

SEAFOOD SERVICES AUSTRALIA

**An Investigation into the Feasibility of
Producing Acceptable Prawn Stock
from the Discarded Heads of
Commercially Processed Prawns**

Final Report September 2001

Project Number 98/419



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98/419 An investigation into the feasibility of producing a commercially acceptable prawn stock from the discarded heads of commercially processed prawns.

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EXECUTIVE SUMMARY

A prototype prawn stock powder has been successfully developed using discarded commercially processed prawn heads. The development of the prawn stock powder has followed the stages set out in this project. A single strength liquid prawn stock was initially developed and then a powdered stock was achieved using pilot plant spray drying equipment. However this project was terminated at the client's request in writing on November 5th 2000 after numerous requests from the project leader for feedback on samples prepared at the Centre for Food Technology and then taken back to Japan for evaluation. Consequently no further work has been undertaken.

This report was submitted as a milestone report prior to termination of the project, and is released in the interests of disseminating the information to date to industry.

NON TECHNICAL SUMMARY

The Fisheries Research and Development Corporation project 98/419 'An Investigation into the feasibility of producing a commercially acceptable prawn stock from the discarded heads of commercially processed prawns' has successfully completed Objective 1, to develop a (prototype) prawn stock (liquid and powder) at the Centre for Food Technology from the discarded prawn heads of commercially processed prawn species *Penaeus monodon*.

Formulations of several prawn and seafood stocks were gathered from both Hiromi Ishikawa of Akebono Services and from a literature search. Hiromi Ishikawa owns a leading seafood restaurant in Japan and therefore has first hand knowledge of the food service industry and what chefs require for producing seafood stocks. Preliminary trials utilised the recipes gained from both Hiromi and the literature search to establish a starting formulation. The early development work identified the potency of the prawn flavour when extracted from the prawn heads, and also determined if there were any off flavours that developed from the prawn heads during processing.

Results from trials 1,2 and 3 indicated the combination of several fresh ingredients utilised in the formulations masked any unacceptable flavours produced during the manufacture of the prawn stock liquid. Some of these masking ingredients included tomato puree, carrots, onions, celery, lemon juice and white wine. The combined effect of these ingredients was a clean but mild tasting prawn flavour with no off flavours or odours.

The single strength liquid prawn stock produced from these early trials had minimal prawn flavour, was bland and had little potential as a seafood stock. The specifications of this liquid stock are 0.4% salt content (NaCl) and 6.9% solids.

The next set of trials attempted to boost the prawn flavour by evaporating the single strength liquid stock through heating to produce a concentrated stock with a solids content of around 35% and a salt level of 1.3%. The evaporation process was conducted on a bench scale using a Bucchi rotary evaporator. The prawn flavour of this concentrate was more potent than previous trials but still lacked the depth of a strong seafood flavour. Further trials were conducted which increased the ratio of prawn heads to water in the initial liquid stock. This aimed to increase the level of prawn flavour in the finished stock by providing more of the prawn heads from which flavour could be extracted during the simmering process. The amount of prawn heads added to the original stock is limited by the solid to liquid ratio required during the simmering process. If there is insufficient water to prawn heads in the initial stock the formulation will boil dry during the 2 hour simmering process which will cause burning and sticking of the product to the inside of the cooking vessel. The optimum ratio of prawn heads to water in the initial stock is 4Kg of prawn heads in 10Lt of water.

Through regular visits to Australia Hiromi Ishikawa provided valuable feedback as to the direction of the prawn stock. Hiromi indicated that a powder would be the ideal form of the product for use in Japan. This would provide ease of use for the chefs in the restaurant trade for applications in soups, stocks and sauces. Hiromi also specified the powder to be made of only natural ingredients and be free of any added flavours or flavour enhancers. Chefs in Japan are currently using similar type powders (artificially flavoured) to boost the seafood taste in authentic Japanese dishes. A spray dried version of a prawn stock would reduce transport costs to Japan (not transporting water) and also give the product a potentially longer shelf life over its liquid counterpart.

Initial spray drying trials using a Niro Mobile Minor spray drier were conducted on the most acceptable liquid prawn stock concentrate. The finished powder contained 0.6% moisture and 20.3% salt. The overall flavour of this powder has a pleasant, moderate, clean tasting prawn flavour with a salty background. The prawn stock powder produced from this last trial was sent to Hiromi Ishikawa in Japan (December 1999) for assessment by head chefs.

The prototype prawn stock powder produced from this project has no added flavours or flavour enhancers. The formulation used prawn heads and all natural ingredients only such as vegetables, tomato puree and salt s per the client's request. The prototype spray dried prawn powder has a moderate seafood flavour, an excellent light brown or mustard colour and dissolves well in hot water.

Despite the advantages of the prototype prawn stock powder having no added flavours, this restriction has prevented a more potent and concentrated powder being produced. In its present form the prawn stock powder would require usage levels higher than those used in the commercially available seafood stocks. The potency of the commercial stocks is due to the use of flavour enhancers.

The raw prawn heads even when used at the highest possible level in the liquid stock (28%) do not produce a strong or potent prawn flavour in the finished powder. Further prototype development may be required to reformulate the current stock through the addition of flavour enhancers to boost the prawn flavour intensity depending on feedback from the Japanese chefs. However if the natural, additive free prawn powder in its current format is deemed acceptable then production trials and shelf life trials as stated in objectives 2,3,4,5 and 6 will be conducted.

DISCARDED RAW PRAWN HEADS OF THE COMMERCIALY PROCESSED PRAWN SPECIES *PENAEUS MONODON*.



SAMPLE OF PROTOTYPE SPRAY DRIED PRAWN STOCK POWDER



BACKGROUND

This project was initiated after several meetings with a Japanese seafood importer who indicated an interest in marketing a prawn stock from the heads of aquaculture black tiger prawns (*Penaeus monodon*). The importer Mrs. Hiromi Ishikawa, is a director of Akebono Services, which is a medium sized seafood wholesaler/distributor in Tokyo. Mrs Ishikawa also owns a leading seafood restaurant. Akebono Services is affiliated with the Nichiro Group, one of Japans leading seafood companies and has a long history of purchasing quality Australian seafood from establishments such as A. Raptis & Sons Pty Ltd, Karasumi Australia, Gold Coast Marine hatcheries and Emery & Lux. A part of Akebono Services run by Mrs Ishikawa imports and distributes a range of speciality foods throughout Tokyo specifically to restaurants. Initially Akebono Services wishes to utilise the heads from black tiger prawns they purchase throughout SE Queensland. The estimated volume of black tiger prawns for 1999 year is 12 to 15 tonnes.

Several seafood processors within the SE QLD region (A.Raptis & Sons Pty Ltd, Rock Oysters and Fish Factory Pty Ltd, Global Seafood Pty Ltd, Moreton Bay Seafood Pty Ltd, Morgan's Seafood, NKR Trading, and Markwell Bait suppliers) were sent questionnaires regarding the processed prawn species and the cost associated with disposal of the prawn heads. The responses indicated that the Endeavour, Gulf Tiger, Gulf Banana and Black Tiger produced the highest volume of waste material (listed in descending order by volume). The questionnaire also asked processors to estimate the costs associated with removing discarded prawn heads. All processors producing more than 20 tonnes of prawns into tails, cutlets or meat estimated a cost between \$5000 and \$20000 per annum. Smaller processors estimated disposal costs up to \$5000 per annum.

Several companies have investigated markets for prawn heads. A Raptis & Sons Pty Ltd in Adelaide found a small market in Japan shipping container loads in 1996 and 1997 at a sale price around the \$1 US per Kg. In 1994/95 they investigated and developed a prawn flavoured stock for use in the pet food industry but did not continue production the following year. Global Seafood Pty Ltd were supplying a silage processor at no cost in 1996 but have been disposing of product in their refuge since. Moreton Bay Seafood Pty Ltd found a small market in Sydney for frozen boxed prawn heads at a sale price \$1.50 AUD per kg. They also sold some prawn waste at 50 cents per kg in bulk to local silage processors. Moreton Bay Seafood has had no market for their prawn heads throughout 1998.

All the seafood processors were keenly interested in seeing a potential market developed for a costly waste product. Several of the processors indicated their interest in becoming involved with the investigation, offering assistance with the supply of raw material.

Additionally P&O Prepared Foods Pty Ltd, Brisbane (now Eurest Australia Pty Ltd) have indicated an interest in trial manufacturing the stock as it is similar to products they presently produce for both the domestic and Asian markets. P& O Prepared Foods will prepare costings on the production of the stock, initial estimate of direct labour to produce single strength stock is \$0.24 per litre, and if the product is deemed feasible make available equipment and personnel for production trials to produce test market samples.

NEED

There is a major benefit both to the fishing and aquaculture industry through better utilisation of prawn waste as a generally discarded seafood waste may be used to produce a value-added product. This will benefit prawn processors by reducing the costly expense of disposing of processing waste and assist in waste management and potentially develop a new market for unwanted material. Presently only small quantities of prawn heads are utilised in further processing, being sold for little or no profit. Generally prawn heads are regarded as an expense to the processor. This expense is increasing as greater pressure is being placed on manufacturers with regards to the disposal of biological waste.

This project will allow processors to investigate an additional product to manufacture without the additional costs of product development. It will also give manufacturers access to detailed technical information on the processing requirements for producing a prawn stock as well as the information on the export market and the domestic market potential. The success of this project is aimed at generating interest in the utilisation of prawn waste into value added food products.

PROJECT OBJECTIVES

1. To develop a (prototype) prawn stock (liquid and powder) at the Centre for Food Technology from the discarded prawn heads of commercially processed prawn species *Penaeus monodon*.
2. To evaluate suitable forms of packaging for the prototype stock. eg UHT (fibreboard plastic), canned (retorted) and plastic bags (fresh/frozen).
3. To conduct pilot scale trials and production trials.
4. To determine the shelf life of the stock produced from processing trials.
5. To evaluate the potential of other species of prawn for use as raw material in the prawn stock.
6. To test market prawn stock samples in Japan and/or domestically if product is not suitable for Japan.

METHODOLOGY

Stage 1: Background Information

Step 1: Conduct literature searches to obtain information on

- a) stock manufacturing processes
- b) previous research on prawn and seafood stock processing
- c) prawn stock recipes
- d) packaging/processing systems
- e) limitations/legal constraints of the products through investigation of the Australian New Zealand Food Standards code.

Step 2: Source and evaluate any commercially produced prawn stocks.

Source and evaluate a range of prawn stocks produced by caterers.
Investigation of current retail stock products.

Step 3: Concept development – for potential retail products.

Chef survey – for potential for wholesale

Stage 2: Prototype development and trials

Step 1: Development of prototype

The development of the stock will be conducted in the laboratory and in the pilot plant at the Centre for Food Technology;

- (a) Trial will include assessing the different raw material quality and preparation requirements for processing.
- (b) Assessment of prawn stock characteristics
- (c) Formulation development to produce a single strength stock.

Step 2: Processing trials to evaluate quality characteristics of the prawn stock and to produce shelf stable (liquid and powder) and frozen products for further evaluation

Stage 3: Product evaluation

Step 1: Prototype evaluation by Japanese partner.

This will involve the transport of samples to Japan for evaluation by Akebono Services who will distribute the samples to selected restaurants with questionnaires using a hedonic scale system.

Step 2: Prototype evaluation for domestic acceptability.

This will involve samples being sent to a number of restaurants situated in S.E. Queensland with questionnaires using a hedonic scales system.

The results from the prototype evaluations may indicate that fine-tuning of the product is required. Reformulation work will be undertaken as part of this development project.

Step 3: Source a manufacturer that will undertake production trials.

P&O Prepared Foods have indicated that they may assist in these production trials

Stage 4: Production Trial

Step 1: Development of process procedure.

Step 2: Up-scaling of bench development to full production trial under normal processing environment.

Step 3: Assessment of production sample against prototype.

Step 4: Documentation of the manufacturing procedures, HACCP.

Stage 5: Shelf life Evaluation using production trial samples.

Using samples from the production trials, the shelf life will be assessed on thawed product held under chilled conditions.

Analysis will include SPC, Yeast, Moulds, pH, salinity and sensory evaluations as well as tests required by the food orders to permit exportation of the product.

Stage 6: Evaluation of Endeavour, Gulf Tiger and Gulf Banana prawns for suitability in prawn stocks.

Development of prototypes from suitable species.

Stage 7: Final Report

This will include all the technical and relevant information required for the development of this product.

RESULTS AND DISCUSSION

Stage 1

Step 1

The library at the Centre for Food Technology conducted an extensive search and identified several recipes and starting formulations for a seafood stock. Appendix 3 lists some of these recipes and associated processing methods.

At the first meeting between The Centre for Food Technology and Hiromi Ishikawa of Akebono services a traditional Japanese recipe for a prawn stock was provided.

Canola Oil	60ml
Onion	250g
Celery	60g
Carrot	120g
Bay Leaf	1
Tomato Puree	1000g
Prawn Heads	500g
White Wine	100g
Water	2000ml

Method:

Fry prawn heads in the oil on high heat. Add the white wine and remove the prawn heads from the pan. Fry the vegetables in a little oil and add back the prawns. Then add the water and the tomato. Simmer for minimum of 1 hour. Sieve out the prawn heads and the vegetables to leave the single strength prawn stock.

Stage 1**Step 2**

The next stage of the project was to source commercially available prawn or seafood stocks. A list of several of these are shown in the table on the next page.

Table 1: Commercial Samples of Seafood Stocks and Powders

Brand	WT	Packaging	Liquid or Powder	Ingredients	Cost
Campbells Fish Stock	375g	Tetra Pack	liquid	Fish Broth, White Wine, Salt, Lemon Juice, Sugar, Spices.	\$1.29
Maggi Fish Stock	120g	Glass Jar	Granulated Powder	Salt, Fish Powder, Flavour Enhancers (621,631,627), Flavouring, Sugar, Vegetable Fat, Corn Starch, Spices.	\$2.15
Maggi Shrimp Paste	120g	Glass Jar	Granulated Powder	Shrimp Powder, Salt, Sugar, Corn Starch, Vegetable Fat, Spices, Flavour Enhancers (621,631,627), Flavouring, Vegetable Gum (412), Colour (caramel).	\$2.15
Knorr Won Ton Soup Mix	227g	Ring Pull Can	Powder	Salt, Flavour Enhancers, Flounder Fish Powder, Cooked Pork Meat Powder, Sugar, Cornstarch, Flavourings, Maltodextrin, Yeast Powder, Chicken Fat, Soy Sauce Powder, White Pepper, Citric Acid, Colourings.	\$7.50
Knorr Ikan Bilis Stock Cube	20g	Foil wrapped cube in cardboard box.	Stock Cube	Salt, Ikan Bilis, MSG, Hydrogenated Palm Fat, Sugar, Palm Oein, Hydrolysed Vegetable Protein, Cornstarch, Yeast Extract, Onion, Pepper, Spices, Sodium Inosinate and guanylate.	\$0.50
Ajinomoto Bonito type soup stock	65g	Glass Jar	Granulated Powder	Salt, MSG, Dried Bonito Powder, Lactose, Sugar, Disodium Inosonate, Hydrolyzed Vegetable Protein, Tangle Extract.	\$5.25

Table 2: Sensory Evaluation of Commercially Available Seafood Stocks

Campbells Fish Stock	Not very salty, Mild fish taste, Milky appearance
Maggi Fish Stock	Strong fish flavour, Quite salty, Off white, milky in appearance.
Maggi Shrimp Paste	Beefier, muddy taste, Not as fishy, Quite salty, Dark brown in colour.
Knorr Won Ton Soup Mix	Flavour good, Not fishy, Well rounded soup base flavour, Clear, light brown appearance.
Knorr Ikan Bilis Stock Cube	Strong fish flavour, Very salty, off white, milky appearance
Ajinomoto Bonito type Soup stock	Watery taste, strong fish background, low salt, Clear, light brown appearance.

NB: Powdered stocks made up 10g into 500ml.

Table 3: Chemical Analysis of Commercially available Seafood Stocks

	Salt (%)	Solids (%)
Maggi Fish Stock	40.1	2.27
Maggi Shrimp Paste	29.4	2.14
Knorr Won Ton Soup Mix	41.5	1.50
Ikan Balis Stock Cube	38.8	6.56
Ajinomoto soup stock	33.8	2.95

Stage 2

Step 1

To begin the development of the prawn stock prototype a bench scale method was developed to assess several different recipes. The first trial was based on the recipe provided by Hiromi Ishakawa as shown on page and used the method described below: This recipe uses the combination of several vegetables and the tomato puree to mask the muddy or dirty type flavours often associated with aquaculture prawns.

- Frozen prawn heads thawed overnight at 0°C.
- Fry prawn heads on high heat with a little oil in a steam jacketed kettle. (until they have turned pink in colour)
- Add white wine and remove prawn head from kettle.
- Dice the vegetables through a food processor
- Fry vegetable with a little oil.
- Add back the prawn heads, water, tomato paste, and bay leaf,
- Simmer for 1 hour
- Sieve out prawn heads and vegetables and collect the stock only.

Table 4: Specifications of Single Strength Liquid Prawn Stock

Characteristics	
Salt	0.4%
Degrees Brix	8°
Solids	6.85%
Flavour	Mild prawn taste, very low salt taste, No off flavours, strong tomato flavour.

Trials 3A – 3D further developed the flavour of the prawn stock by varying the quantities and types ingredients used in the stock.

Table 5: Prawn Stock Trial Formulations

Ingredients	Trial 3A	Trial 3B	Trial 3C	Trial 3D
Prawn Heads	500g	500g	500g	500g
Carrot	-	120g	120g	120g
Onion	-	250g	250g	250g
Celery	-	60g	60g	60g
Bay Leaves	-	-	1	1
Tomato Puree	-	250g	250g	-
White Wine	-	-	100ml	100ml
Salt	15g	15g	15g	15g
Brandy	-	100ml	-	-
Lemon Juice	-	-	80ml	-
Peppercorns	-	-	12	-
Water	2350ml	2250ml	2200ml	2500ml

Table 6: Sensory Evaluation of Prawn Stock Trials 3A-3D

Trial No.	Salt Content (%)	Sensory Characteristics	Overall Acceptability
3A	1.4%	Muddy taste, strong prawn flavour, Black in colour	Poor
3B	1.3%	Unpleasant aftertaste, colour is dark orange/brown,	Poor
3C	1.1%	Mild prawn flavour, dark orange/brown in colour,	Good
3D	1.3%	Mild prawn flavour, colour very dark brown/black.	Poor

Overall, trials 3A –3D lacked prawn flavour intensity and aroma. The low salt level also meant the stock was bland to taste.

In order to concentrate and intensify the prawn and salt flavour in the stock, the same recipe as 3C was made and evaporated further in a rotary evaporator to increase the solids content.

After reduction of the single strength stock (8°Brix) for 50 minutes in a Buchi Rotary Evaporator (85°C water bath temperature) the stock became very dark in colour, had a thick consistency and was approximately 35% Solids. This concentrated stock had a stronger prawn flavour but had an unappealing colour and consistency. The next step was to turn this concentrate into a powder, which would be both, easy to use and visually appealing.

The flavour perception of the stock concentrate was that the prawn flavour was still lacking. To intensify this further without adding flavours and flavour enhancers a trial was conducted which increased the ratio of prawn heads to water in the original recipe. The simmering time was also increased from 1 hour to 2 hours to further extract the natural flavours from the prawn heads.

Table 7: Prawn Stock Formulation for Trial 5

Ingredients	TRIAL 5
Prawn Heads	1500g
Carrot Slice (fresh)	250g
Onion Slice (fresh)	500g
Celery Slice (fresh)	125g
Bay Leaves	2
Tomato Puree	400g
Tomato Paste	50g
White Wine	200ml
Salt	30g
Lemon Juice	200ml
Whole Black Peppercorns	5g
Water	3000ml

Method for Trial 5.

1. Fry defrosted prawn heads on high heat in the small kettle until they turn pink.
2. Add white wine and let the alcohol flash off.
3. Remove prawns and any liquid from kettle. (put aside)
4. Add pre diced vegetables to kettle and fry for a few minutes with 100ml of the water.
5. Add the remainder of the water
6. Add remaining ingredients.
(peppercorns, lemon juice, salt, bay leaves, tomato paste & puree)
7. Add prawn heads back to the kettle.
8. Simmer and reduce stock for 2 hr.
9. Remove prawn heads and any vegetables manually.

10. Pass stock through brush finisher (coarse & fine screen)
11. Rinse out kettle and return screened stock to kettle.
12. Continue reducing stock until a Brix of approx. 25-30° is reached.

To simulate the spray drying process and to gauge the intensity of the prawn flavour in a powdered form, a small amount of the concentrated stock from above was dried in a vacuum drying oven at 70°C for 10 hours. Large pieces of dried stock were then ground in a coffee grinder to produce a fine powder.

Table 8: Specification of Dried Prawn Stock (vacuum oven dried)

Colour	Dark brown, chocolate colour
Moisture	11.4%
Salt	11.3%
Flavour*	Mild prawn aroma and flavour, no off flavours.

*NB: 5g of powdered stock dissolved in 250ml of hot water.

To develop this product further a pilot scale spray drier was utilised to produce a prawn stock powder similar to a commercial product. A Niro Mobile Minor spray drier situated at Food Science Australia at Cannon Hill, Brisbane was used.

Trial 8 used a larger batch quantity so that a larger amount of the concentrate would be available for spray drying. Once again the ratio of prawn heads to water was increased, as was the salt level to try to strengthen the prawn flavour extracted from the prawn heads.

Table 9: Prawn Stock Formulation of trial 7

Ingredients	Trial 7D
Prawn Heads	4000g
Carrot Slice (fresh)	500g
Onion Slice (fresh)	1000g
Celery Slice (fresh)	250g
Bay Leaves	6g
Tomato Puree (canned)	800g
White Wine	400g
Salt	140g
Lemon Juice	400g
Whole Black Peppercorns	10g
Water	10000g

Method

- 1: Fry defrosted prawn heads and fresh vegetables on high heat in the steam kettle.
(prawns will turn pink when ready)
- 2: Add white wine and let the alcohol flash off.
- 3: Add the water
- 4: Add remaining ingredients. (peppercorns, lemon juice, salt, bay leaves, tomato paste & puree)
- 5: Simmer and reduce stock for 2 hours.
- 6: Remove prawn heads and any vegetables manually.
- 7: Pass stock through brush finisher twice (fine screen)
- 8: Place screened stock into a large saucepan.
- 9: Continue reducing stock until a Brix of approx. 20° is reached.

The concentrated liquid stock from trial 8 was spray dried using the Niro Mobile Minor spray drier under the following processing conditions:

- The stock was preheated in a water bath at 70°C.
- Spray drier inlet Temperature 175°C
- Outlet Temperature 65°C
- Flow Rate 40ml per minute.

Table 10: Specifications of Dried Prawn Stock (Niro spray drier)

Colour	Excellent, light brown/mustard colour
Salt	20.3%
Moisture	0.64%
Flavour*	Moderate prawn flavour, quite salty, no off odours or flavours.

*NB: 5g of powdered stock dissolved in 250ml of hot water.

The most recent samples produced from trial 8 were packed and sent to Hiromi Ishakawa in Japan for feedback and comments. Hiromi intended to test the prawn stock powder with several top class chefs in Japan who will utilise the prawn powder in authentic Japanese menu applications.

The most difficult issue in this project has been the attempt to intensify the prawn flavour in the stock without the use of flavours and flavour enhancers. This has meant the use of only natural ingredients and hence the prawn flavour has not been as potent in the final powder as anticipated.

This project has to this point extracted the best possible prawn flavour from the prawn heads without the use of flavours and flavour enhancers. The prawn flavour produced is only moderate, however the flavour has been increased through the addition of salt, which adds to the overall flavour profile of the powder.

Feedback on the acceptability of the current prawn stock powder from the chefs in Japan and their comments will direct the project to the next development stage. The powder may require further work, which will include development of the stock to boost the prawn flavour. If the prawn stock powder receives a favourable response then a production scale batch will be manufactured in the next stage of the project. The shelf life of the powder will then be determined from these trials.

CONCLUSION

A prototype prawn stock powder report has been successfully developed using discarded commercially processed prawn heads. The development of the prawn stock powder has followed the stages as set down in this project in the methods on pages 7 and 8. Initially a single strength liquid prawn stock was developed through the manufacture of several trial batches developing the flavour of the stock through changes to both the quantity and type of ingredients used in the formulations. Some of these ingredients included carrots, onions, celery, tomato puree, lemon juice and white wine. The final prototype formulation is shown below:

Table 11: Prototype Prawn Stock Formulation

Ingredients	%
Prawn Heads	22.9%g
Carrot Slice (fresh)	2.9%
Onion Slice (fresh)	5.7%
Celery Slice (fresh)	1.4%
Bay Leaves	0.04%
Tomato Puree (canned)	4.6%
White Wine	2.3%
Salt	0.8%
Lemon Juice	2.3%
Whole Black Peppercorns	0.06%g
Water	57.0%

The aim of this formulation development was to mask the muddy or dirty flavours often associated with aquaculture prawns after boiling to produce a stock. Through the process of evaporation (open evaporation using steam jacketed kettles), the liquid prawn stock is reduced to produce a concentrated extract which is approximately 35% solids. The stock concentrate is then spray dried to produce a very fine textured, mustard brown coloured powder that has a moderate prawn/seafood flavour with no off odours or flavours. The final stock powder has moisture content of 0.64% and a salt content of 20.3%

Preliminary feedback from several Japanese markets is currently under way to determine the overall acceptability and useability of the prawn stock powder concept in traditional oriental recipes.

STATUS: COMPLETE

This project was terminated at the client's request in writing on November 5th 2000 after numerous requests from the project leader for feedback on samples prepared at the Centre for Food Technology and then taken back to Japan for evaluation. Consequently no further work has been undertaken.

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APPENDIX 1: PROJECT STAFF

The principal investigator of this project would like to thank the following people for their invaluable assistance on this project:

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APPENDIX 2: INGREDIENT SUPPLIERS

Fresh Vegetables	Tamara Foods 82-84 Redland Bay Road Capalaba, Qld 4157 Ph 07 3390 2185
Spices (Bay leaves, Peppercorns)	Heinmann Foodmaker Group 29-41 Lysaght Street Acacia Ridge, Qld 4110 Ph 07 3216 9886
Lemon Juice Concentrate	Orchy Fruit Juices Pty Ltd 67 Kinross Road Thornlands, Qld 4164 Ph 07 3206 4152
Tomato products	SPC 606 Sherwood Road Sherwood, Qld 4075 Ph 07 3379 3722
Salt	Cheetham Salt Pty Ltd 30 Bellrick Street Acacia Ridge, Qld 4110 Ph 07 3344 4022
White wine	Southcorp Wines Pty Ltd 129 Kerry Road Archerfield, Qld 4108 Ph 07 3259 1400

APPENDIX 3: LITERATURE SEARCH

Prawn and Seafood stock recipes from the literature search.

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FISH STOCKS

Any white fish or shellfish trimmings can be made into a rich stock, which is indispensable when making soups, sauces, and stews. When the fishmonger is cleaning your purchase, ask him for the head and backbone. If you are buying fillets, get him to add 1 or 2 large fish heads—those of snapper, bream, mullet, Murray cod, and gurnard make excellent stock. Stock can be kept in an airtight container in the refrigerator for up to a week, or successfully frozen. For this purpose reduce the stock to a concentrated liquid to save storage space.

Fish Stock 1

1 kilo fish heads and trimmings
1 onion, chopped
2 leeks, sliced
3 sticks celery, chopped
1 teaspoon lemon rind
3 cloves garlic, crushed

bouquet garni consisting of a sprig of parsley, 2 bay leaves, sprig of tarragon (optional), sprig of thyme
8 black peppercorns
2 tablespoons dry sherry
1 glass white wine
1 litre water

Place all the ingredients in a large saucepan, bring to the boil. Simmer for 1 hour, then strain through a fine sieve or muslin.

Fish Stock 2

1 kilo white fish trimmings
1 cup onion, chopped
 $\frac{1}{2}$ cup parsley, chopped with stalks
 $\frac{1}{2}$ cup mushroom, chopped with stalks
1 cup white wine

2 tablespoons lemon juice
2 bay leaves
6 peppercorns
1 litre of water

Place all the ingredients in a large saucepan, bring to the boil and simmer for 1 hour. Strain through a fine sieve or muslin.

Fish Stock 3

500 gms fish or shellfish trimmings
bouquet garni
1 onion, chopped
2 sticks celery, chopped

1 large carrot, chopped
1 litre water
salt and freshly milled pepper

Simmer the ingredients in a large saucepan for 30 minutes to reduce by $\frac{1}{3}$, strain through a sieve or muslin.



MURES FISH TALES

BASIC FISH STOCK OR FUMET

Some people may not like the idea of making their own fish stock as it entails boiling up fish heads, trimmings and bones. Quite a lot of good fishmongers now stock either frozen or pasteurised fumets which are excellent. However, for the purist or for those who cannot buy fumet, here is the recipe.

1 kg fish heads and bones (we use trevalla)	6 parsley stalks
1 large onion	1 bay leaf
2 carrots	6 peppercorns
1 stick celery	water to cover (approx 1.5 L)

Put all ingredients into a large pot. Bring to the boil. Simmer for 20 minutes skimming the surface several times. Strain and reduce the stock to one litre. *Do not boil the bones for longer than 20 minutes or they will sour the stock.*



PRAWN BISQUE

If available the smaller cheaper prawns, such as endeavours or royal reds, are suitable for this dish. Brandy is an essential ingredient and makes this a dinner party soup to be proud of.

(for 6)	60 g butter
500 g whole cooked prawns	60 g flour
1 onion peeled and roughly chopped	1 tbsp tomato paste
6 parsley stalks	200 mL milk
3 celery stalks	salt and pepper
1 bay leaf	30 mL brandy
600 mL fish stock	6 tbsp whipped cream
400 mL white wine	finely chopped parsley

Shell the prawns and put all shells into a large pan with stock, wine, parsley stalks, celery and bay leaf. Bring to boil and simmer for about 1 hour. Chop the prawn meat into bite size pieces then set to one side. Melt the butter in a saucepan, stir in the flour and cook for 2 minutes. Pour on the strained prawn shell stock and milk stirring vigorously and bring to the boil. Add the tomato paste and whisk until thoroughly mixed. Season and add the chopped prawn meat and brandy just before serving. Top each bowl of soup with a spoonful of whipped cream and dust with parsley.

S O U P S

SMOKY CHOWDER

We originally devised this recipe to use up damaged smoked fish fillets. It has become so popular now that we smoke trevally specifically for the soup. It is a gutsy, honest, heart-warming soup that makes an ideal meal for lunch.

(for 6)

<i>60 g butter</i>	<i>2 tbsp tomato paste</i>
<i>3 rashers rindless bacon finely chopped</i>	<i>1 x 425 g can tomatoes pureed</i>
<i>2 medium onions finely chopped</i>	<i>pinch saffron</i>
<i>3 stalks celery finely chopped</i>	<i>400 g smoked trevally</i>
<i>60 g flour</i>	<i>ground pepper</i>
<i>1 L fumet</i>	<i>6 tbsp cream</i>

Melt butter in a large pot over a moderate heat. Add bacon, onion, celery and cook gently without colouring for 10 minutes. Add flour and cook for a further 5 minutes. Heat fumet till nearly boiling and add to the large pot, stirring vigorously. Add tomato paste, tomato puree and saffron. Boil for 5 minutes and then lower temperature and simmer for a further 10 minutes. While the soup is cooking, skin and de-bone the smoked fish and chop into very small pieces. Stir fish into the chowder and bring to the boil. Season the soup, although it will probably need no salt. Simmer for 15 minutes before serving with a splash of cream on the top of each bowl.



GEORGE & JILL MONE

FISH AND SEAFOOD SOUPS

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Seafood soups form part of the cuisine in many countries; some soups, in fact, are so rich in seafood and vegetables that they are more like a stew. The best known of these is probably the French Bouillabaisse which is a mixture of different species of fish and shellfish cooked together in a large pot with onions, garlic and tomatoes.

The Spanish saute garlic, onion and tomatoes in olive oil then add fish or a variety of fish and let it all simmer until it is rich and thick; shellfish is sometimes added. Variations of this soup are also served in Italy, Greece and Portugal.

Chowder, the well known American version of fish soup-cum-stew has a base of potatoes and often the stock is made with milk. In southern parts of the United States, tomatoes are used instead of potatoes as thickening.

Bisque, served in many countries, is a rich creamy puree of shellfish and is light in colour. It is sometimes, however, prepared with tomatoes, giving it a richer colour and flavour.

Scandinavians serve mainly clear soups to which pieces of fish and vegetables are added. The stock is sometimes enriched by cream and thickened with egg yolks.

In Asia, clear soups with the addition of noodles and fish and often including abalone, squid or shellfish, are served.

FISH STOCKS:

Fish stock is the base of soups and sauces. It is made from the bones, heads and trimmings, with the exception of gills. It is quick to prepare and needs only a short cooking time 20-25 minutes — prolonged cooking will give a bitter flavour to the stock.

The stock can be made with plain water, water and wine, or water and lemon juice. Vegetables such as onions, carrots and celery are added together with bayleaves, peppercorns and a couple of cloves. No salt should be added until the stock is used in a recipe. Shells of crayfish, crab or prawns can be added to give extra flavour and richness to the stock, or a stock can be made with the shells only.

After the stock is strained and all solids discarded, it is ready to be used or frozen. The stock is usually reduced when required for sauces to give a stronger flavour.

FISH STOCK

head & bones of a medium fish
1 small onion, studded with 2 whole cloves
1 bay leaf
6 peppercorns
1 small carrot
celery tops (if available)

1. Place head and bones in a large saucepan together with remaining ingredients. Cover with cold water and bring to the boil. Simmer for 20 mins. Strain and use as needed.

To freeze: Place in small containers, cover and freeze.

Soups, Stews and Stocks

The traditional stock or court-bouillon used to poach fish and shellfish is one of the basic means of preparation that can turn a simple dish into a memorable and exceptional meal.

The prime ingredient for a vegetable stock used for poaching shellfish or as a basis for soups and stews is a bouquet garni, which is a bunch of herbs tied together with cotton; after simmering the bouquet garni is removed. The three main ingredients that make up a bouquet garni are a sprig of thyme, a small bunch of parsley and one or two bay leaves. But other herbs like oregano, chervil, tarragon, fennel and dill can be added to produce a stock that brings out the best of the particular shellfish. Lemon peel is also excellent in a bouquet garni.

Basic Court-Bouillon

bouquet garni

1 teaspoon crushed peppercorns

2 teaspoons salt

1 large onion, chopped

1 litre water

500 ml white wine

1 cup diced carrot

1 cup chopped celery and tops

1 teaspoon pickling spices

1 piece lemon rind

1 clove minced garlic

1 cup sliced leeks (if in season)

Combine all the ingredients in a large saucepan, cover and simmer for about 20 minutes. Strain through a sieve, forcing any excess liquid out of the vegetables.

Court-Bouillon Two

*The trimmings of shellfish or
fish heads and bones*

1 bunch leeks or 1 large sliced onion

bouquet garni

2 tablespoons lemon juice

1 large carrot diced

1 cup dry white wine

1 litre water

12 black peppercorns, crushed

2 teaspoons salt

1 fennel stalk

Combine all the ingredients in a large saucepan and simmer gently for 30 minutes. Strain through a fine sieve or cheesecloth.