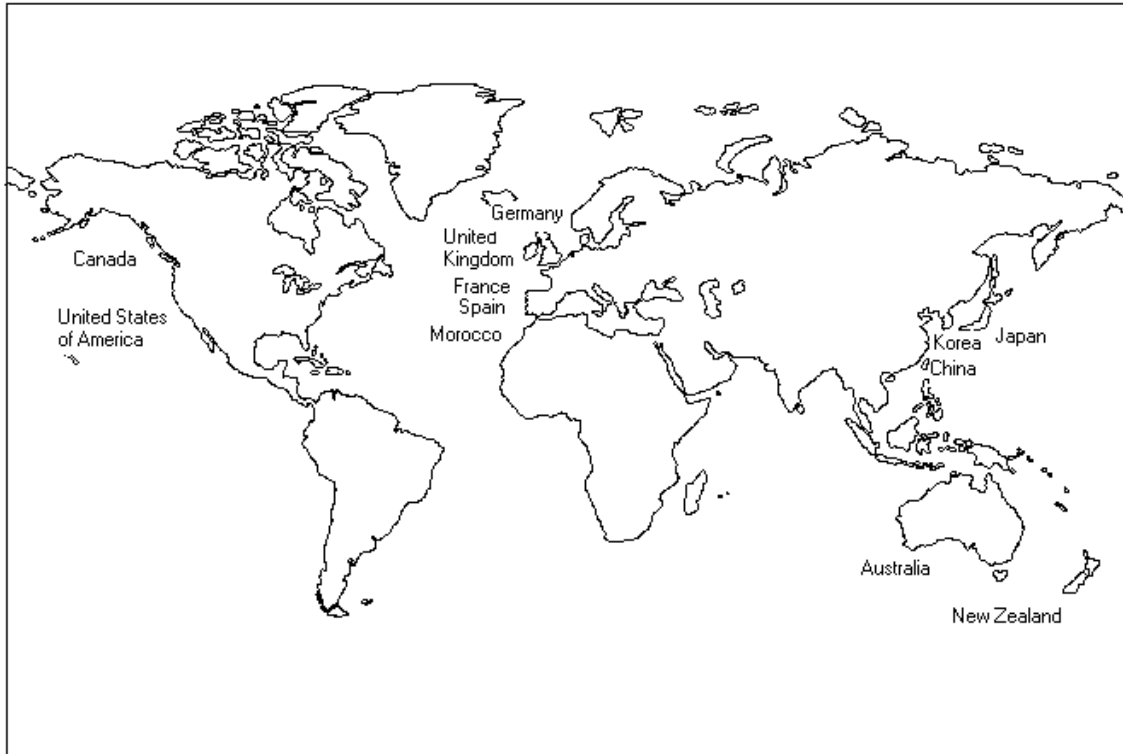
Environmental Parameter	Variation Tolerance Range	Optimum Levels
pH	7.4 - 8.5	over 7.4
Temperatures	1 - 34°C	15 - 18°C
Salinity	11 - 48‰	24‰
Dissolved Oxygen	40 - 100%	>70%

(Mitchell, Jones and Crawford 2000)

Even though oysters are encased in what is in effect a concrete shelter they are still vulnerable to a range of fish, ray, starfish and other marine predators. The native Eleven-armed seastar *Coscinasterias muricata* have in the past caused large stock losses on farms in Tasmania (J. Davis, 1999 pers. comm.). Mudworms *Polydora websteri* have also caused significant stock losses. (Mitchell, Jones and Crawford 2000) Juvenile oysters are especially at risk as their shells are often thin and soft. It has been observed that growers will often use floating, enclosed trays (that are lined by fine mesh material) to minimise exposure to predators for young spat.

1.2 The International Perspective

The Pacific oyster is endemic to the waters of Japan, where it has been utilised as a source of protein for centuries. Today the Pacific oyster is commercially grown in many countries around the globe (Map 1).



Map 1 Countries where the Pacific oyster *Crassostrea gigas* are commercially grown (Quayle 1988; Kailola et. al., 1993; Han Fa, 2000, pers. comm., Krishen & Immink 1997; Mitchell, Jones and Crawford 2000)

The Pacific oyster is sold in a range of product forms including live, frozen, canned, brined and salt dried. Recent United Nations figures suggest that China is the biggest producer of Pacific oysters, while the republic of Korea is the major exporter and relies on a competitive advantage based on price due to low costs for labour and raw materials. During 1996 international production figures topped 2 920 000 tonnes, making Pacific oysters the second highest tonnage of any single species produced by aquaculture (Krishen & Immink 1997).

1.3 The Domestic Situation

Culture of oysters in this country started in the Georges Bay and Botany Bay areas around 1870 (Kailoa 1993; Underwood & Chapman 1995). The Commonwealth Science and Industrial Research Organization successfully introduced the Pacific oyster into Australian waters in November 1947. Of the 825 000 oysters initially sent from Japan by sea, only 30% survived the 21 day voyage. The two trial sites selected were Oyster Harbour in southern West Australia and Pittwater in Tasmania. The oysters sent to West Australia suffered total mortality but the site at Pittwater proved to be successful (Thompson 1952).

Today Pacific oysters are commercially grown in Tasmania, South Australia, New South Wales and Victoria. Domestically Pacific oysters are generally sold live to processors for later processing to fresh and frozen half-shell products. Oysters sold in the shell are categorised into different size classes as per Table 2. The annual per head consumption rate of oysters in Australia is 0.6 dozen, compared to ten years ago when the rate was 1.2 dozen. The Pacific oyster makes up 44% of the Australian domestic oyster market (Hoare 2001).

Table 2 Size categories for the Australian Domestic Live Pacific Oyster Market

Size category	Size range (mm)
Buffet	55 – 70
Standards	70 – 85
Large	85 – 100
Jumbo	100 +

1.4 The Tasmanian Case

Three species of oyster are found in Tasmania, however one of these the Sydney rock oyster (*Saccostrea glomerata*) is only found on eastern Bass Strait Islands. Of the two species of oysters found on the Tasmanian mainland the Pacific oyster (*Crassostrea gigas*) (Thunberg, 1793) can be identified from Native (or Flat) oyster (*Ostrea angasi*)

(Sowerby, 1871) by the shape of the shell and the fact that they attach one valve to substrate. (Mitchell, Jones & Crawford 2000)

After the successful introduction of the Pacific oyster in Tasmanian waters the benefits for aquaculture were inconsistent. The 'stick culture' method of aquaculture used at this time required natural spat to settle on bundles of tar and cement coated sticks (Mitchell, Jones and Crawford 2000). Due to a failure of natural spat fall in 1978 the growth potential of the industry was restricted. The Tasmanian Fisheries Development Authority introduced hatchery technology to Tasmania in 1979. A group of growers formed the first commercial hatchery Shellfish Culture Pty. Ltd in July of that year. However it was not until the mid 1980's that the operation started to supply a constant and reliable supply of spat. (Evans 2000)

Tasmanian growers produced 2 647 964 dozen Pacific Oysters, worth \$10 459 457 at the farm gate during the 1998 – 99 financial year. (DPIWE 1999). The total leased area licensed for oyster culture in 1995 was 1 351 ha. Of this 1 051 ha was suited to intertidal culture and 300 ha fit for subtidal methods. The Department of Primary Industry at this time estimated that only one third of the available area was developed. These figures are expected to change, as new areas suitable for oyster culture have become available in 1999 after a government-enforced moratorium on marine leases.

The Pacific oyster is hardy and a fast grower. Under Tasmanian conditions spat at 3 – 5mm may reach marketable size in around two years. Pacific oysters grown in temperate waters have a season cycle of growth and fatness (Sumner 1981). The Tasmanian Pacific oyster peaks in condition (fatness) through late winter and spring until spawning occurs in summer. After spawning the oyster is flaccid and spent and not acceptable to the market. Down time for the producer, from spawning usually lasts around 8 to 10 weeks. Pacific oysters produced in Tasmania are generally sold direct to the Melbourne and Sydney Fish Markets. Transport to markets is generally via refrigerated container by land and sea for the live market, and airfreight for fresh half-shell products because of their shorter shelf life. (Yates, A. 2001, pers. comm.)

1.5 The Opportunity for a Meat Based Industry in Tasmania

The commercial harvest of feral oysters has to this time been minimal and inconsistent, for the 98 –99 period only 20 983 dozen oysters were harvested. Commercial wild harvest in Tasmania started in 1997 at Georges Bay, St. Helens. In 2000 there were five harvest permits, 2 for Georges Bay, 1 at Port Sorell and 2 in the Huon region. (Green, R. 2000, pers. comm.)

Problems associated with wild harvest stocks are generally associated with shell quality, especially external fouling, shell blister and shell shape. Market expectation is for consistent product with uniform shape and condition (fatness). Feral oysters are rarely suitable for the high quality live oyster market, with the exception of some small niche sales for very large oysters. Wild harvest is currently undertaken around Tasmania and is regulated by the DPIWE. Management requires that all wild harvest stocks be held on a registered oyster lease for a minimum period of 60 days before sale, that only individual oysters over 110mm can be sold live and smaller oysters can only be utilised for half shell or meat products.

The benefits of harvesting feral stocks of Pacific oysters would be realised by a wide range of user groups. Large concentrations of feral oysters in Tasmania are found in rural areas with high unemployment rates, such as St Helens, Huonville and Smithton. (Mitchell, Jones & Crawford 2000) State government funding has been provided in the past to fund employment programs that utilise and process stocks in St Helens and the Hounville region. (Harris, S. 2001 pers. comm.; Thorne, S. 2001 pers. comm.). Socially the benefits extend to reclamation of coastal areas that are infested with oysters that are seen as a nuisance and create an economic return to the community. The Tasmanian State Government priorities at this time are to develop employment opportunities and remove all feral oysters (Brown, R. 2001 pers. comm.).

The potential reduction in the numbers of feral oysters would also benefit the ecology of infested areas. Pacific oysters have been blamed for the displacement of native Flat

oysters *Ostrea angasi* from the Tamar River. The challenge to management is the controlled removal of wild oysters so that there is no ecological impact. It is recognised that large quantities of oysters have a major impact on water quality and are thought to be important in controlling eutrophication in some estuaries (Crawford and Mitchell 1999).

Oyster growers would stand to benefit from increased harvesting of wild stocks. Benefits to growers include the clean up of wild oysters (which can create stocking density problems in the local environment), improve public perception of the industry and diminish the risk of predation and disease to stock. (Mitchell, Jones and Crawford 2000) Processed wild harvest oysters would offer the potential for import replacement rather than competing with local growers for the high quality live market. Currently there are meat-based products being imported into Australia mainly as canned product. Frozen half shell oysters are imported from New Zealand. With the benefits of the increased harvest of wild oysters the establishment of an oyster meat processing industry in Tasmania would demonstrate the ‘knock on’ effects associated with the utilisation of the feral population. In addition to the economic benefits to the community this would also provide an opportunity for growers to sell product that is unsuitable for the live market. Industry and government are increasing production at significant levels, with the objective to more than double production over the next five years. (Ross, D.2001 pers. comm.; Shelley, P.2001 pers. comm.). Since the advent of hatchery technology the Australian domestic market for oysters has been in the form of table oysters. Generally Pacific oysters are presented and consumed in the shell. There is evidence to suggest that different culture methods currently employed around Tasmania, namely intertidal and subtidal culture, produce significantly different products with regard to market expectations. Oyster culture requires accessible, shallow and sheltered areas that offer environmental conditions within productive parameters and acceptable pollution levels. With increasing multi-user pressure on coastal areas expansion and future availability of suitable intertidal water is unlikely beyond that recently offered for lease. To achieve the proposed increased production levels substantial areas of subtidal water have been identified as suitable for the culture of Pacific oysters (Ross, D. 2000 pers. comm.). In an

effort to avoid a potential industry bottle neck and saturated domestic market, new value added products need to be developed to increase the current market share held by oysters.

1.6 Objectives

The objectives of the project were to:

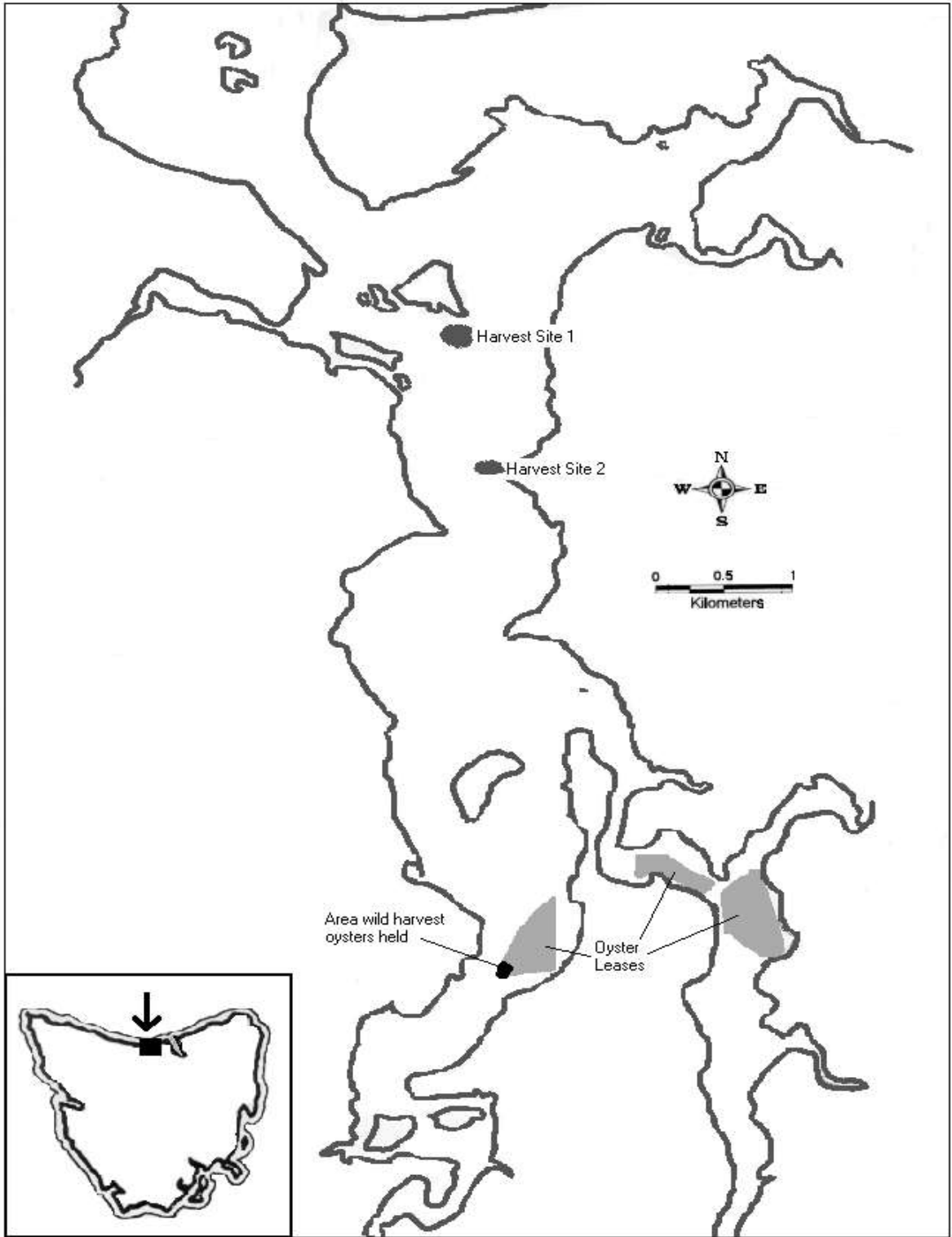
1. Develop new wild harvest Pacific oyster meat products according to the requirements:
 - a) The product must be comparable to current commercial seafood products and production methods.
 - b) Trial products must complement each other in a quality cascade.
 - c) Production must be technically and financially attainable within the budget confines and time restraints of the project.
 - d) Be able to be compared to commercially available products to establish safe shelf live time.
 - e) Be compatible to the handling and processing of oyster meat.
2. Consumer test new products with market acceptability tests, targeting the Tasmanian domestic retail market.
3. Determine and document statistical differences in scores for overall impression of the products due to the consumer's demographics and preferences with regard to purchases, outlets and consumption of oysters, to identify possible target groups for future marketing.

2.0 METHODS

2.1 Raw Materials

A scientific research permit (Appendix 1) was issued by the DPIWE on the 1st March 2000, to harvest wild Pacific oysters *Crassostrea gigas* from Port Sorell in northern Tasmania (Fig. 1). All oysters were harvested under the conditions of the permit, were used for scientific research and complied with the requirements of the TSQAP.

On the 25th March 2000, AMC students and TMS staff harvested 113 Kg of wild oysters. Due to extreme fouling it was necessary to de-clump and clean each oyster. A base was established at Shell Island (Fig. 5) and a crew of four were responsible for recording harvest data, cleaning and grading the oysters. The AMC vessel *Vega* was used to deliver harvest parties to pre-selected sites as shown in Fig 1. Harvesters were instructed to only harvest individual oysters that they measured to be under 110 mm (as required by the permit) and over 75 mm (expected market size). Harvesting teams of two were established and each pair was issued with a ruler, a fish bin and a claw hammer or geologist pick. All oysters were relayed to Lease No. 95 situated in the Rubicon River upstream of the marine estuary at Port Sorell (Fig. 1) where a small area of lease and equipment was rented from the lease owner for the duration of the trials. Oysters were stored in B.S.T. cylinders and suspended in one area on the lease. The Port Sorell site was chosen due to the close location to AMC, the huge numbers of oysters easily accessible for harvest and the close locality of a TSQAP approved Pacific oyster lease.



Map 2. Port Sorell estuary showing harvest and lease areas.

The oysters were collected from the lease area as required and transported in B.S.T. cylinders to AMC Beauty Point. Large quantities of mud were found to have covered the cylinders and the external surface of the oysters. A Karcher high pressure water unit (Model No. 350) was used to clean the culture units and oysters. All oysters were refrigerated within 6 hours of harvest and processed within 24 hours.

After removal from the B.S.T. cylinders the oysters were tumbled in a purpose built rumbler to remove the brittle and sharp edges from the shell surfaces of the wild harvest Pacific oysters. Without the benefit of the rumbler it was found to be hard to exclude shell fragments from the raw material meat product. The rumbler was powered by a 12 volt car window wiper motor and battery. The stainless steel barrel had a diameter of 50 cm and a length of 90 cm, with 15 mm holes drilled at 30 mm centres (Plate 2). The barrel was geared to turn at 15 revolutions per minute. After rumbling the oysters were individually cleaned with running potable water and scrubbing brushes. Oyster knives were used to remove more stubborn fouling organisms such as barnacles and overcatch of small oysters. Heavy duty gloves were required to handle the sharp oyster shells.

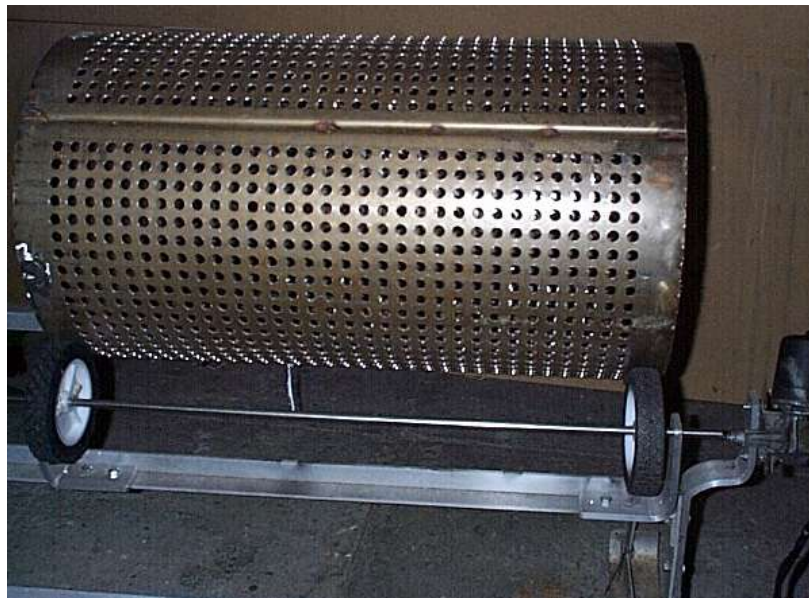


Plate 2 Wild Harvest Oyster Rumbler Equipment

All oysters were cooked whole in a Simpson® 2001 Thermoflow electric oven (Model No. 65-637) for 20 minutes at 250 °C. Cooked batches were processed to remove the meats and the shells disregarded. Any individuals that were found to be in very poor condition or infested with mud worm were rejected. The meats were individually washed in potable water and stored in refrigerated conditions until the complete production run was ready for brining and smoking.

2.2 Product Development

Two products were developed incorporating the quality cascade. Meat with high quality (A grade) was used to produce ‘Cold Smoked Oysters in Apple Cider Vinegar’ (Plate 3) while lower grade meat (B grade) was used in a ‘Cold Smoked Oyster Dip with Bacon’ (Plate 4). These two products were chosen due to the fact that they complied with the objectives of the project.



Plate 3 Cold Smoked Pacific Oysters in Apple Cider Vinegar



Plate 4 Cold Smoked Pacific Oyster Dip with Bacon

2.2.1 Cold Smoked Pacific Oysters in Apple Cider Vinegar

The use of pH as a preservative for seafood is a common method that is readily available to the consumer. Commercially available value added seafood products were purchased from supermarkets in Launceston (Table 1) and used as a bench mark for the development of the Cold Smoked Oysters in Apple Cider Vinegar recipe. During the development phase of the product various types of commercially available vinegar was trialed by friends and family of TMS, however most were found to taste overpowering at pH levels suitable to produce an end point pH below 4.3, the limit for *Listeria* (Kow 1997). Commercially available Mercury Apple Cider Vinegar proved successful in providing the most pleasant taste and was used as the basis for the market acceptability phase of the project.

Table 3 Commercially available pH preserved seafood products that were tested

Product	Listed ingredients	Manufacturer	Country of origin
Pirates Bay pickled octopus	Octopus, vinegar, water, olive oil, garlic, sugar, herbs & pepper	Pirates Bay Octopus	Australia
Superior Gold Squid in herb and garlic vinaigrette	Squid, onions, dill, oil, vinegar, salt & sugar	Butterfields	Australia
Talley's Mussels cooked & marinated	Cooked mussels in water, acidity regulator (E260), sugar & salt	Talley's Fisheries Ltd.	New Zealand
Superior Gold Marinated smoked hickory mussels	Greenshell™ mussels (Perma canaliculus), water, sugar, food acid (260, 300), salt & natural smoked hickory flavour	Butterfields	New Zealand

The standard Association of Analytical Chemists Official Methods of Analysis method for determining pH was used to determine the four products final point pH. Samples of the product were tested using ConvoL® Product No. 18026 sodium hydroxide 0.1 mol l⁻¹.

Three samples were taken from each product, two samples of meat and one sample of liquid from the product's container. Meat samples were processed to a fine paste using a Ronson 'Compact Kitchen' Model No. 8333 domestic food processor. Each sample was ground using the cutting blade on high speed for 30 seconds. The samples were coded for

ease of identification from A to D. (Meat samples were given a supplementary number code of 1 or 2 while the liquid samples were additionally coded with an 'L', as: A1, A2 and AL). Samples were stored in glass beakers surrounded with crushed ice until required. Duplicate sets of blanks were also tested. Results were used as a bench mark for the development of a new wild harvest oyster meat product.

2.2.3 Cold Smoked Pacific Oyster Dip with Bacon

Lower grade oysters were used to make ‘Cold Smoked Pacific Oyster Dip with Bacon’ (Plate 4). There are currently seafood dips available (Table 4), generally dips are stored frozen and sold to the consumer thawed with a shelf life of seven days in refrigerated conditions.

Table 4 Commercially available oyster dip products that were evaluated

Product	Listed ingredients	Manufacturer	Country of origin
Bruny Oyster Pate	Cooked oysters, cream cheese	Bruny Oyster Pate	Australia
Prawn and Crab Dip	Cream cheese, cream, milk solids, tomato, prawn meat, onion, crab meat, lemon juice, flavour, chives, salt, vinegar, food acid (200), spices, water added.	Kraft Foods Limited	Australia

2.3 Market Acceptability Tests

Market acceptability tests were held in Tasmania during 2000. The first test was held on the 26th August at the Inveresk railway yards ‘Liesure and Outdoor Expo’ in Launceston (Plate 6). Taste testing was also held during ‘Aquafest’ at the Wrest Point Casino in Hobart on the 7th October (Plate 5). Staff and families of TMS were also surveyed.

The surveys included a series of questions designed to help identify the consumer’s demographics and preferences with regard to purchasing, preparation and outlets as detailed in Table 5

Table 5 Survey questions for market acceptability trials

Question No.	Description
1	Overall impression of the product
2	Age category of respondent
3	Gender of respondent
4	Home postcode
5	Preferred style of preparation for oysters
6	Purchase rate for oysters
7	Preferred outlet for oysters
8	Factors of most concern regarding purchase of oysters

Trained interviewers were used to read the question from the survey form and recorded the respondents answers (Plate 7). Products were accompanied with product specification sheets (Appendix 3 and 4), serviettes, individually wrapped toothpicks and Home Brand plain water crackers. Cherry tomatoes, parsley sprigs and lemon wedges were used as garnishes.



Plate 5 Market acceptability test held at ‘Aquafest’ at the Wrest Point Casino in Hobart on the 7th October, 2000



Plate 6 Market acceptability test held on the 26th August, 2000 at the Inveresk railway yards ‘Liesure and Outdoor Expo’ in Launceston



Plate 7 Trained interviewers read the questions from the survey form and recorded the respondent’s answers

2.3.1 Question 1 Overall impression of the product

A hedonic smiley scale combined with a written description (Plate 8) was used to determine the overall impression of the sample product. This method of documenting consumer preferences has been used extensively in the past to field test new value added products (Stone, H. & Sibel, J. 1985; Resurreccion, A. 1998; Kow and Iverson 1999). Tasters were asked to indicate the face that best described their overall impression of the sample.

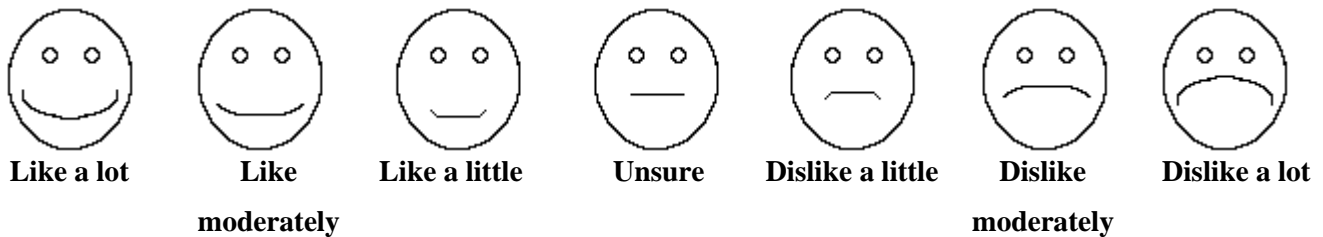


Plate 8 Hedonic scale used in the market acceptability study

Each scoring category was assigned a numerical value from 1 for 'Dislike a lot' to 7 for 'Like a lot'.

Assumption:

There is no significant difference in scores between sampling locations.

Hypothesis:

Ho: There is no significant difference in preferences between sampling locations.

Ha: There is a significant difference in preferences between sampling locations.

2.3.2 Question 2 Age category of respondent

Respondents were presented with three age categories (less than 18, 18 to 45 and over 45 years of age) and asked to indicate which group they were in.

Assumption:

There is no significant difference in scores between different age groups in the survey.

Hypothesis

Ho: There is no significant difference in preferences between different age groups in the survey.

Ha: There is a significant difference in preferences between different age groups in the survey.

2.3.3 Question 3 Gender of respondents

The tasters gender was noted and recorded into male and female sub-groups.

Assumption:

There is no significant difference in the scores for the sample between male and female respondents in the survey.

Hypothesis:

Ho: There is no significant difference in the scores for the sample between male and female respondents in the survey.

Ha: There is a significant difference in the scores for the sample between male and female respondents in the survey.

2.3.4 Question 4 Home postcode

All respondents were asked to provide their home postcode.

Assumption:

There is no significant difference in the respondents scores for the sample based on home postcode.

Hypothesis:

Ho: There is no significant difference in the respondents scores for the sample based on home postcode.

Ha: There is a significant difference in the respondents scores for the sample based on home postcode.

2.3.5 Question 5 Preferred style of preparation for oysters

Respondents were asked to indicate which style of preparation they most preferred for oysters. Options were provided as:

Natural (raw)

Canned

Cooked (please specify)

Assumption:

There is no significant difference in the scores between different styles of preparation respondents most prefer for oysters.

Hypothesis:

Ho: There is no significant difference in the scores between different styles of preparation respondents most prefer for oysters.

Ha: There is a significant difference in the scores between different styles of preparation respondents most prefer for oysters.

2.3.6 Question 6 Purchase rate for oysters

The respondents were asked to indicate how often they buy oysters for consumption. This question was designed to test for significant differences in scores and to indicate those surveyed that were purchasers of oysters. Options were provided as:

Never

1 to 2 times per year

3 to 4 times per year

1 to 2 times per month

3 to 4 times per month

At least once per week

Assumption:

There is no significant difference in the scores between different purchase rates of oysters.

Hypothesis:

Ho: There is no significant difference in the scores between different purchase rates of oysters.

Ha: There is a significant difference in the scores between different purchase rates of oysters.

2.3.7 Question 7 Preferred outlet for oysters

Each taster was asked to nominate from which of the following outlets they generally buy oysters. The respondents were advised that they could choose more than one supplier. Optional answers were provided as:

- Supermarket
- Restaurant
- Fish monger
- Other (please specify)

Assumption:

There is no significant difference in the scores between different preferred outlets for oysters.

Hypothesis:

Ho: There is no significant difference in the scores between different preferred outlets for oysters.

Ha: There is a significant difference in the scores between different preferred outlets for oysters.

2.3.8 Question 8 Factors of most concern regarding purchase of oysters

Respondents were asked to rank a list of factor that most concern them when they purchase oysters. Options were:

- Quality
- Value for money
- Availability
- Taste
- Nutrition
- Convenience
- Other (please specify)

Each factor was scored as 1 (most concerned) to 7 (least concerned). Any factors could be assigned the same score if the respondent believed they were equally important. This question was included in the survey to demonstrate the most important issues affecting the purchase of oysters.

2.4 Statistical Analysis

2.4.1 Assumptions

Interviewers completed the questionnaire forms. Standard questions, training of interviewers and investigators presence avoided interviewer bias.

2.4.2 Descriptive statistics

Microsoft® Excel 97 SR1 was used to compile and edit the data and graphs.

2.4.3 Inferential statistics

Microsoft® Excel 97 SR1 was used to statistically analyse the data and to generate graphs.

The Chi² test first calculates a Chi² statistic and then sums the differences of actual values from the expected values.

The equation for this function is:

$$\text{Chi}^2 \text{ result} = p(X > \text{Chi}^2)$$

Where:

$$\text{Chi}^2 = \sum^r \sum^c \frac{(A_{ij} - E_{ij})^2}{E_{ij}}$$

And where:

A_{ij} = actual frequency in the i -th row, j -th column

E_{ij} = expected frequency in the i -th row, j -th column

r = number of rows

c = number of columns

(Microsoft® Excel 97 SR1)

Degrees of freedom were calculated as, df , where $df = (r - 1)(c - 1)$.

Decision rule:

Given:

Chi² result > Chi² table at 5% level:

Reject null hypothesis. The variable is significant at the 5% level.

Chi² result < Chi² table at 5% level:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.0 RESULTS

3.1 Commercial Product Testing

Results of commercial product testing showed that all meat and liquid samples had a final point pH of less than 4.0 (Figure 1).

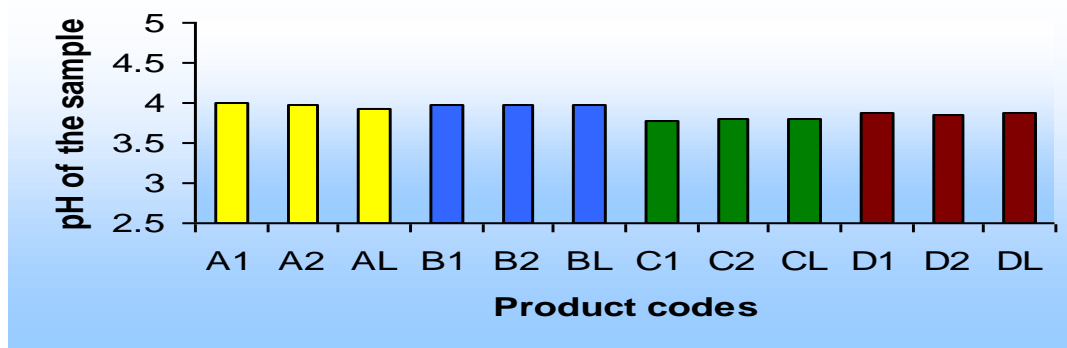


Figure 1 Results of pH tests of commercial products for meat and liquid samples (Product A Pirates Bay Pickled Octopus; Product B Superior Gold, Squid in herb and garlic vinaigrette; Product C Talley’s Mussels cooked & marinated; Product D Superior Gold, Marinated smoked hickory mussels)

3.2 Cold Smoked Pacific Oysters in Apple Cider Vinegar

A total of 276 surveys were recorded for Cold Smoked Pacific Oysters in Apple Cider Vinegar. Tas Marinated Seafood staff and families completed 15 surveys. At the 'Liesure and Outdoor Expo' in Launceston a total of 94 responses were received and 167 were recorded during 'Aquafest' at the Wrest Point Casino in Hobart.

Hypothesis

Ho: There is no significant difference in scores between sampling locations.

Ha: There is a significant difference in scores between sampling locations.

The Chi² test for independence produced a result of 0.063.

Given the critical value of the Chi² distribution at the 0.5% level with 12 degrees of freedom is 21.026.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.2.1 Question 1 Overall impression of the product

Tasters were asked to give a score for their overall impression for a sample of Cold Smoked Pacific Oysters in Apple Cider Vinegar using a seven point hedonic scale. 71% of those polled gave the product the highest score of ‘like a lot’ and 20% of respondents gave the product the second highest score of ‘like moderately’ (Figure 2). The overall mean score for Cold Smoked Pacific Oysters in Apple Cider Vinegar was 6.57.

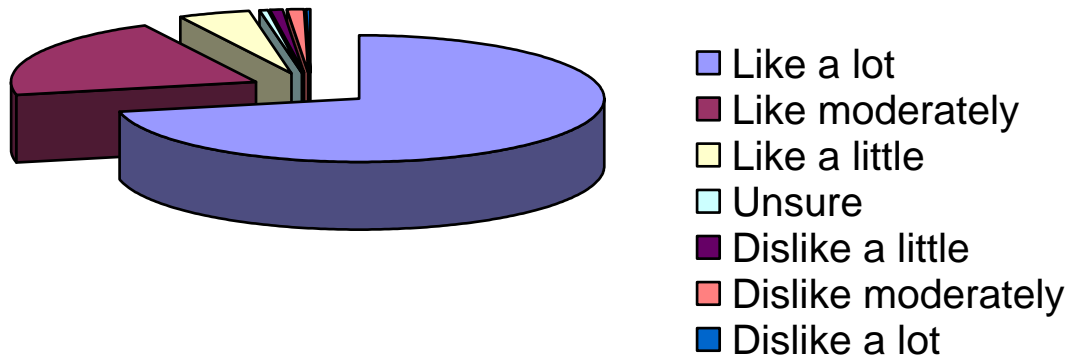
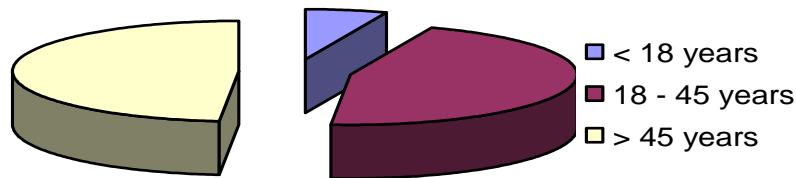


Figure 2 Percentage of Scores for ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’

3.2.2 Question 2 Age category of the respondent

The ages of respondents were recorded as three age group categories < 18, 18 – 45 and > 45 years of age. Of the 276 respondents 6% were less than 18 years of age, 46 % were in the 18 to 45 years age group and 48% were aged over 45 years as in Figure 3.



% of Responents by Age Group

Figure 3 Percentage breakdown of respondents for ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’ by age

Hypothesis:

Ho: There is no significant difference in the preferences of the respondents in the survey based on their age group.

Ha: There is a significant difference in the preferences of the respondents in the survey based on their age group.

The Chi² test for independence produced a result of 0.023.

Given the critical value of the Chi² distribution at the 0.5% level with 12 degrees of freedom is 21.026.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.2.3 Question 3 Gender of respondent

The gender of respondents was recorded for all respondents for the ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’ market acceptability tests. 42% of respondents were female and 58% male (Figure 4).

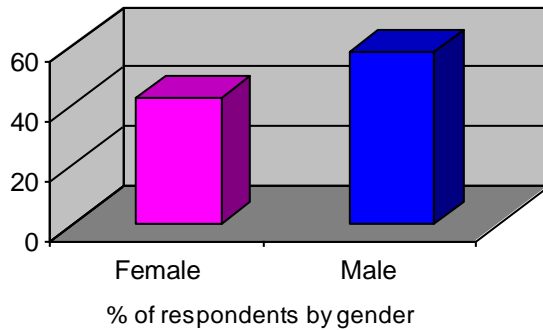


Figure 4 Percentage breakdown of respondents for ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’ by gender

Hypothesis:

Ho: There is no significant difference in the preferences of the respondents in the survey based on their gender.

Ha: There is a significant difference in the preferences of the respondents in the survey based on their gender.

The Chi² test for independence produced a result of 0.043.

Given the critical value of the Chi² distribution at the 0.5% level with 6 degrees of freedom is 12.592.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.2.4 Question 4 Home postcode

Respondents were asked to provide their home postcodes. 8% of those polled were from mainland Australia and 1 survey was from a visiting American. The Tasmanian component of those surveyed was 91.7%. Respondents home postcodes were grouped as in Figure 5.

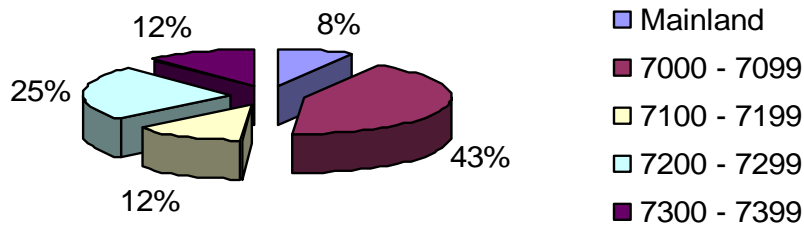


Figure 5 Distribution of respondents by nominated home post code for ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’

Hypothesis

Ho: There is no significant difference in the preferences of the respondents in the survey based on their home postcode.

Ha: There is a significant difference in the preferences of the respondents in the survey based on their home postcode.

The Chi² test for independence produced a result of 0.690.

Given the critical value of the Chi² distribution at the 0.5% level with 24 degrees of freedom is 36.415.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.2.5 Question 5 Preferred style of preparation for oysters

The respondents were asked to indicate the style of preparation that they most prefer for oysters, the choices were natural, canned or cooked. Those surveyed that preferred cooked oysters were asked to specify the method of cooking. More than one method could be nominated and 21 different combinations were received. Each response whether singular or multiple were given equal values and then compiled into single style responses. Any styles nominated with less than 10 responses, excluding those with no preference, was grouped as 'other'. The most popular style of preparation was for natural oysters, with 48%. Kilpatrick was the second most preferred method of those polled, with 23% (Figure 6).

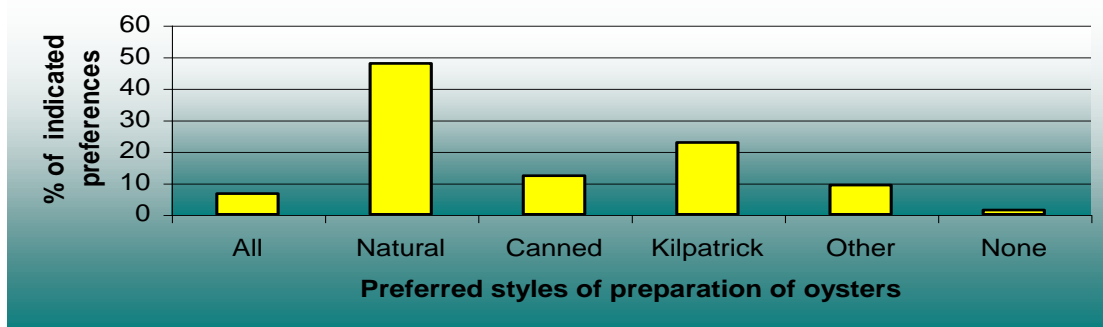


Figure 6 Percentage of total responses for rreferred method of preparation for oysters for ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’

Hypothesis:

Ho: There is no significant difference in the scores of the respondents in the survey based on their preference of style of the preparation for oysters.

Ha: There is a significant difference in the scores of the respondents in the survey based on their preference of style of the preparation for oysters.

The Chi² test for independence produced a result of 4.32×10^{-15} .

Given:

Critical value of the Chi^2 distribution at the 0.5% level with 30 degrees of freedom is 43.773.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.2.6 Question 6 Purchase rate for oysters

Each respondent was asked to indicate how often he or she buys oysters for consumption. The most popular response for those surveyed in the ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’ market acceptability tests was for three to four times per year (Figure 7).

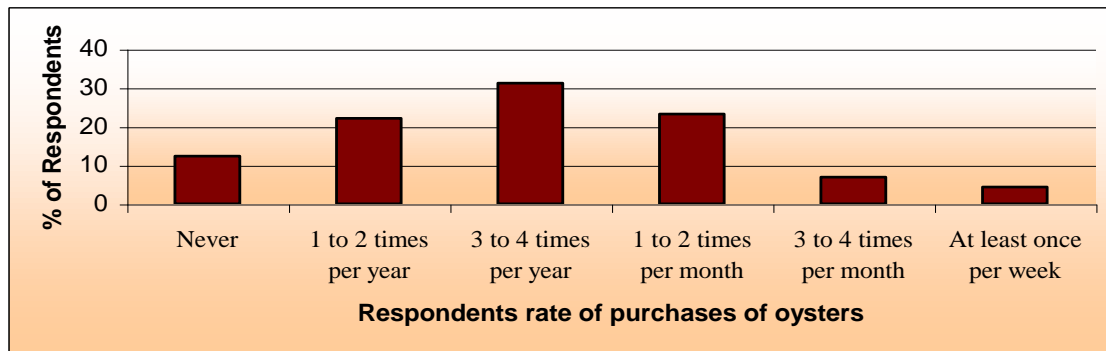


Figure 7 Percentage of total responses for purchase rates of oysters for consumption for ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’

Hypothesis:

Ho: There is no significant difference in the preferences of the respondents in the survey based on their purchase rate for oysters.

Ha: There is a significant difference in the preferences of the respondents in the survey based on their purchase rate for oysters.

The Chi² test for independence produced a result of 0.594.

Given the critical value of the Chi² distribution at the 0.5% level with 10 degrees of freedom is 18.307.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.2.7 Question 7 Preferred outlet for oysters

Respondents were asked to indicate from which outlets they generally buy oysters. More than one method could be nominated and 17 different combinations were received. Each response whether singular or multiple were given equal values and then compiled into single outlet responses. The top three responses were fishmonger, supermarkets and restaurants (Figure 8).

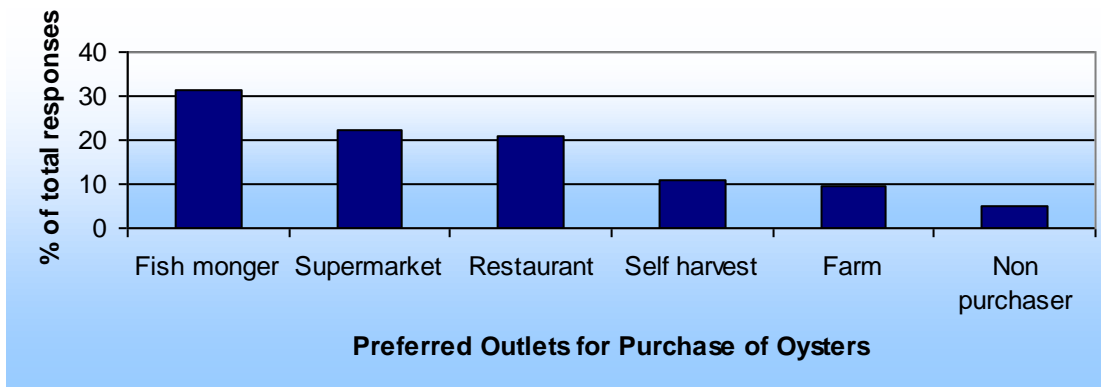


Figure 8 Percentage of total responses for respondents preferred outlets for purchasing oysters for ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’

Hypothesis:

Ho: There is no significant difference in the preferences of the respondents in the survey based on their preferred outlet for oysters.

Ha: There is a significant difference in the preferences of the respondents in the survey based on their preferred outlet for oysters.

The Chi² test for independence produced a result of 0.003. Given the critical value of the Chi² distribution at the 0.5% level with 30 degrees of freedom is 43.773.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.2.8 Question 8 Factors of most concern regarding purchase of oysters

Respondents were asked to assign a score, from 1 (most concerned) to 7 (least concerned) indicating the level of their concern, as to quality, value for money, availability, taste, nutrition and convenience (and specify any other factor) that most concerns them when they purchase oysters. Respondents were advised to assign the same score to any two factors if you believe they are equally important.

Scores of 1 and 2 were assigned to a category of most concerned, scores 3, 4 and 5 were grouped as moderately concerned while scores of 6 and 7 were nominated as of no concern. Respondents that nominated other as a response chose factors such as source, appearance, freshness and size. Quality and taste were the most important factors identified by the respondents (Table 6).

Table 6 Percentage breakdown of factors that most affect the purchase of oysters for respondents of ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’ market acceptability tests

% of respondents	Quality	Value	Availability	Taste	Nutrition	Convenience	Other
most concerned	85.9	46.4	17.0	71.7	12.7	15.9	2.2
moderately concerned	6.9	32.2	47.1	17.4	33.3	32.6	0.7
least concerned	7.2	21.4	35.9	10.9	54.0	51.5	97.1

3.3 Cold Smoked Pacific Oyster Dip with Bacon

A total of 204 surveys were recorded for Cold Smoked Pacific Oyster Dip with Bacon. Tas Marinated Seafood staff and families completed 24 surveys. At the ‘Liesure and Outdoor Expo’ in Launceston a total of 92 responses were received and 88 were recorded during ‘Aquafest’ at the Wrest Point Casino in Hobart.

There were no responses for two scoring categories: dislike a lot and dislike moderately. To make statistical analysis possible the scores were grouped into three sub categories (Figure 9). The Chi-Squared test for significance was used to determine if there was significant differences in the scores between the age groups, gender, postcode, purchasing rate for oysters and the preferred style of preparation and outlet for those surveyed for the ‘Cold Smoked Pacific Oyster Dip with Bacon’.

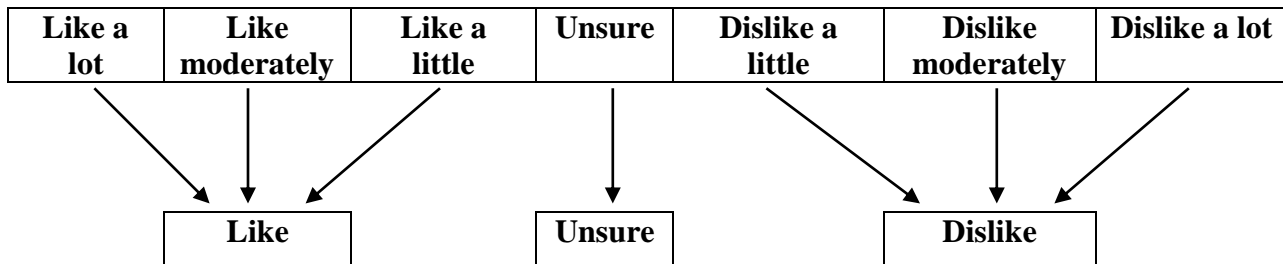


Figure 9 Sub categories allotted to scores for ‘Cold Smoked Pacific Oyster Dip with Bacon’ for statistical analysis

Hypothesis:

Ho: There is no significant difference in preferences between sampling locations.

Ha: There is a significant difference in preferences between sampling locations.

The Chi² test for independence produced a result of 0.169.

Given:

Critical value of the Chi^2 distribution at the 0.5% level with 4 degrees of freedom is 9.488.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.3.1 Question 1 Overall impression of the product

Tasters were asked to give a score for the sample using a seven point hedonic scale. The mean overall scores were 6.34, with 53% of those polled giving the product the highest score (Figure 10).

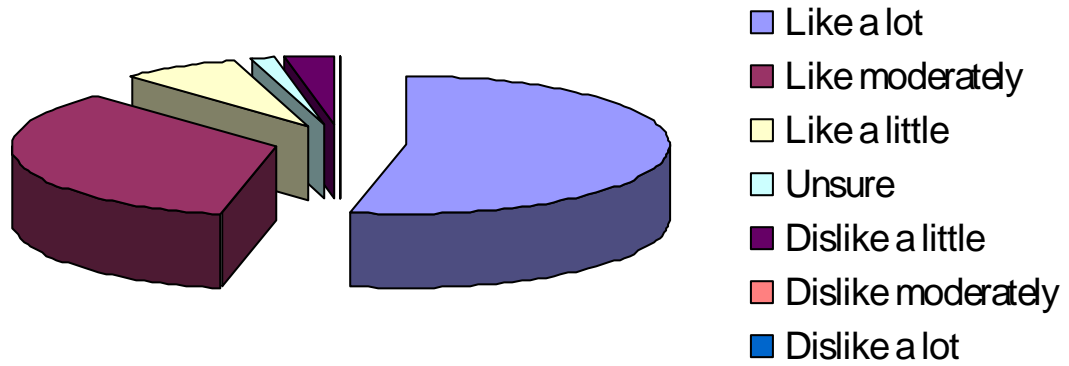


Figure 10 Percentage of scores for 'Cold Smoked Oyster Dip with Bacon'

3.3.2 Question 2 Age categories of respondent

Respondents were split into age categories. 5% of those polled were under 18, 42% were aged 18 to 45 and 53% over 45 (Figure 11).

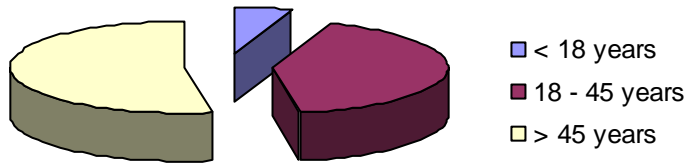


Figure 11 Percentage breakdown of respondents for ‘Cold Smoked Oyster Dip with Bacon’ by age

Hypothesis:

Ho: There is no significant difference in the preferences of the respondents in the survey based on their age group.

Ha: There is a significant difference in the preferences of the respondents in the survey based on their age group.

The Chi² test for independence produced a result of 0.1377.

Given the critical value of the Chi² distribution at the 0.5% level with 4 degrees of freedom is 9.488.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.3.3 Question 3 Gender of respondent

The gender breakdown of respondents for 'Cold Smoked Oyster Dip with Bacon' showed that 54% of those polled were female and 46% were male (Figure 12).

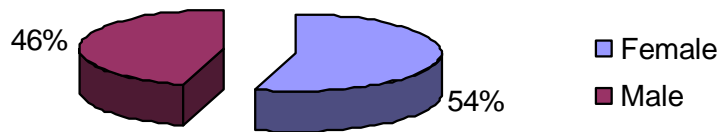


Figure 12 Percentage breakdown of respondents for 'Cold Smoked Oyster Dip with Bacon' by gender

Hypothesis

Ho: There is no significant difference in the preferences of the respondents in the survey based on their gender.

Ha: There is a significant difference in the preferences of the respondents in the survey based on their gender.

The χ^2 test for independence produced a result of 0.157.

Given:

Critical value of the χ^2 distribution at the 0.5% level with 2 degrees of freedom is 5.991.

Decision rule

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.3.4 Question 4 Home postcode

Of those surveyed for ‘Cold Smoked Oyster Dip with Bacon’ 5.4% were from mainland Australia and the remaining 94.5% indicated a Tasmanian postcode as their home postcode. Respondents home postcodes were grouped into categories as in Figure 13.

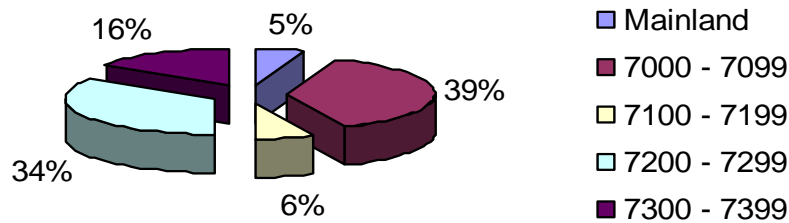


Figure 13 Distribution of respondents by nominated home post code for ‘Cold Smoked Oyster Dip with Bacon’

Hypothesis:

Ho: There is no significant difference in the preferences of the respondents in the survey based on their home postcode.

Ha: There is a significant difference in the preferences of the respondents in the survey based on their home postcode.

The Chi² test for independence produced a result of 0.480.

Given the critical value of the Chi² distribution at the 0.5% level with 8 degrees of freedom is 15.507.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.3.5 Question 5 Preferred style of preparation for oysters

The respondents were asked to indicate the style of preparation that they most prefer for oysters, the choices were natural, canned or cooked. Those surveyed that preferred cooked oysters were asked to specify the method of cooking. More than one method could be nominated and 16 different combinations were received. Each response whether singular or multiple were given equal values and then compiled into single style responses. Any styles nominated with less than 10 responses, excluding those with no preference, was grouped as 'other'. Natural and kilpatrick were the two most preferred methods (Figure 14).

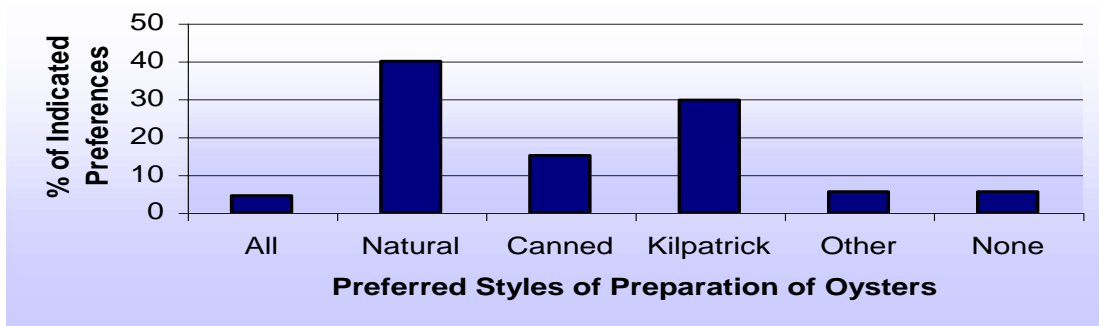


Figure 14 Percentage of total responses for preferred style of preparation for oysters for 'Cold Smoked Oyster Dip with Bacon'

Hypothesis:

Ho: There is no significant difference in the preferences of the respondents in the survey based on their preference of style of the preparation for oysters.

Ha: There is no significant difference in the preferences of the respondents in the survey based on their preference of style of the preparation for oysters.

The Chi² test for independence produced a result of 0.762.

Given:

Critical value of the Chi^2 distribution at the 0.5% level with 10 degrees of freedom is 18.307.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.3.6 Question 6 Purchase rate for oysters

Consumption rates of respondents for ‘Cold Smoked Oyster Dip with Bacon’ were recorded. The top three responses were 1 to 2 times per year, 3 to 4 times per year and 1 to 2 times per month (Figure 15).

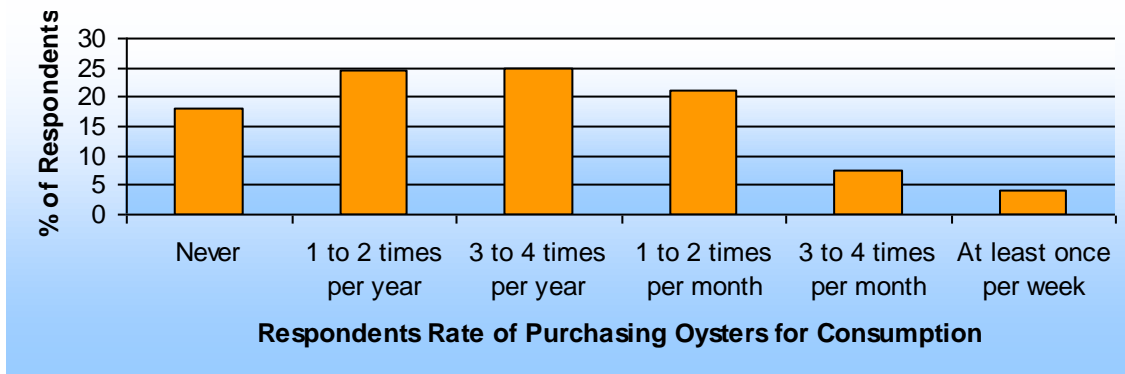


Figure 15 Percentage of total responses for purchase rates of oysters for consumption for ‘Cold Smoked Oyster Dip with Bacon’

Hypothesis:

Ho: There is no significant difference in the preferences of the respondents in the survey based on their purchase rate for oysters.

Ha: There is no significant difference in the preferences of the respondents in the survey based on their purchase rate for oysters.

The Chi² test for independence produced a result of 0.594.

Given the critical value of the Chi² distribution at the 0.5% level with 10 degrees of freedom is 18.307.

Decision rule:

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.3.7 Question 7 Preferred outlet for oysters

Respondents were asked to indicate from which outlets they generally buy oysters. More than one method could be nominated and 14 different combinations were received. Each response whether singular or multiple were given equal values and then compiled into single outlet responses. Restaurants, fishmonger and supermarkets were the most popular choice for preferred outlets (Figure 16).

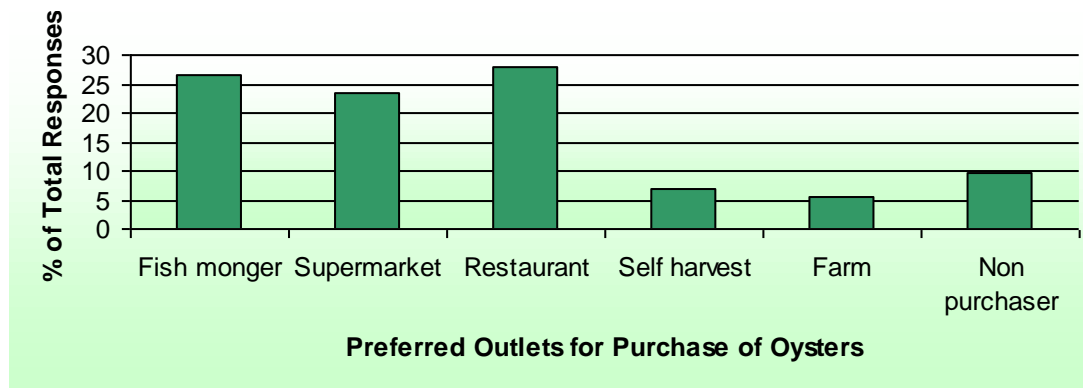


Figure 16 Percentage of total responses of respondents preferred outlets for purchasing oysters for ‘Cold smoked oyster Dip with Bacon’

Hypothesis:

Ho: There is no significant difference in the preferences of the respondents in the survey based on their preferred outlet for oysters.

Ha: There is a significant difference in the preferences of the respondents in the survey based on their preferred outlet for oysters.

The Chi² test for independence produced a result of 0.594. Given the critical value of the Chi² distribution at the 0.5% level with 10 degrees of freedom is 18.307.

Decision rule

Do not reject the null hypothesis. The variable is not significant at the 5% level.

3.3.8 Question 8 Factors of most concern regarding purchase of oysters

Respondents were asked to assign a score, from 1 (most concerned) to 7 (least concerned) indicating the level of their consideration. As to quality, value for money, availability, taste, nutrition and convenience (and specify any other factor) that most concerns them when they purchase oysters.

Scores of 1 and 2 were assigned to a category of most concerned, scores 3, 4 and 5 were grouped as moderately concerned while scores of 6 and 7 were nominated as of no concern.

Quality and taste (Table 7) were the two factors identified as the most important for respondents.

Table 7 Percentage breakdown of factors that most affect the purchase of oysters for respondents of ‘Cold Smoked Oyster Dip with Bacon’ market acceptability tests

% of respondents	Quality	Value	Availability	Taste	Nutrition	Convenience	Other
most concerned	80.4	46.1	21.6	66.7	15.7	15.2	0.5
moderately concerned	6.4	27.9	37.7	18.1	27.0	27.5	0.5
least concerned	13.2	26.0	40.7	15.2	57.3	57.3	99.0

4.0 DISCUSSION AND CONCLUSIONS

Overall the response for the new value added Wild Harvest Pacific Oyster products was very favorable with both products meeting the objectives of the project.

Consumer testing new products with market acceptability tests, targeting the Tasmanian domestic retail market proved successful and achieved high scores for the overall impression of both ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’ and ‘Cold Smoked Oyster Dip with Bacon’.

No significant differences in scores for the overall impression of the products, due to the consumer’s demographics and preferences, suggests that the two products could be marketed with campaigns aimed at a general target market. It should be noted that there was a higher percentage of female respondents for the ‘Cold Smoked Oyster Dip with Bacon’, while there was a higher percentage of male respondents for ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’. The gender imbalance between the two products suggests that further investigations could be made into marketing of individual products at specific gender markets. Constructing an open question asking the respondent to nominate the factor or factors that were of most concern to them may better suit future studies of this type.

Identifying the factors that most concerned respondents regarding purchasing provided an opportunity to detect key words that consumers would respond to in marketing campaigns. Quality and taste were identified as the most important factors that were offered to the respondents. Constructing an open question asking the respondent to nominate the factor or factors that were of most concern to them may better suit future studies of this type.

Given the high level of the overall impression for the trials for both ‘Cold Smoked Pacific Oysters in Apple Cider Vinegar’ and ‘Cold Smoked Oyster Dip with Bacon’ there is a need for further investigation to refine and commercialise the products. Any future product development of Wild Harvest Pacific Oyster meat products may need to be developed with the main two preferred styles that scored the highest for both products, natural and kilpatrick.

The gender imbalance between the two products suggests that further investigations could be made into marketing of individual products at specific gender markets. Constructing an open question asking the respondent to nominate the factor or factors that were of most concern to them may better suit future studies of this type.

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APPENDIX 1 PERMIT DETAILS

Permit No: P99/00 – 161

Permit Holder: Mr Andrew Duke, 39 Napier St, Beauty Point, 7270.

Date of Issue: 1 March 2000

Date of Expiry: 28 February 2001

Activities Authorised By The Permit

The permit was issued for the purpose of scientific research. It authorised the permit holder to take and possess 1000 dozen Pacific oysters *Crassostrea gigas* of shell length less than 110 mm from the state waters of Port Sorell, and classified by the Department of Health and Community Services as areas open to shellfish harvesting for scientific research purposes in accordance with a set criteria of terms and conditions.

APPENDIX 2 HARVEST DATA

Cylinder No.	No. oysters	Total weight (Kg)	Average weight (g)
1	60	5.25	87.50
2	60	5.00	83.33
3	60	4.80	80.00
4	60	5.20	86.67
5	75	6.25	83.33
6	68	5.80	85.29
7	60	5.50	91.67
8	51	6.60	129.41
9	48	6.00	125.00
10	50	6.50	130.00
11	56	5.50	98.21
12	52	5.20	100.00
13	60	6.60	110.00
14	60	6.00	100.00
15	50	6.00	120.00
16	56	6.40	114.29
17	58	7.00	120.69
18	58	7.20	124.14
19	60	6.20	103.33

1102

113.0

Site No.	No. Harvesters	Start	Stop	Time (min)	Harvest min	Total hours	No Harvested
1	3	9.30	10.30	60	180	3.00	291
1	2	10.40	10.50	10	20	0.33	167
1	2	10.40	11.30	50	100	1.67	122
2	2	11.00	11.30	30	60	1.00	68
2	5	11.45	1.00	75	375	6.25	522

No Harvested	1102
No Harvested/hr	90
No Harvested/hr (site 1)	116
No Harvested/hr (site 2)	81

APPENDIX 3 SPECIFICATION SHEET SMOKED OYSTER AND BACON DIP

Gourmet Tasmanian Wild Harvest Oysters

Smoked Oyster and Bacon Dip

Gourmet Tasmanian Wild Harvest Oysters offer a new and exciting product range for even the most discerning pallet.

Ready to serve straight from the fridge Tas Marinated Seafood smoked oyster and bacon dip is ideal for a snack, antipasto platter or as an entrée for that important dinner party.

DESCRIPTION

Tasmanian Pacific oysters are harvested by hand from Tasmania's most pristine waters. Processed to export standards the oysters are baked in the shell to highlight their sweet and mild flavor. Cold smoked and blended with the finest Tasmanian bacon and cheese Tas Marinated Seafood smoked oyster and bacon dip is among the finest available.

All oysters are harvested and held on a registered shellfish lease for a minimum of 60 days in accordance with the **TASMANIAN SHELLFISH QUALITY ASSURANCE PROGRAM**

INGREDIENTS

Cream cheese, smoked Pacific oysters (*Crassostrea gigas*), bacon, salt, pepper, water added.

NUTRITIONAL INFORMATION

Composition of Pacific oyster meat	Per 100g
Energy	340kJ
Protein	9.5g
Total fat	2.3g
Saturated fat	0.5g
Sodium	106mg
Cholesterol	47mg
Omega-3	0.7g
Calories from fat	87.5kJ

STORAGE GUIDE

Keep chilled between 0-4°C.

PACKAGING

The product is available in plastic containers with tamper evident seals.

**APPENDIX 4 SPECIFICATION SHEET COLD SMOKED OYSTERS IN APPLE
CIDER VINEGAR**

Gourmet Tasmanian Wild Harvest Oysters

Cold Smoked Oysters

in

Apple Cider Vinegar

Gourmet Tasmanian Wild Harvest Oysters offer a new and exciting product range for even the most discerning pallet.

Ready to serve straight from the jar Tas Marinated Seafood oysters are ideal for a snack, antipasto platter or as an entrée for that important dinner party.

DESCRIPTION

Tasmanian Pacific oysters are harvested by hand from Tasmania's most pristine waters. Processed to export standards the oysters are baked in the shell to highlight their sweet and mild flavor. Cold smoked and marinated in Tasmanian made apple cider vinegar Gourmet Tasmanian Wild Harvest Oysters are among the finest available.

All oysters are harvested and held on a registered shellfish lease for a minimum of 60 days in accordance with the **TASMANIAN SHELLFISH QUALITY ASSURANCE PROGRAM**

INGREDIENTS

Smoked Pacific oysters (*Crassostrea gigas*), apple cider vinegar, sugar, salt, water added.

NUTRITIONAL INFORMATION

Composition of Pacific oyster meat	Per 100g
Energy	340kJ
Protein	9.5g
Total fat	2.3g
Saturated fat	0.5g
Sodium	106mg
Cholesterol	47mg
Omega-3	0.7g
Calories from fat	87.5kJ

STORAGE GUIDE

Keep chilled between 0-4°C.

SPECIFICATION

The product is available in 195ml glass containers with tamper evident seals.

PACKAGING

Pack configuration:
12 x 195ml quadra jars.
Labeled with gold lids.