SUPPORT FOR HARVESTING STRATEGY DEVELOPMENT FOR SOUTH AUSTRALIA'S LAKES AND COORONG FISHERY FOR PIPI (*DONAX DELTOIDES*)

Final report to the Fisheries Research and Development Corporation

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LIST OF ACRONYMS

CCA	Coorong Classified Area
DEWNR	Department of Water and Natural Resources
ESD	Ecologically Sustainable Development
FGM	Fishery Gross Margin
FRDC	Fisheries Research and Development Corporation
GPHA	Goolwa Pipi Harvester's Association
RIADF	Rural Industries Adjustment and Development Fund
LCF	Lakes and Coorong Fishery
LMS	Legal Minimum Size
MSC	Marine Stewardship Council
MSF	Marine Scale Fishery
PFWG	Pipi Fishery Working Group
PIRSA	Primary Industries and Regions South Australia
SARDI	South Australian Research and Development Institute
SASQAP	South Australian Shellfish Quality Assurance Program
SFA	Southern Fishermen's Association
TACC	Total Allowable Commercial Catch

1. NON-TECHNICAL SUMMARY

2008/008 Harvesting Strategy development for South Australia's Lakes and Coorong Fishery for pipi (*Donax deltoides*)

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OBJECTIVES:

1. Protect sustainability by developing an index of relative biomass for pipi/clam populations;
2. Identify key market requirements to maximise return from pipi fishery;
3. Identify available and other innovative management tools for pipi/clam fisheries;
4. Evaluate temporal closures as a management tool for the pipi fishery;
5. Develop and evaluate a method to provide catch and effort data with fine spatial resolution to the South Australian Research and Development Institute (SARDI) in an electronic form;
6. Develop biological performance Indicators for commercial pipi/clam fisheries;
7. Provide a harvesting strategy for pipi that is informed by information on market demand, market prices and relative abundance, distribution and reproductive development of pipi.

NON-TECHNICAL SUMMARY:

OUTCOMES ACHIEVED TO DATE

The project outputs have contributed to the following outcomes:

1. Evaluation of performance indicators for the pipi fishery based on (i) relative abundance, (ii) size structures and (iii) economic performance;
2. Development of a harvest strategy for the South Australian fishery for pipi that allows the resource to be exploited for maximum economic value, within the framework of sustainable exploitation;
3. Development of a harvest strategy for the South Australian fishery that provides the framework for setting the annual total allowable commercial catch (TACC);
4. Evaluation of temporal aspects of the fishery for pipi;
5. Improved catch and effort reporting that includes information on destination market and spatial distribution of catches/effort;
6. Development of a digital catch and effort reporting system that has fine spatial resolution that can be delivered to SARDI in digital format in real time;
7. Provision of market strategy options for the pipi fishery.

In 2007, the Australian Commonwealth Government introduced the *Commonwealth Fisheries Harvest Strategy: Policy and Guidelines*, which drove considerable advancement of harvest strategy development in Australian Commonwealth fisheries (Rayns 2007). Harvest strategies are also becoming increasingly common in Australian State administered fisheries i.e. Fisheries Research and Development Corporation (FRDC) project 2010/061 "National Guidelines to Develop Fishery Harvest Strategies". In South Australia, the *Fisheries Management Act 2007* requires a management plan to be developed for each fishery. Development of harvest strategies for all key species is a requirement of the management plans for fisheries in South Australia.

Pipi (*Donax deltoides*) is a key species in the multi-species Lakes and Coorong Fishery (LCF) in South Australia. The LCF currently has Marine Stewardship Council accreditation for this species. Annual catches of pipi comprised 50% and 41% of the total value of the fishery in 2008-09 and 2011-12, respectively (Knight and Tsolos 2012).

The primary outcome from this project was the development of performance indicators for a harvest strategy/plan for the LCF for pipi. The harvest strategy was

developed through the multi-stakeholder Pipi Fishery Working Group (PFWG), convened by Primary Industries and Regions South Australia- Fisheries and Aquaculture (PIRSA Fisheries and Aquaculture). The harvest strategy provides a framework for recommending the annual Total Allowable Commercial Catch (TACC) (Objective 7, Appendix 8). Decision rules in the harvest strategy use annual estimates of two biological performance indicators that were evaluated as part of this project (Objectives 1, 6): (i) fishery-independent relative biomass; and (ii) presence/absence of pre-recruits. Following from this, development of an index of relative biomass of pre-recruits began in 2013 as part of a collaborative project involving PIRSA, SARDI and the LCF for pipi. It is intended that once developed, the index of pre-recruits will replace the presence/absence of pre-recruits as an indicator for recruitment. An additional economic performance indicator, fishery gross margin (FGM), was developed by EconSearch and provides an estimate of economic performance of the fishery (EconSearch 2012b) (Objective 7).

In 2012, the harvest strategy for pipi and its associated performance indicators and decision rules were used to recommend the TACC for the 2012-13 pipi fishing season. The harvest strategy decision rules determined a TACC in the range of 400-500 t. The economic indicator (FGM) suggested that optimum market return was achieved at 400 t due to volume sensitivity of the market. Consequently, the TACC for 2012-13 was set at 400 t. In 2013, the harvest strategy for pipi was formally adopted to recommend the TACC of 450 t for 2013-14. The harvest strategy for pipi will be incorporated into the Management Plan for the LCF which is due for completion in 2014.

In 2009, pipi fishers suggested that there was potential to increase market return by fishing in the historically closed season from July to October. In order to evaluate the potential for winter-harvesting, individual fishers withheld quota from each of two pipi fishing seasons (2009-10 and 2010-11) to participate in winter-harvesting trials in 2010 and 2011. The first trial was restricted to 12 t, whilst the second trial of 32 t sought to test the market under higher catch levels consistent with commercial fishing. Market prices were found to be significantly higher in winter compared to the historical fishing season in both trials (Objectives 4, 2). The market for pipi was found to be sensitive to volume, particularly for the higher value, large size-class (>50 mm) of pipi.

Prior to the introduction of the TACC in 2007-08, the key management tools for the pipi fishery were the annual fishery closure from July to October and the Legal

Minimum Size (LMS) of 35 mm. In order to evaluate risks associated with fishing during the historical closed period several biological knowledge gaps were addressed (Objective 4): (i) size at maturity; (ii) intra-annual trends in gonad development; (iii) intra-annual trends in size distributions of pipi; and (iv) intra-annual trends in relative biomass of pipi. This study provided the first quantitative estimate of size at 50% (28 mm) and 95% maturity (32 mm) for pipi on Younghusband Peninsula which indicated that the LMS of 35 mm for pipi is conservative. Intra-annual trends in reproductive development indicated that gonad development occurs throughout winter-spring with spawning observed in October-November.

Spatially resolved estimates of relative biomass of pipi obtained during the winter-harvesting trials indicated that sufficient relative biomass of pipi was available for fishing at relatively low (12 t) and commercial (32 t) catch levels. Also, the winter-harvesting trials provided monthly size-frequency distributions which improved understanding of the timing of pre-recruit entry to the pipi population on Younghusband Peninsula.

Improvements to catch and effort reporting were made by incorporating additional information into the South Australian Inland Waters Catch and Effort Return for Goolwa Cockles (pipi) including: (i) spatial distribution of catches and effort (5 km blocks); (ii) destination markets; and (iii) levels of discarding. Additional information on the proportion of catches sent to the developing human consumption market and the traditional bait market is important because the markets prefer different size classes of pipi. Consequently, removal of different size classes of pipi for bait and human consumption markets may impact the stock differently. Information on destination markets of pipi from catch and effort reporting is available to improve annual estimates of FGM.

For each day fished, pipi fishers in South Australia are required to complete the South Australian Inland Waters Catch and Effort Return for Goolwa Cockles which provides catch/effort and research information to SARDI and the Catch and Disposal Record (CDR) which provides quota management information to PIRSA Fisheries and Aquaculture. An existing digital catch and effort acquisition system (Deckhand) was modified to accept the data required for SARDI research and the CDR data required by PIRSA. The system was trialled successfully during winter-harvesting in 2011 and demonstrated potential to improve catch and effort reporting by: (i) reducing duplication associated with two paper based catch reporting systems; (ii) providing accurate catch locations (latitude/longitude) compared to 5 km blocks; and

(iii) potentially allows catch and effort to be reported and stored in databases on the day of fishing (Objective 5; Appendix 4).

The information from this project, including that from the winter-harvesting trials, was used to inform a market strategy for the LCF for pipi which was developed by Ruello and Associates Pty. Ltd. The market strategy identified key market requirements that had the potential to maximise economic return from the fishery (Objectives 2, 7; Appendix 6). Following from this, Ridge Partners provided a framework for development of modified atmosphere packaging to improve marketing of pipi via a cooperative group (Objectives 2, 7; Appendix 7).

In summary, the key outcome of this project is support for a harvest strategy for pipi which will be incorporated into the Management Plan for the LCF. The annual TACC is determined using decision rules based on fishery-independent relative biomass, recruitment and economic performance of the fishery. The harvest strategy was used successfully to inform setting the TACC for the 2012-13 pipi fishing season and formally adopted in 2013-14. Additionally, the optimal fishing season was evaluated and key biological knowledge gaps were addressed with new information provided on size at maturity, intra-annual trends in reproductive development, relative biomass and recruitment. As an extension of this, industry, PIRSA Fisheries and Aquaculture and SARDI are working together to set the annual TACC for pipi over financial years, instead of calendar years, to accommodate management of individual fishery businesses.

KEYWORDS: surf calm; pipi; *Donax spp.;* Australia; reproduction; size at maturity; harvest strategy; fishing season; marketing; business development.

2. ACKNOWLEDGEMENTS

The project was funded by FRDC and was extended through an FRDC Tactical Research Fund with half of the funds contributed from FRDC and matching funds from the LCF and SARDI. SARDI also provided administrative support and access to library and laboratory facilities. We thank fishers of the LCF: Tom Robinson for his enthusiastic support and willingness to share his knowledge of markets; Roger Edwards (Chair: Goolwa Pipi Harvester's Association; GPHA) and Neil MacDonald (Chair: Lakes and Coorong Consultative Committee; LCCC) who provided support, advice and coordinated catch value information. In particular, Roger Edwards and Dr Julian Morison (EconSearch) developed the concept of FGM as an economic indicator for the fishery. Kevin Hoad, Darren Hoad, Rod Ayres and Greg Kessegian provided valuable advice and considerable in-kind support to get the project underway. Alice Fistr and Lianos Triantafilos of PIRSA Fisheries and Aquaculture provided advice in the project planning stage whilst Mark Spencer, James Bennett and Jonathan McPhail provided ongoing support. SARDI staff, Ben Martin, David Fleer, Juan Livore, Alex Ivey and Graham Hooper provided field and laboratory support. Zac Lewis helped to provide an estimate of size at maturity for pipi whilst on an internship supported by Victoria Department of Primary Industries (Fisheries) and SARDI.

Additional information was available from two linked projects: (i) a fishery-independent study of relative abundance, distribution and size structure of pipi, conducted by SARDI and funded by PIRSA (Fisheries and Aquaculture); and (ii) a Rural Industry Adjustment and Development funded project to investigate technologies for transporting pipi.

This report was reviewed by Drs Adrian Linnane and Ben Stobart (SARDI). The report was formally approved for release by Dr Tony Fowler (SARDI).

3. BACKGROUND

Pipi (*Donax deltoides*) are an important commercial and recreational bivalve species in Australia. They are harvested commercially in South Australia with smaller catches from New South Wales (Kailola et al. 1993). In South Australia, catches were greater than 1000 t.year^{-1} from 2001-02 to 2006-07 but declined steeply thereafter (Ferguson 2012). Similarly, catches from New South Wales ranged from 300 to 570 t.year^{-1} prior to 2005 then declined to less than 118 t in 2006-07 (ABARES 2005; 2009).

In South Australia, pipi are a key species in the multi-species Lakes and Coorong Fishery (LCF) that operates in the Lower Lakes, Coorong Lagoons and adjacent near-shore marine environment (Fig. 3-1). Annual catches of pipi had a peak value of $3.2 M in 2008-09 which comprised 50% of the total value of the fishery. In 2010-11, pipi catch value was $2.2 M which contributed 41% to the total value of the fishery (Knight and Tsolos 2012). The total value of pipi catches may be higher than that estimated by Knight and Tsolos (2012) when product sold to inter-state markets is taken into account (EconSearch 2011). The LCF for pipi was granted Marine Stewardship Council (MSC) accreditation in 2008 and underwent re-assessment in 2013.

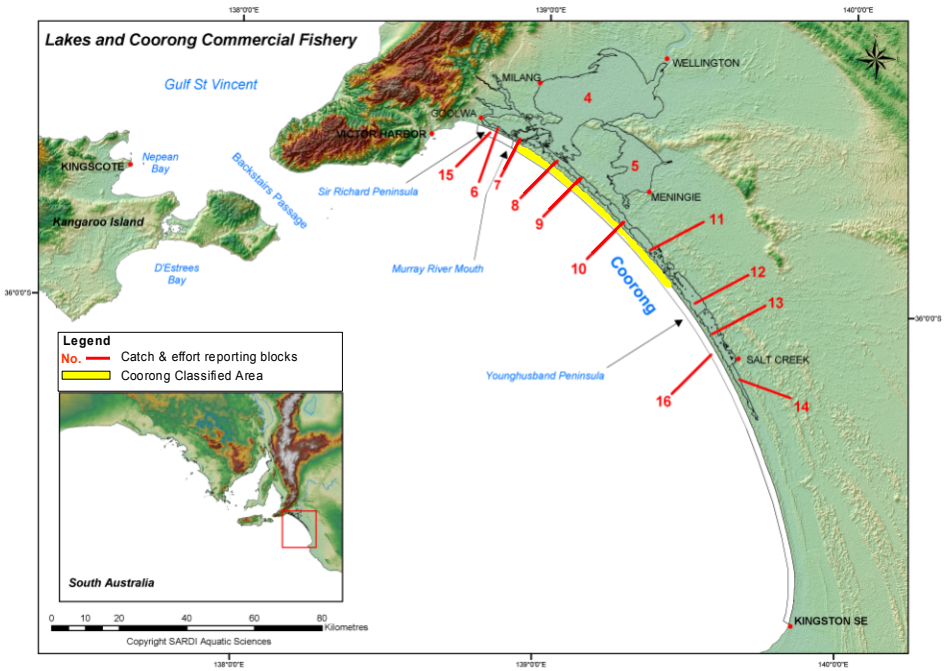

Figure 3-1. Map of South Australia (inset) showing the location of the Coorong region (red box). The main map shows the location of the fishery for pipi on Younghusband Peninsula including the Coorong Classified Area (yellow shading) from which pipi for human consumption must be taken. Numbers in red are fishery reporting blocks.

The LCF is governed by the *Fisheries Management Act 2007* which came into effect in December 2007, the *Fisheries Management (LCF) Regulations 2009* and the *Fisheries Management (General) Regulations 2007*. Under the *Fisheries Management Act 2007* a management plan is required for the LCF and is due in 2014. In order to achieve the aims of the management plan a harvest strategy is also required for each of the key species in the LCF, including pipi.

Prior to 2007, the LCF for pipi was managed through effort controls: (i) limited entry (29 licences in 2006); (ii) two agents per licence; (iii) one pipi rake per person; (iv) a legal minimum size (LMS) of 35 mm; and (v) a seasonal closure from 1 June to 31 October. Historically high annual catches and consistent decline in relative abundance (CPUE) from the mid-1990s until the mid-2000s suggested that the resource supporting the fishery for pipi was over-exploited (Ferguson and Mayfield 2006). The fishery moved to quota management at the start of the 2007-08 season and annual catches were restrained by the total allowable commercial catch (TACC) from 2009-10 onwards (Ferguson 2011).

Prior to 2007, the fishery performance indicators were based on catch and effort data: (i) total catch; (ii) catch per unit effort (CPUE; $kg.day^{-1}$); (iii) catch trend (slope of catch over three years); and (iv) CPUE trend (slope of CPUE over three years). Upper and lower reference limits for these performance indicators were prescribed in the Management Plan (Sloan 2005).

The primary aim of this project was to support development of a harvest strategy for the LCF for pipi. The aim of the harvest strategy is to provide a decision making framework for setting the annual TACC based on one or more suitable fishery performance indicators. Uncertainty around commercial CPUE as an estimate of relative abundance of pipis prompted development of a fishery-independent estimate of relative abundance (referred to as relative biomass in this report) which was achieved co-operatively between SARDI, PIRSA Fisheries and Aquaculture and the LCF for pipi (Ferguson and Mayfield 2006; Ward et al. 2010). Further evaluation of this index of relative biomass was required to assess its suitability to provide a fishery performance indicator for the harvest strategy. Additional fishery performance indicators that were considered were (i) presence/absence of pre-recruits in size structures and (ii) an indicator based on the economic performance of the fishery.

At a series of industry/government working group meetings during 2009 it was recognised that there was potential to maximise economic return by improving the timing of placement of pipi on the market to coincide with periods of highest market

demand. The potential for harvesting and marketing pipi during the historical winter fishery closure was investigated over two years and at two levels of catch.

This project also aimed to address knowledge gaps associated with the biology of pipi on Younghusband Peninsula: (i) improve understanding of intra-annual trends in reproductive development; (ii) provide a quantitative estimate of size at maturity; (iii) (iv) investigate intra-annual trends in size frequency distributions to better understand recruitment and growth; and (v) to determine if levels of relative biomass during winter were sufficient to support commercial harvesting.

The original project was extended with a Tactical Research Fund project with funds from industry and SARDI and an equal contribution from FRDC. The extension provided an investigation of inter-annual differences in reproductive biology, relative abundance and market demand/return. Additionally, the extended project aimed to improve fishery catch and effort reporting to allow monitoring of spatial trends in catches in addition to destination markets and rates of discarding. This included evaluation of a method for digital capture of catch and effort data on the day of fishing. The final part of the project was an independent study of the market supply-chain for pipi to identify options with potential to increase market value. Further work was done to provide a business development framework for the preferred option.

This project is related to the FRDC Project 2010/061 'Development of a National Harvest Strategy Framework' and also has linkages with several concurrent projects: (i) investigation of effectiveness of fishery-independent surveys of relative abundance and size structures of pipi (PIRSA Fisheries and Aquaculture/SARDI; Ward et al. 2010); (ii) Lakes and Coorong Pipi Fishery Gross Margin Model Development (EconSearch 2012b; 2013); (iii) evaluation of modified atmosphere packaging of pipi (*Donax deltoides*) for international markets (Rural Industries Adjustment and Development Fund/PIRSA; (Carragher 2010); (iv) "Value chain assessment and development of the pipi (*Donax deltoides*) fishery" (Anon 2010a); (v) a project to develop optimal modified atmosphere packaging for pipi (Innovation Voucher Program, Department of Further Education Employment Science and Technology); (vi) "Developing clam aquaculture in Australia: a feasibility study on culturing *Donax deltoides* and *Katylesia spp*. on intertidal and sub-tidal leases in South Australia" (FRDC/SARDI); and (vii) an investigation to assess the potential impacts of discharge of hyper-saline water on relative biomass of pipi on Younghusband Peninsula (DEWNR/SARDI) (Gorman et al. 2010).

4. NEED

Effective strategies for stock assessment and sustainable management have not been developed for surf clam fisheries. Following implementation of the *Fisheries Management (General) Regulations 2007,* development of a new management plan for the LCF is due for completion in 2014. A component of the new management plan is a harvest strategy for the pipi resource with appropriate decision rules for setting the annual TACC. The overall aim of such a harvest strategy is to maximise the economic value of the fishery whilst fishing at a sustainable catch level.

In order to develop the harvest strategy there was a need for an indicator of relative abundance. Due to concerns regarding uncertainty associated with the use of fishery CPUE to provide an index of relative abundance, a fishery-independent indicator was developed (referred to as "relative biomass" in this report; Ward et al. 2010). The suitability of potential fishery performance indicators including the fishery-independent estimate of relative biomass as a primary indicator of stock status required evaluation prior to development of decision rules for the harvest strategy. The need to evaluate secondary fishery performance indicators based on pre-recruits and economic performance of the fishery was also identified.

Pipi fishers identified the potential to maximise market return by fishing during the historically closed winter period (June to October) when market demand was potentially high. However, to achieve this required information on: (i) relative biomass during the historically unfished period; (ii) sizes of pipi available during the historically unfished period; and (iii) new information on market prices during this period.

In addition, the winter closure of the fishery for pipi provided a key management measure which was thought to protect pipi during the pre-spawning/spawning season. Consequently, there was a need to better understand the relationship of the winter closure and intra-annual trends in reproductive development. The LMS of 35 mm also provided an important management measure in the fishery for pipi. The LMS was based on an estimate of size at maturity (35 mm) from the early 1970s, but the method used to obtain this estimate is not known (King 1976). Consequently, a robust quantitative estimate of size at maturity based on appropriate sample sizes was required.

There was also a need for improved catch and effort reporting of pipi. All pipi catches were reported from a single fishery statistical block that included the entire 60 km fishing ground on Younghusband Peninsula. Consequently, there was a need for

improved spatial reporting of catch and effort. Such improved spatial reporting of catch was also identified as important for continued certification under the MSC. Additional monitoring of destination markets, search time and discarding was also requested by MSC. In addition to improved spatial resolution of catch and effort data an opportunity existed to address other potential areas of uncertainty by improved additional reporting on levels of discarding and destination markets.

Fishers highlighted duplication of fishery reporting when providing catch and effort information used by SARDI for research and catch information used by PIRSA Fisheries and Aquaculture for quota management. There was a need for a data acquisition system that simultaneously provided: (i) detailed records for the licence holder; (ii) research catch and effort information to SARDI; and (iii) Catch and Disposal Record (CDR) to PIRSA Fisheries and Aquaculture.

Finally, fishers identified a need for a marketing strategy and options for further business development for the pipi industry. Achieving this required an improved understanding of the Australian market for pipi.

5. OBJECTIVES

The overarching goal of this project was to address knowledge gaps relating to fisheries biology and markets for pipi (*Donax deltoides*) and to use this information to support the development of a harvesting strategy for the LCF for pipi.

There were 7 objectives:

1. Protect sustainability by developing an index of relative biomass for pipi/clam populations;
2. Identify key market requirements to maximise return from the pipi fishery;
3. Identify available and other innovative management tools for pipi/clam fisheries;
4. Evaluate temporal closures as a management tool for the pipi fishery;
5. Develop a method to provide catch and effort data with fine spatial resolution to SARDI in an electronic form;
6. Develop biological performance indicators for commercial pipi/clam fisheries;
7. Provide a harvesting strategy/plan for pipi that is informed by information on market demand, market prices and relative biomass and distribution of pipi and reproductive development of pipi.

6. METHODS

6.1 Fishery biology

6.1.1 Reproduction

Two aspects of the reproduction of pipi were examined: (i) intra-annual trends in gonad development; and (ii) size at sexual maturity.

Intra annual trends in gonad development

Samples of whole pipi were collected from Younghusband Peninsula on a monthly basis from March 2010 to November 2011 and were frozen and stored. For laboratory analysis, samples were thawed then fixed using formaldehyde (10% in seawater) for 24 hours and subsequently transferred to an ethanol solution (70% in seawater) prior to assessment of gonad development.

Assessment of gonad development of pipi followed a method used for mud cockles *Katelysia spp.,* (Gorman et al. 2011). The shell width of each pipi was measured to the nearest 0.1 mm and the whole formalin-fixed gonad and connective tissue removed from the shell. A transverse section was made between the top of the gonad and the foot margin. Individual sections were examined under a Leica MZ16 binocular microscope at 10x magnification and assigned a gonad score. Gonad scores were defined using a categorical scale from 1 to 5 (Edwards 1999; Gorman et al. 2011) that describes a qualitative series of developmental stages (Fig. 6-1; Table 6-1).

Figure 6-1. Developmental stages of pipi gonads: (1) no visible gonad; (2) gonad visible at visceral margin; (3) gonad extending from viscera into foot; (4) gonad fills foot and has grainy appearance; and (5) gonad extends to apex of foot.

Table 6-1. Criteria used to determine gonad development (after Edwards 1999; Gorman et al. 2010).

Gonad stage	Gonad condition
1	No gonad material visible (includes immature individuals)
2	Poorly developed A small amount of gonad material is evident on margins of the viscera Digestive gland completely uncovered upon external observation
3	Moderately developed Gonad material does not cover an extended area A proportion of the digestive gland is still visible upon external observation
4	Well developed Gonad material covers large area extending in to the foot Digestive gland completely covered upon external observation Gonad material 'oozes' out with the release of pressure when the body wall is broken Gonad appears 'grainy'; and white to cream in colour
5	Fully developed Digestive gland completely covered upon external observation Gonad material covers large area extending in to the apex of the foot Very tightly packed and body wall hard to touch Gonad appears 'grainy' throughout; white to cream in colour

Macroscopic assignment of gonad developmental stages was validated by comparison with stages assigned from histological preparations for a sub-set of pipi (n=27) following the methods of Herrmann et al. (2009a). Gonads for histological examination were prepared from transverse sections (6-7 µm thick) of gonad mounted on a microscope slide and stained with haematoxylin and eosin.

Size at sexual maturity

Separate size at maturity (SAM) estimates were obtained for pipi collected during the main reproductive period from September to November in 2010 and 2011. Non-linear regression was used to estimate $SAM_{50,95}$ (Farmer 2003).

$$P = \{1 + e^{[-Ln(19)(L-L_{50})(L_{95}-L_{50})]^{-1}}\}^{-1}$$

Where, P=proportion of individuals with developed gonads (stage ≥3), L_{50}=size at which 50% of individuals would be expected to have gonads at developmental stage

3 or greater, L_{95}=size at which 95% of individuals would be expected to have developed gonads.

6.1.2 Intra-annual trends in size distributions of pipi

Pipi size data were collected from Younghusband Peninsula (10 mm research nets) with the aim to better understand (i) timing of recruitment to the fishery and (ii) impacts of fishing outside the established fishing season (November to April). The surveys were conducted across the main fishing ground on the Younghusband Peninsula which extends from the mouth of the Murray River to a point 60 km south-east of the Murray River (Coorong Classified Area; CCA; Fig. 3-1).

Size frequency data for pipi on Younghusband Peninsula were available from pre-, mid- and post-season (October-November, February-March and April-May) surveys of the pipi resource conducted by SARDI, PIRSA and industry in 2009-10, 2010-11 and 2011-12 (Ward et al. 2010). In these surveys, research rakes (10 mm mesh) were used to collect pipi from each of 30 transect locations. Samples (n~100) were stored in labelled plastic bags and frozen for later laboratory analysis. In the laboratory, pipi were measured to the nearest 0.1 mm across the widest axis (width). Size frequency distributions were then generated for three 20 km sections of beach (Section A, 0 to ≤20 km; Section B, >20 to ≤40 km; Section C, >40 to ≤60 km from the mouth of the Murray River).

Additional monthly size frequency samples were collected using the same method and locations as in the pre-, mid- and post-season surveys (Ward et al. 2010). Samples were collected in June, July, September and October in 2010 and June, August and September in 2011.

6.1.3 Intra-annual trends in relative biomass of pipi

Annual estimates of fishery-independent relative biomass of pipi were available from surveys of the pipi resource conducted by SARDI, PIRSA and industry in 2007-08, 2008-09, 2009-10, 2010-11 and 2011-12. The annual estimates of relative biomass were obtained by aggregating data from pre-, mid- and post-season (October-November, February-March and April) surveys.

For annual estimates of relative biomass, the survey method followed that described in Ward et al. (2010). Thirty transects were located at fixed stations, 2 km apart, across the main fishing ground on Younghusband Peninsula from the mouth of the

Murray River to a point 60 km south-east of the Murray River. Each transect covered an area of 4.5 m^2 (3 m along the beach x 1.5 m across the beach).

Pipi were fished in each transect by commercial fishers using commercial pipi rakes with standardised 44 mm stretched mesh which was similar to that used by most commercial fishers and selected pipi above the LMS. The weight of each sample was measured to the nearest 100 g by a scientific observer using calibrated spring scales.

Prior to commencement of each survey, relative sampling efficiency was compared among fishers. Catch weights for each fisher were compared from five randomly selected sites with each fisher completing one transect from each site. Where significant differences among fishers were detected, efficiency corrections were applied to the data for that survey.

For each survey, the entire survey area (0 to 60 km from the Murray River) was sampled on two separate days. The estimate of relative biomass for a particular survey was the average of the combined data from all transects (n=30) from each of the two days (n=60). For annual estimates, relative biomass was pooled from the pre-, mid- and post-season surveys for that year (n=180).

On the second day of each survey, samples of pipi were collected to provide size frequency distributions. Modified pipi rakes with fine (10 mm stretched mesh) net were used to collect pipi from each transect location. To provide spatial comparison of size frequency distributions, the survey area (60 km) was divided into the three 20 km sections. Shell size (maximum shell width) of each pipi was measured to the nearest 0.01 mm using electronic callipers in the laboratory.

In addition to annual estimates of fishery-independent relative biomass further estimates were obtained as part of the winter-harvesting trial (this study) from June, July, September and October in 2010 and June, August and September in 2011. The surveys in this study differed by being conducted during one day instead of two days as used for the pre-, mid-, post-season surveys.

6.2 Improvement to fishery catch and effort reporting

Under the *Fisheries Management Act 2007,* licensed quota holders must supply catch data to PIRSA for quota management, as well as catch/effort and other data to SARDI for research. PIRSA require that licensed quota holder prior-report intention to fish by telephone and that pipi are moved from the fishing ground to the

processors/market using standard sized bags (20 kg) marked with a plastic tag bearing a unique number. For each fishing event, a CDR must be returned to PIRSA including: date; port of landing; time (start and finish of fishing); catch (kg) and tag numbers. Catch and effort data are also returned to SARDI via the South Australian Inland Waters Catch and Effort Return for Goolwa Cockles (pipi). Data returned are: date; effort (fisher days); effort (days); gear (number of rakes) and port of landing.

6.2.1 Modified catch and effort reporting logbook

The South Australian Inland Waters Catch and Effort Return for Goolwa Cockles (pipi) was modified to include additional information on: (i) time of fishing (am/pm); (ii) location of catch/effort (5 km blocks); (iii) search time (hours); (iv) disposal (personal bait use, bait market, human consumption, discarded); and (v) sea conditions (Appendix 3).

6.2.2 Evaluation of a digital method for catch and effort reporting

A version of the Deckhand system (Real Time Data Pty Ltd) was modified to accept data from the LCF for pipi including all data collected in the CDR forms and South Australian Inland Waters Catch and Effort Return for Goolwa Cockles. The modified system was tested during the winter-harvesting trial in 2011 with five fishers participating (Appendix 4).

6.3 Market information

6.3.1 Inter-annual trends in pipi price

Fishery catch data were available from 1984-85 to 2011-12. An estimate of the total value of the annual pipi production was also available based on per kg prices at the Adelaide Fish Market. Estimates of the total annual values of catches, adjusted for inter-state markets were available from 1984-85 to 2010-11.

6.3.2 Intra-annual trends in pipi price

Winter-harvesting trials were conducted during the fishery closure period (1 June to 31 October) in 2010 and 2011. In 2010, a pilot study was conducted to determine if pipi abundance on Younghusband Peninsula during June-October was sufficient to support small-scale commercial fishing (12 t). This was followed in 2011 with a second winter-harvesting trial at a level of catch consistent with commercial fishing during the pipi fishing season (November to May, 32 t).

The first winter-harvesting trial was conducted on the first three weeks of June, July, September and October, 2010 (Table 6-2). Six participating licence holders withheld a proportion of their individual quota totalling 12 t. During each month, fishing was spatially and temporally structured with one week of fishing in each of three sections of Younghusband Peninsula (Section A, 0 to ≤20 km; Section B, >20 to ≤40 km and Section C, >40 to ≤60 km from the mouth of the Murray River) (Table 6-2). The period from July 26 to September 10 was not fished.

Fisher catches were recorded by SARDI observers. Prior to removal from the fishing ground, each bag of pipi (20 kg) was secured with a research tag bearing a unique identification number. Information on destination markets and market prices were summarised and provided by GPHA.

Fishing during each survey week was conducted on Tuesdays to allow pipi to be processed and placed on the market the following Thursday. Product was delivered to Coorong Cockles, Port Elliot for processing. During processing pipi were purged of sand then packed for sale on the (i) Sydney Fish Market; (ii) Melbourne Fish Market; (iii) other domestic markets and (iv) an export market in Europe.

Table 6-2. Winter-harvesting of pipi during closed season. "X" marks location and time of fishing.

Week		Section A (0 to <20 km)	Section B (20 to <40 km)	Section C (40 to <60 km)
1	Jun 7 - 11	X		
2	Jun 14 - 18		X	
3	Jun 21 - 25			X
	Jun 28 – Jul 2	No sampling		
4	Jul 5 – 9	X		
5	Jul 12 -16		X	
6	Jul 19 - 23			X
	Jul 26 - 30	No sampling		
	Aug 2 - 6	"		
	Aug 9 - 13	"		
	Aug 16 - 17	"		
	Aug 23 - 27	"		
	Aug 30 – Sep 3	"		
	Sep 6 - 10	"		
7	Sep 13 - 17	X		
8	Sep 20 - 24		X	
9	Sep 27 – Oct 1			X
10	Oct 4 - 8	X		
11	Oct 11 - 15		X	
12	Oct 18-22			X

Prior to placement on the market, product was classified by size: small (35-41 mm); medium (42-49 mm); and large (50-59 mm). For product placed on the Sydney Fish

Market, prices were compared (i) among size classes and (ii) among size classes on different market days (Thursdays and Fridays).

The second winter-harvesting trial was conducted during the June-October fishery closure in 2011. Similar to the trial in 2010, eight participating licence holders withheld a proportion of their individual quota with an increased catch of 32 t. Unlike the trial in 2010, the timing and location of fishing was not restricted. Fishers recorded catch and destination market data on forms provided by SARDI (Appendix 5).

Pipi catches by fishers from the Goolwa Pipi Harvesting Association (GPHA), based in Goolwa, were delivered to Coorong Cockles, Port Elliot for processing. During processing pipi were purged of sand, graded into three size classes then packed for sale on (i) the Sydney Fish market, (ii) Melbourne Fish Market and (iii) other domestic markets. Pipi collected by members of the Southern Fishermen's Association (SFA) based in the southern Coorong were supplied to the Sydney Fish Market.

6.3.3 Market strategy for the LCF for pipi

Two studies of the Australian market for pipi were undertaken: (i) Ruello and Associates Pty. Ltd. provided a desktop study of the market for pipi and other bivalves in Australia and (ii) Ridge Partners provided a business development plan for the key opportunity identified in the study of Ruello and Associates Pty. Ltd.

The aim of the study by Ruello and Associates was to develop potential market strategies for the LCF for pipi. Options were to be assessed and ranked in terms of potential impacts including costs, potential returns, payback periods and likelihood of success. It was intended that the review also provide examples of strategies implemented by other sectors with similar structures and markets, which have led to improved returns.

The key output of the market strategy study was to provide options around: (i) supply management; (ii) supply chain structure; (iii) market development; and (iv) competition from imports. Other work available to this study included: (i) value chain assessment and development of the pipi fishery, Rural Industries Adjustment and Development Project (GPHA, 2010); (ii) economic indicators for the LCF 2010/11, (EconSearch 2012a); and (iii) the draft harvest strategy for pipi.

To achieve the project aims, this study included meetings with the key industry groups, GPHA and SFA, in addition to PIRSA Fisheries and Aquaculture and SARDI. Part of the industry research was conducted by interviewing individual licence

holders to gather additional industry information and to canvass strategy options. At the conclusion of the study a report was provided (Appendix 6) and a verbal presentation given to industry and government stakeholders.

The first objective of the study by Ridge Partners was to assess and compare the business case for value adding commercial pipi using either a new, standalone operation or an operation located in existing processing facility. The second objective was to develop a business framework which included investment, business structure and operations for the preferred value adding process.

The key outputs from the study by Ridge Partners were the viability assessment of the industry development options and a description of the recommended business and operational model including the industry collaboration model and the business case for the development, investment and operational structures for the value adding initiative. Detailed methods and results were provided in a report at the conclusion of the study (Appendix 7).

6.4 Development of fishery performance indicators

The Pipi Fishery Working Group (PFWG) was convened on 19 December 2011 and met throughout 2012 to develop the harvest strategy for the LCF for pipi. The PFWG comprised an independent chair (Richard Stevens) and representatives from SARDI, PIRSA Fisheries and Aquaculture, GPHA and SFA.

The PFWG evaluated several potential performance indicators for the harvest strategy. Information available to the PFWG for consideration included (i) estimates of fishery-independent relative biomass for the 2007-08, 2009-10, 2010-11 and 2011-12 pipi fishing seasons; (ii) size frequency distributions from pre-, mid- and post-season fishery-independent surveys (i.e. October-November, February-March, April-May) for 2007-09 to 2011-12; (iii) additional size frequency information collected during the winter trials in 2010 and 2011 (used to indicate the timing of recruitment); and (iv) economic information used to estimate fishery gross margin (FGM) (EconSearch 2012b).

7. RESULTS/DISCUSSION

7.1 Fishery biology

7.1.1 Reproduction

Intra-annual trends in gonad development

All pipi in March and April 2010 had undeveloped gonads. The proportion of pipi with developed gonads increased to approximately 20% in May then increased steeply to >75% in August-November (Fig. 7-1). Similarly in 2011, >75% of gonads were developed from July to November. Agreement (100%) between macroscopically determined gonad stages and those from histological sections validated the use of macroscopic staging.

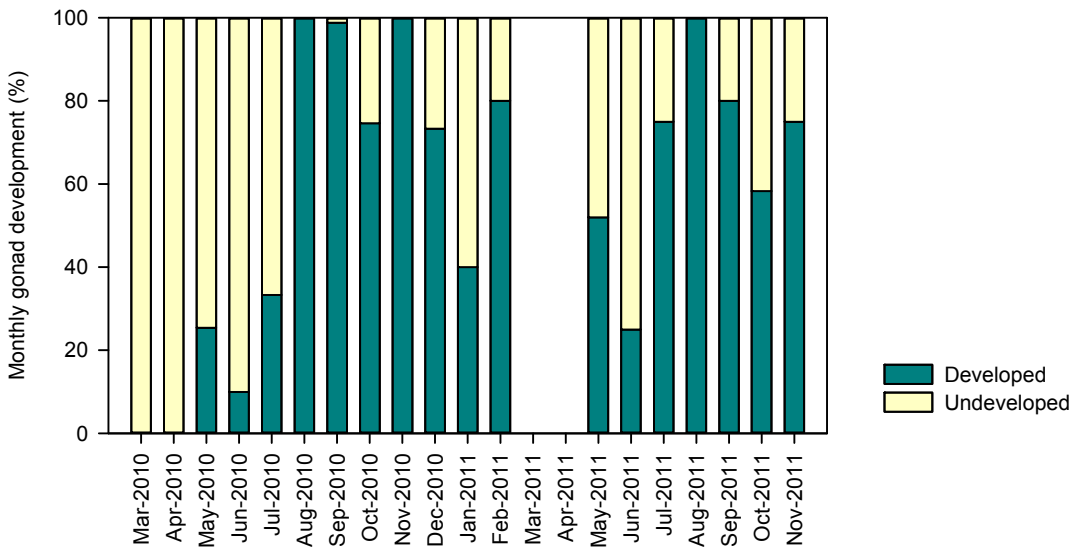

Figure 7-1. Monthly gonad development of pipis measured as percentage mature (pipi >30 mm, n=1034, gonad stage ≥3).

Whilst pipi gonads developed throughout winter with most fully developed in September, November and December 2010, approximately 30% of pipi were observed to have immature/spent gonads in October 2010. This suggested that spawning may have occurred at this time and was consistent with an observed spawning of pipi at the aquaculture facility at SARDI, West Beach in mid-October (Mark Gluis, pers. com.).

Size of maturity

Estimates of the size at maturity where 50% (SAM_{50}) and 95% (SAM_{95}) of pipi were mature were similar in 2010 and 2011. The estimate of SAM_{50} for combined samples was 28.25 mm, while that for SAM_{95} was 32.48 mm (Table 7-1; Fig. 7-2).

Table 7-1. Estimates of SAM_{50} and SAM_{95} for pipi from Younghusband Peninsula in 2010, 2011 and both years combined.

Year	Parameter	Estimate	SE	95% Confidence bounds		
				Lower	Upper	n
2010	SAM_{50}	28.20	0.119	27.954	28.436	540
	SAM_{95}	32.02	0.332	31.348	33.172	
2011	SAM_{50}	28.22	0.439	27.329	32.686	249
	SAM_{95}	33.37	1.219	30.903	35.829	
2010 / 2011 Combined	SAM_{50}	28.25	0.470	27.955	28.547	789
	SAM_{95}	32.48	0.409	31.654	33.299	

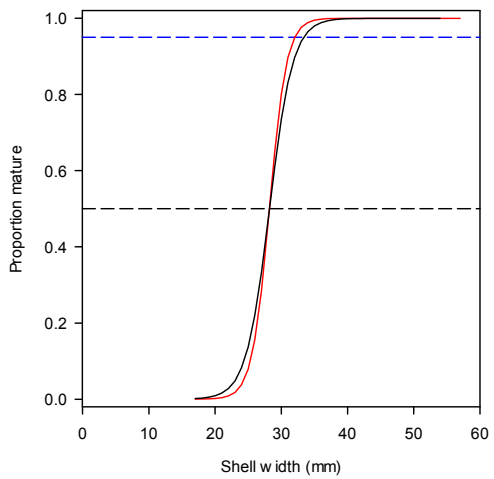

Figure 7-2. Size at maturity for pipi from the Younghusband Peninsula, in 2010 (red) and 2011 (black). Horizontal reference lines represent size at 50% (SAM_{50}, black dashes) and 95% maturity (SAM_{95}, blue dashes).

7.1.2 Intra-annual trends in size distributions of pipi

Size frequency distributions from fishery-independent surveys undertaken as part of the winter-harvesting trials in 2010 and 2011, supplemented with size structures from fishery-independent surveys (November, February and April) in 2009, 2010 and 2011

provide an indication of the timing of recruitment to the pipi population on Younghusband Peninsula (Fig. 7-3).

In Section A, pre-recruits (<35 mm, LMS) comprised the dominant mode (24 mm) in the size structure from November 2009. The presence of a larger dominant mode (37 mm) in February 2010 and April 2010 (40 mm) suggested growth of the pre-recruits and recruitment to the fishable biomass (i.e. >LMS 35 mm). Similarly, in November 2010 a minor mode (14 mm) suggested that pre-recruits were present and the increase in modal size through February (26 mm) to May 2011 suggested growth of these pre-recruits. Pre-recruits were present in June, (modal size 33 mm), August, September and November of 2011.

Pre-recruits were also present in size structures from Sections B and C, however, their contribution to the overall size structure was relatively low compared to Section A. In particular, pre-recruits contributed less to the overall size structures in Section C than in Sections A and B. Additionally, pre-recruits were not present in size structures in Section C until February 2010 which was one month later than in Sections A and B. Similarly in 2011, pre-recruits were poorly represented in size structures from Section C until November which was several months later than occurred in Sections A and B.

Throughout the period of this study the maximum modal size of pipi in size structures from all sections increased from ~37 mm in February 2010 to ~50 mm from February 2011 onwards.

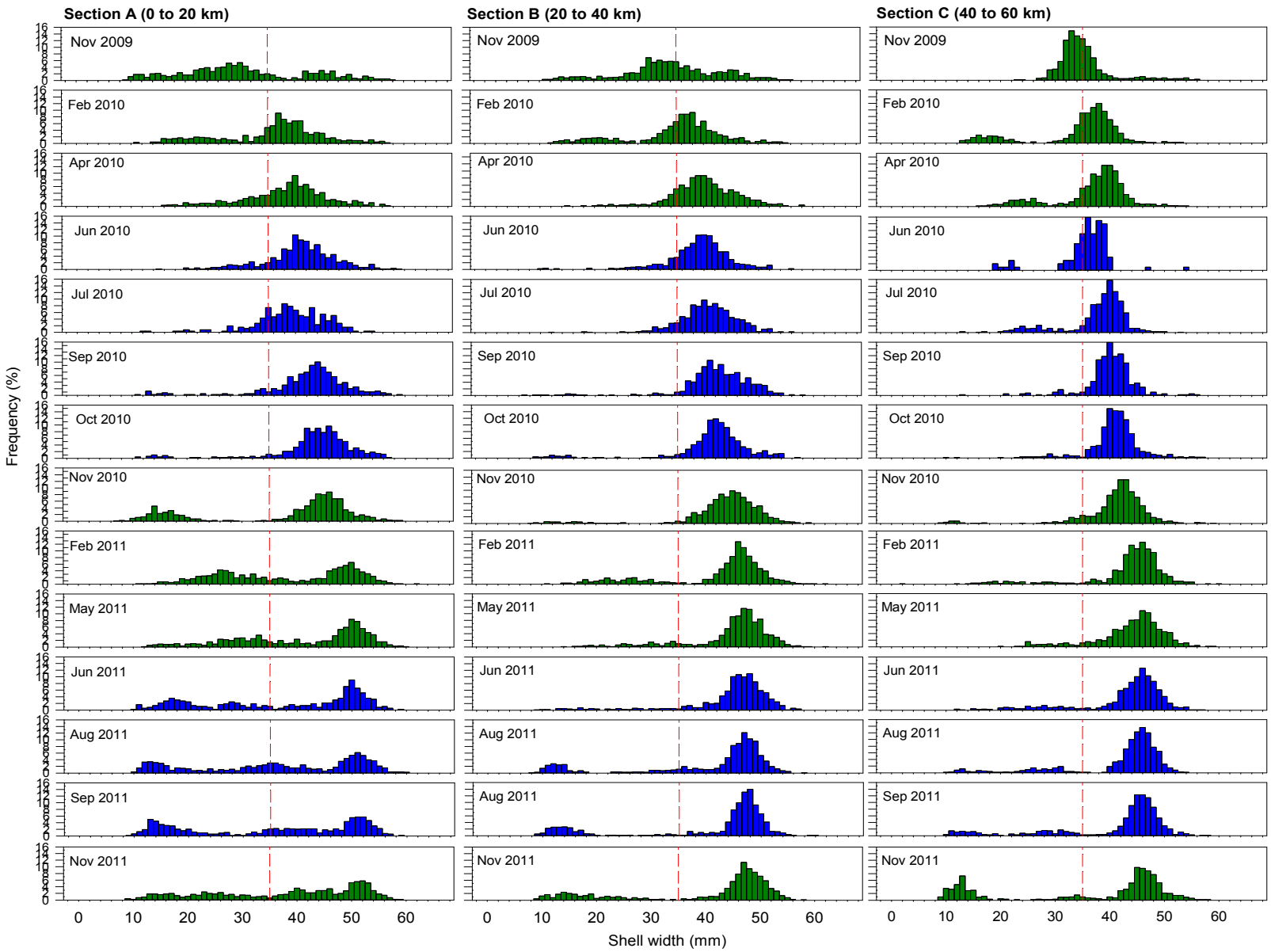

Figure 7-3. Size distribution of pipi from annual surveys (green) and winter-harvesting trials (blue) in 2010 and 2011. Vertical dashed line (red) indicates legal minimum size.

7.1.3 Intra-annual trends in relative biomass of pipi

Estimates of the relative biomass of pipi from the fishing ground on Younghusband Peninsula were available for the 2009-10 and 2010-11 and 2011-12 fishing seasons (Fig. 7-4). Estimates of relative biomass were also available from fishery-independent surveys done during the winter-harvesting trials in 2010 (four surveys, n=30 transects in each month) and 2011 (three surveys, n=30 transects in each month).

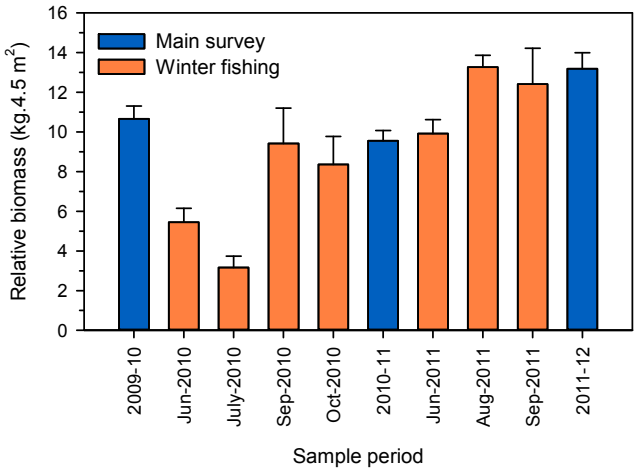

Figure 7-4. Comparison of monthly estimates of relative biomass of pipi from winter-harvesting trials with annual estimates of relative biomass.

Relative biomass of pipi during the winter-harvesting trial in June and July of 2010 was low compared to that in the previous fishing season (2009-10). However, relative biomass during September and October of 2010 was similar to that in the following season (2010-11). Relative biomass during winter-harvesting in August and September of 2011 was also similar to that of the following season (2011-12).

7.1.4 Discussion of fishery biology of pipi

For the population of pipi on Younghusband Peninsula, gonad development occurs throughout winter with most gonads in sexually mature individuals fully developed by spring-summer. Additionally, it is likely that a discrete spawning event occurs in October-November because: (i) there was a decline in the proportion of pipi (>35 mm) with developed gonads in October of 2010 and 2011; (ii) discrete modes of pre-recruits were present in size frequency distributions; and (iii) spawning was observed in pipi under ambient conditions in an aquaculture facility during October. This differs

from several previous studies which have suggested that *Donax deltoides* “dribble” spawns over a prolonged period in (King 1976; Murray-Jones 1999).

The first quantitative estimates of size at 50% maturity (28 mm) and 95% maturity (32 mm) for pipi from Younghusband Peninsula provided by this study were consistent with qualitative estimates from a previous study in South Australia where developed gonads were present in individuals greater than 29 mm and full maturity occurred at approximately 36 mm (King 1976). In contrast, a quantitative estimate of size at 50% at 37 mm for pipi from New South Wales was considerably larger than that from this study (Murray-Jones, 1999). However, the maximum size of pipi in New South Wales may be 80 mm which is much larger than the maximum size of 59 mm observed in this study (Murray-Jones and Steffe 2000). The estimates of SAM_{50} (28 mm) and SAM_{95} (32 mm) were 20% and 6% smaller, respectively than the LMS of 35 mm indicating that the LMS is conservative and individual pipi would be expected to spawn at least once prior to capture.

Recruitment strength and seasonality of recruitment were variable among years. In 2010, pre-recruits (modal size 24 mm) were first observed in the monthly size frequency distributions in November. In contrast, during 2011 pre-recruits were present from June onwards. Recruitment may also vary spatially. For example, the mode of pre-recruits observed in size distributions from Section A in November 2011 was less pronounced in Section B and not observed in those from Section C.

The pipi resource on Younghusband Peninsula was likely overfished prior to 2009-10 (Ferguson 2010; 2013) as suggested by low relative biomass in 2007-08 and 2008-09 (Ward et al. 2010) and by the reduced size of the largest mode in size distributions from February 2010 to February 2011. During this study, the pipi resource appeared to recover from 2009-10 as indicated by the trend of increasing relative biomass from September 2010. This increase in relative biomass may have been due to growth of larger pipi as suggested by an increase in the size of the largest mode in size distributions from February 2010 (~42 mm) to February 2011 (~52 mm). The largest mode of ~52 mm in February 2010 was consistent with the maximum modal size of ~58 mm from in size structures from the early 1970s when annual catches were historically low (King 1976). Growth of pre-recruits from May (~30 mm) to November in 2011 (~37 mm) may also have contributed to increasing relative biomass.

7.2 Market information for pipi in South Australia

7.2.1 Inter-annual trends in market price of pipi

Total annual catches of pipi increased to a peak of 1,250 t in 2000-01, remained stable for 5 years to 2005-06 then declined steeply to 470 t in 2008-09 (Fig. 7-5). Catches were constrained by conservative TACCs from 2009-10 to 2011-12. Total annual catch value increased from 1984-85 to an historic peak of $3.2 M in 2008-09 then declined to $3 M in 2010-11, before increasing to $2.7 M in 2011-12.

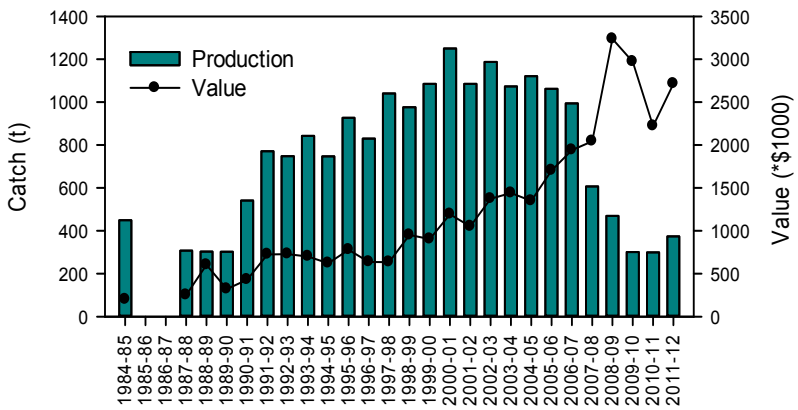

Figure 7-5. Total annual value of pipi from South Australia.

The mean annual price/kg of pipi sold on the South Australian market was $9.86, $7.42 and $7.25 in 2009-10, 2010-11 and 2011-12, respectively. In comparison, mean annual price/kg adjusted for interstate markets was slightly higher at $9.59 and $9.40 in 2009-10 and 2010-11, respectively (EconSearch 2012a).

During the 12 year period from the peak annual catch in 2000-01 to the significantly lower catch in 2011-12, the value of pipi ($/kg) followed an inverse exponential trend (Non Linear Regression, NLR: r^2=0.97; $F_{1,11}$=309.334, p<0.005) with years of high catch associated with low average prices on the South Australian fish market (Fig. 7-6). There was a similar relationship between total catch and value of pipi ($/kg) when inter-state markets were considered (NLR: r^2=0.94; $F_{1,10}$=133.452, p<0.001) (EconSearch 2012a).

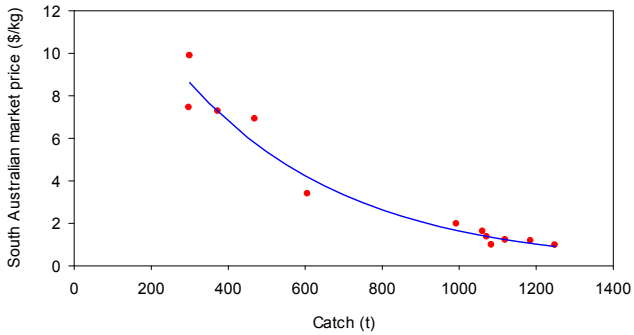

Figure 7-6. Total annual catch and local market price for 10 years from 2000-01 to 2011-12.

In 2008-09, 23% of pipi were supplied to the human consumption market with the remainder sent to the bait market (Fig. 7-7). The percentage of pipi supplied to the human consumption market increased to 49% in 2010-11 and was 45% in 2011-12.

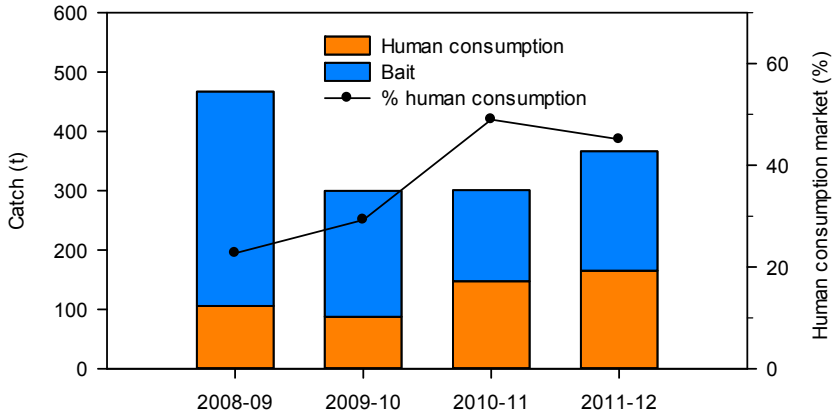

Figure 7-7. Destination markets for pipi from 2008-09 to 2011-12.

7.2.2 Intra-annual trends in market price of pipi

Detailed results of the winter-harvest trial were provided by the GPHA in a written report in 2010 (Anon 2010b) and in spreadsheets in 2011. As the detailed data (i.e. daily markets, sizes and prices) are commercial in confidence, aggregated data are presented in this report.

During the winter-harvesting trial in 2010, fishing was conducted on 12 fishing/market days over 12 weeks over the historical fishery closure period (June to October). In total, 12,676 kg of pipi were harvested. The catch had a total value of $187,000 which was equivalent to a mean value of $15.46 per kg (Table 7-2). Of the total amount, 9,676 kg (80% of total) of pipi were placed on the Sydney and Melbourne

fish markets. The remainder comprised small quantities sent to individual suppliers (7 suppliers), frozen stock held in storage, South Australian Seafood Quality Assurance Program (SASQAP) meat samples, gas flushing trials and a trial where product was placed on a European market. Only pipi sent to Sydney and Melbourne Fish Markets are considered in this report.

Table 7-2. Days fished in winter-harvesting trials in 2010 and 2011. (SFA, Southern Fishermen's Association; GPHA, Goolwa Pipi Harvester's Association)

Harvest trial	Fishers	Months fished	No. Days	Catch (kg)	Value ($)	Average price ($/kg)
2010	SFA and GPHA	June July September October	12	12,676	187,000	15.46
2011	GPHA	June July August September October	22	23,904	389,196	16.28
	SFA	June July September October November	13	4,513	77,340	18.62
	GPHA and SFA		35	28,417	466,536	16.41

In the 2010 winter-harvesting trial, approximately 2000 kg of pipi were placed on the market in June, July, September and October (Fig. 7-8A). The average price per kg was $20-21/kg in June and July then increased to $27/kg in September, before declining to $21/kg in October. The mean price for the 2010-11 fishing season for pipi was $9.80/kg although this included approximately 50% of the catch sold on the bait market.

During the winter-harvesting trial in 2011, 28,417 kg were harvested over 5 months and 35 fishing/market days (Table 7-2). The total value was $466,536 which was equivalent to $16.41/kg. Of the total catch, 23,904 kg was harvested by the GPHA (4 licence holders) with a total value of $389,196 which was equivalent to $16.28 per kg. Of this, 23,449 kg (94%) was placed on the Sydney (63%) and Melbourne (31%) fish markets. The remainder (6%) comprised small quantities sent to individual suppliers (6 suppliers). An additional 4,513 kg were harvested by members of the SFA (3 licence holders) with a total value of $77,340 which was equivalent to $18.62

per kg. A fourth fisher from the SFA participated in the trial but did not provide data (~1,800 kg). All pipi from the SFA were placed on the Sydney Fish Market.

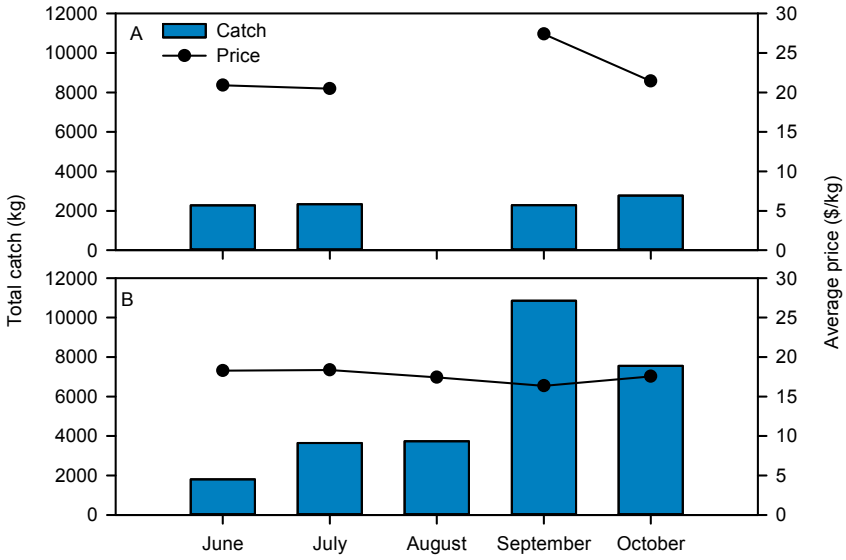

Figure 7-8. Total catch per month from winter-harvesting trials in (A) 2010 and (B) 2011.

In 2011, 1,810 kg of pipi were harvested and placed on the market in June. This increased to ~3,500 KG in July-August (Fig. 7-8B). Higher catches of 10,858 kg and 7,558 kg were taken in September and October. The price was $18.27 and $18.37/kg in July and August, respectively. The price then declined to $17.44/kg in August and $16.36/kg in September. In October the mean price was $17.55/kg. The mean price for the 2011-12 fishing season for pipi was $7.42/kg although this included approximately 50% of catch sold on the bait market.

Information on size of pipi was available for all catches in 2010 and for catches from the GPHA in 2011. Pipi were classified small (35-41 mm), medium (42-49 mm), or large (50-59 mm). In 2010, most catches comprised small pipi (61%) with smaller contributions from medium (20%) and large pipi (<5%). In 2011, most catches comprised medium sized pipi with smaller contributions from small (38%) and large (<5%) pipi.

Table 7-3. Contribution to total catch by three size classes of pipi during winter-harvesting trials in 2010 and 2011.

		Size class			
Year	Region	Large (%) 50-59 mm	Medium (%) 42-49 mm	Small (%) 35-41 mm	Small-medium (%) 35-49 mm
2010	All	4.7	19.6	60.8	14.9
2011	All	3.6	58.6	37.8	na

In 2010, the relative contribution of the different size classes was consistent among months with small/small-medium, medium and large pipi contributing 5%, 20% and 76% to the total amount placed on the market, respectively (Fig. 7-9A).

In 2011, the amount of pipi placed on the market ranged from ~1,700 kg in June to 7,500 kg and 6,900 kg in September and October, respectively (Fig. 7-9B). Compared to the trial in 2010, medium size pipi contributed more to the total catch in 2011 with large, medium and small pipi comprising 4%, 54% and 43% of the total winter-harvest, respectively.

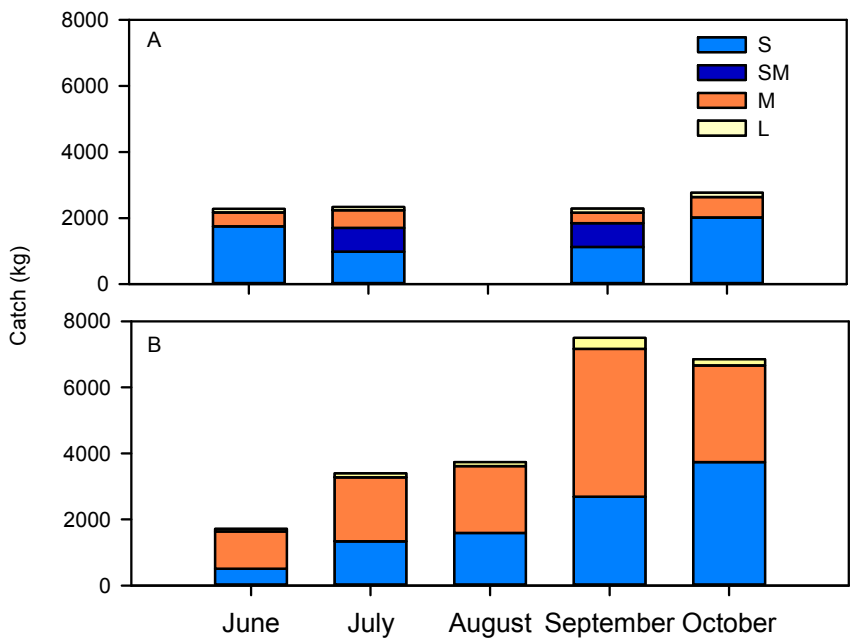

Figure 7-9. Pipi placed on market during winter-harvesting trials in (A) 2010 and (B) 2011. (S=small, SM=small-medium, M=medium, L=large).

For the winter-harvesting trial in 2010, the amount of pipi placed on the market did not significantly affect mean price. However, there was a difference in price among markets, months and size classes (Table 7-4).

Table 7-4. Key results of General Linear Model (GLM) comparing daily price ($/kg) of pipi from Sydney and Melbourne fish markets, month and pipi size class during the winter-harvesting trial in 2010. (^{ns}not significant, *significant)

Parameter	df	F	*P*
Market	1	42.972	0.000*
Amount	1	0.916	0.343^{ns}
Month	3	5.476	0.003*
Size	2	27.790	0.000*

In 2010, prices paid for pipi placed on the Sydney Fish Market were approximately double those from the Melbourne Fish Market (Table 7-5). For the Sydney Fish Market, highest prices were paid for large pipi with intermediate prices paid for medium sized pipi and the lowest price paid for small pipi.

Table 7-5. Average price ($/kg) for pipi placed on Sydney and Melbourne fish markets during the winter-harvesting trial for in 2010.

Market	Size	Price ($/kg)	±SE
Sydney	Large	36.94	3.315
	Medium	27.87	1.701
	Small	18.50	0.497
	All	25.50	1.397
Melbourne	Small/Medium	12.35	0.291
	Small	12.50	0.148
	All	12.42	0.593

For the winter-harvesting trial in 2011, there was a difference in price ($/kg) associated with the amount of pipi placed on the market (Table 7-6). There was also a difference in price among markets and months. In contrast to 2010, there was no difference in price among sizes of pipi.

In 2011, prices paid for pipi placed on the Sydney Fish Market were higher than for pipi placed on the Melbourne Fish Market (Table 7-5). For the Sydney Fish Market, highest prices were paid for large pipi, however the high prices for large and medium pipi that were observed in 2010 did not occur in 2011. Prices for pipi placed on the Melbourne Fish Market in 2011 were similar to those in 2010.

Table 7-6. Key results of General Linear Model (GLM) comparing daily price ($/kg) of pipi from Sydney and Melbourne fish markets, month and pipi size class during the winter-harvesting trial in 2011. (^{ns}not significant, *significant).

Parameter	df	F	*P*
Market	2	20.170	0.000*
Amount	1	6.119	0.016*
Month	3	2.773	0.035*
Size	2	1.925	0.135^{ns}

Table 7-7. Average price ($/kg) for pipi placed on Sydney and Melbourne fish markets during the winter-harvesting trial in 2011.

Market	Size	Price ($/kg)	±SE
Sydney	Large	20.81	0.656
	Medium	18.95	0.591
	Small	18.16	0.819
	All	19.57	0.410
Melbourne	Medium	11.50	2.500
	Small	13.26	0.330
	All	12.95	0.373
Other	Medium	14.00	0.408
	Small	11.67	2.028
	All	13.50	0.522

Catch sampling

In Section B, the size distributions of pipi from research nets on July 2011 ranged from 9 to 57 mm, with the main mode at 49 mm (Fig. 7-10A). The size range of commercial catches in Section B ranged from 38 to 57 mm, with a mode at 48 mm. The size distribution of catches from the GPHA ranged from 40 to 57 mm with a modal size of 48 mm and that for one SFA fisher was 41 to 53 mm, with a modal size of 47 mm.

In Section C, the size of pipi from research nets ranged from 12 to 57 mm, with a main mode at 46 mm (Fig. 7-10B). The size distribution from the commercial catch ranged from 33 to 61 mm with a modal size of 45 mm. The size distribution from one fisher ranged from 39-48 mm, with a modal size of 45 mm compared to that of a second fisher which was 33 to 61 mm, with a modal size of 49 mm.

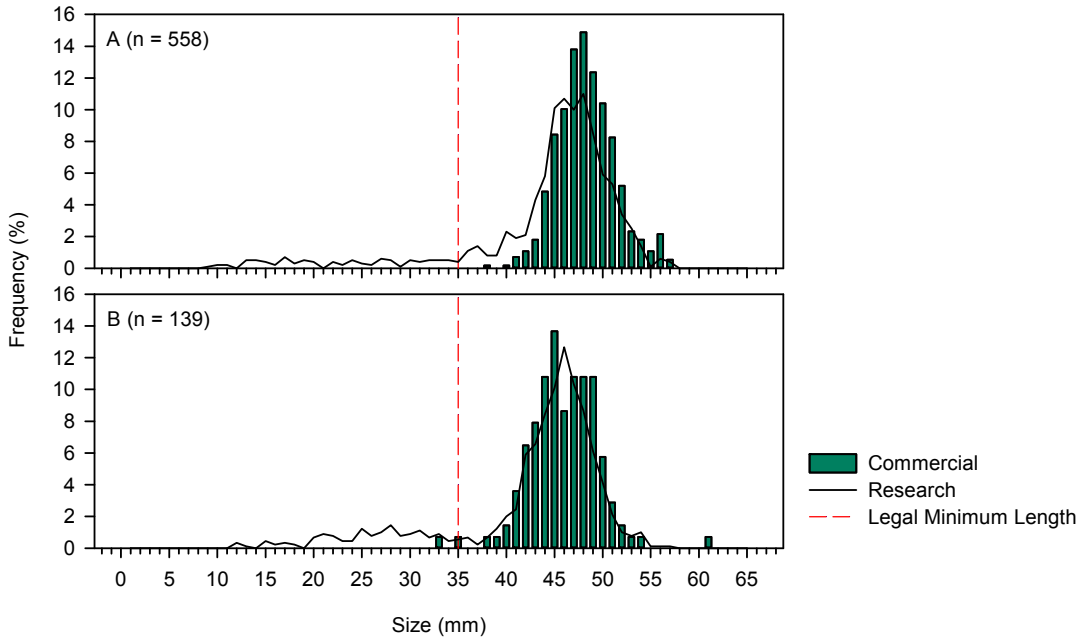

Figure 7-10. Size distribution of commercial catches from (A) Section B (20 to < 40 km) and (B) Section C (40 to <60 km), compared to research catch size distribution.

7.2.3 Discussion of market information for pipi

The Australian market for pipi is sensitive to production volume and the total annual value of pipi from the LCF generally increased concurrently with declines in annual catches from 2006-07 onwards. Winter-harvesting trials indicated that there is potential to increase the value of pipi on the Sydney Fish Market. In 2010, consistent, relatively low quantities of pipi (~2000 kg/month) returned high prices ($18.62/kg) compared to $7.42/kg on the South Australian market (Knight and Tsolos 2012). Similarly, high mean monthly prices ($18.27/kg) were returned from June to October in 2011 with amounts of pipi placed on the market ranging from ~ 2000 kg to 10,000 kg.

Under lower monthly market volumes (~2000 kg) during the 2010 winter-harvesting the size class of pipi placed on the market influenced price and decreased with size from $36.99/kg for large pipi to $18.50/kg for small pipi. However, in 2011 when monthly volumes of pipi placed on the market were higher the mean price paid for large pipi was significantly lower than in 2010 ($20.81/kg) and the differences in market price between large, medium and small size classes of pipi were also less pronounced.

The availability to the fishery of different size classes of pipi likely varies among years as suggested by proportional differences in the sizes of pipi in catches from winter-

harvesting trials in 2010 and 2011. In 2010, the catch comprised mostly (>61%) small pipi with approximately 20% medium sized pipi. In 2011, medium sized pipi comprised most of the catch (59%) and smaller pipi contributed less (39%) than in 2010. The increase in the proportion of medium sized and decline in the proportion of small sized, pipi between 2010 and 2011 likely reflects increasing availability of the larger pipi. Increasing availability of medium and large pipi is suggested by the increase in the modal size of large pipi in fishery-independent size frequencies during 2010 and 2011. In contrast, large pipi which returned the highest price in 2010 comprised a small proportion (<5%) of catches in 2010 and 2011.

Catch sampling indicated that pipi harvesters typically target medium to large pipi. In 2011, sizes of pipi in catch samples ranged from 40-57 mm and modal size of 48 mm which was significantly larger than the LMS of 35 mm. However, the distribution of sizes from limited catch sampling was not reflected in the distribution of sizes reported in the market sales. For example, 61% and 38% of pipi sent to market in 2010 and 2011 respectively were classed as small (35-41 mm). A catch sampling program conducted on a scale appropriate to the fishery would complement fishery-independent size structures. This may potentially become more important because the percentage of pipi sent to human consumption markets which have a preference for larger pipi has increased and was 45% in 2011-12.

7.3 Optimising the harvest period for pipi

7.3.1 Markets

The value of the annual catch of pipi from the LCF has increased after 2007-08. Further, the negative exponential relationship between mean annual market prices and annual catches suggests that the Australian market for pipi is sensitive to volume.

Results from the winter-harvesting trials in 2010 and 2011 indicate that the potential exists to increase the value of catches by placing pipi on the human consumption market during the fishery closure period from June to October. Significantly higher market prices were obtained when small volumes (~2,000 kg/month) of pipi were placed on the Sydney Fish Market during the temporal closure of the LCF for Pipi from June to October. Similarly, larger volumes (2,000-4,000 kg/month) also returned higher prices from the Sydney Fish Market during 2011.

7.3.2 Biology

The LCF for pipi has been managed under annual TACCs since 2007-08 with a limited number of licence holders having access to the resource (26 licences in 2013). Increasing mean annual relative biomass, increasing representation of larger pipis in size distributions and presence of pre-recruits in size structures suggest that in 2012-13 the resource on which the LCF for pipi is based is recovering following a period of over-exploitation (Ferguson and Mayfield 2006; Ferguson 2012, 2013).

Prior to the introduction of quota management in 2007-08, the LMS of 35 mm and the temporal closure to the pipi fishery from June to October were key management tools for sustainable exploitation of the pipi resource. The temporal closure limited fishery effort and was also thought to protect pipi during a protracted spawning period (King 1976; Murray-Jones 1999). The LMS of 35 mm was similarly important for management of the resource but prior to this study a robust, quantitative estimate of size at maturity was not available.

Results from this study indicate that the gonads of pipi develop throughout winter-spring with higher levels occurring during August to November. The intra-annual trend in gonad development suggested that synchronous spawning may have occurred in October in 2010 and 2011. The sizes at which 50% (SAM_{50}) and 95% (SAM_{95}) of pipi were expected to be mature were 28 and 33 mm, respectively. Thus, SAM_{50} was 20% and SAM_{95} was 6% smaller than the LMS of 35 mm. Consequently, the LMS is relatively conservative and individual pipi would be expected to spawn at least once prior to capture.

Levels of fishery-independent relative biomass (fishable biomass) were sufficient to support low (12 t) and intermediate (32 t) commercial catches during winter-harvesting trials conducted in the fishery closure period from June to October. In 2010, monthly estimates of fishery-independent relative biomass from September and October were similar to that for the 2010-11 fishing season for pipi. In 2011, monthly estimates of fishery-independent relative biomass from June to October were similar to the estimate for the 2011-12 fishing season for pipi.

7.3.3 Discussion of harvest period optimisation

Fishing during the historically closed period from June to October, under relatively low to moderate levels of catch, is unlikely to have negative biological impacts because: (i) the LMS is conservative and individual pipi spawn at least once prior to capture; (ii) levels of relative (fishable) biomass during the closure period are similar to those during the existing fishing season; and (iii) temporal trends in fishery-independent relative biomass and size frequency distributions indicate that the resource is recovering from a period of over-exploitation likely resulting from conservative annual TACCs since 2009-10.

The fishery closure around the spawning period may be less important for protecting spawning and recruitment when annual catches of pipi are limited by a TACC. From 2007-08, the LCF for pipi has been managed under annual TACCs and from 2009-10 onwards, annual catches have been constrained by the TACCs (Ferguson 2013). Under conservative TACCs, combined with a LMS that is equivalent to the size at which approximately 95% of pipi are mature, removal of biomass by fishing is unlikely to be the main factor influencing recruitment. This is supported by strong modes of sub-legal sized pipi in size-structures from 2010 and 2011.

7.4 Development of fishery performance indicators

Potential fishery performance indicators were evaluated at a series of workshops/meetings conducted throughout 2011 and early 2012 by the Pipi Fishery Working Group (PFWG). Potential indicators considered were: (i) fishery-independent relative biomass, (ii) presence/absence of pre-recruits from size frequency distributions and (iii) an indicator based on economic performance of the fishery. Detailed decision rules for each performance indicator are provided in the Harvest Strategy for the LCF for pipi (Appendix 8).

7.4.1 Fishery-independent relative biomass

During development of the harvest strategy by the PFWG, estimates of annual relative biomass were available for a reference period from 2007-08 to 2010-11 (Fig. 7-11; Table 7-8). During the reference period estimates of fishery-independent relative biomass ranged from 5.9 to 9.7 kg/4.5 m^2.

The objectives of the harvest strategy were to (i) maintain a target relative biomass of pipi above 10 kg/4.5 m^2 and not less than 8 kg/4.5 m^2; and (ii) ensure that the pipi relative biomass does not drop below a limit reference point of 4 kg/4.5 m^2.

The limit reference point of 4 kg/4.5 m² was considered to represent the level of relative biomass where a significant risk of overfishing may occur i.e. recruitment overfishing where reduced spawning stock is insufficient to ensure sustainable levels of recruitment.

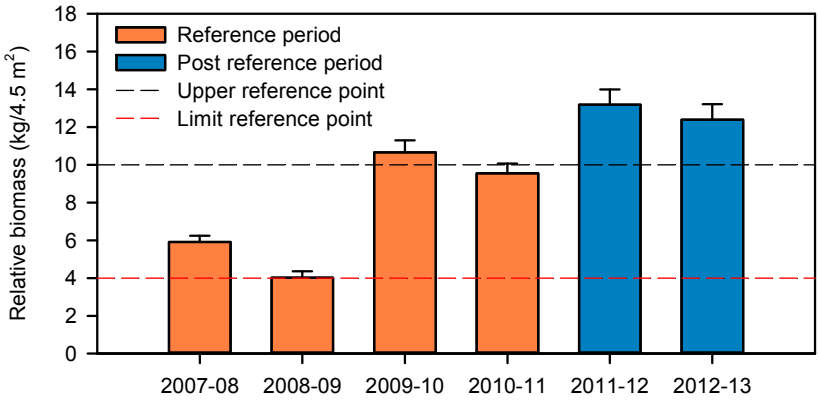

Figure 7-11. Annual estimates for fishery-independent relative biomass. Time-series available during harvest strategy development (orange) and recent estimates (blue).

Table 7-8. Annual estimates of fishery-independent relative biomass.

Year	Relative biomass (kg/4.5m^2)	SE
2007-08	5.9	0.33
2008-09	4.0	0.34
2009-10	10.7	0.65
2010-11	9.7	0.51
2011-12	13.2	0.81
2012-13	12.4	0.82

Assumptions of this indicator were (i) that it represented biomass of pipi on the fishing ground and (ii) that it was sensitive to changes in biomass of pipi on the fishing ground. Importantly, relative biomass is not affected by the changes in fishing practices that may have contributed to uncertainty around commercial CPUE as an index of relative abundance.

Because the target and limit reference points are based on estimates of annual relative biomass from only four years it is important that they are re-evaluated when a longer time-series of estimates becomes available. This is particularly important because the reference period follows (i) a period of likely over-exploitation; (ii)

possibly several years of poor recruitment; and (iii) occurred when a re-building strategy was in place. Because estimates of annual relative biomass from 2011-12 (13.2 kg/4.5 m^2) and 2012-13 (12.4 kg/4.5 m^2) are higher than those during the reference period the upper limit reference point may be conservative.

The harvest strategy is scheduled for review in 2015 when a time-series of estimates of annual relative abundance over 8 years will be available for re-evaluation of the upper and lower reference points.

7.4.2 Presence/absence of pre-recruits

The presence/absence of pre-recruits (sub-legal sized pipi) was considered to provide an indicator of recruitment to the fishery as an interim measure whilst an index of relative biomass of pre-recruits could be developed and evaluated. Size frequency distributions were available from each of three surveys conducted in October-November, February-March and April-May of each year from 2007-09 to 2011-12 (Fig. 7-12). Samples were collected as described in Ward et al. (2010).

A significant mode (>30% of the sample) of pre-recruits (<35 mm) was present in size distributions from pre-season surveys in 2007, 2009, 2011 and 2012. However, in 2008 and 2010 pre-recruits were poorly represented in size frequency distributions. Under the harvest strategy decision rules, the presence/absence of pre-recruits is used in deciding the TACC when the primary performance indicator relative biomass, lies in the bottom of the green range using the traffic light method described in the harvest strategy (Appendix 8, Figure 1). If pre-recruits are present (i.e. comprise >30% of the size frequency distribution) a decision to allow the TACC to increase to the top of the green range will be considered. If pre-recruits are absent (i.e. <30%) a decision for the TACC to remain in the lower part of the green range will be considered.

The use of presence/absence of pre-recruits in size frequencies to identify recruitment to the fishery assumes that a high proportion of sub-legal sized pipi in size frequency distributions represents recruitment to the fishery and not loss of older, larger individuals from the population. Providing this indicator is interpreted within the context of the temporal trend in relative biomass and that exploitation rates remain conservative it should provide an indication of recruitment to the fishery. However, development of a robust index of relative biomass of pre-recruits is required.

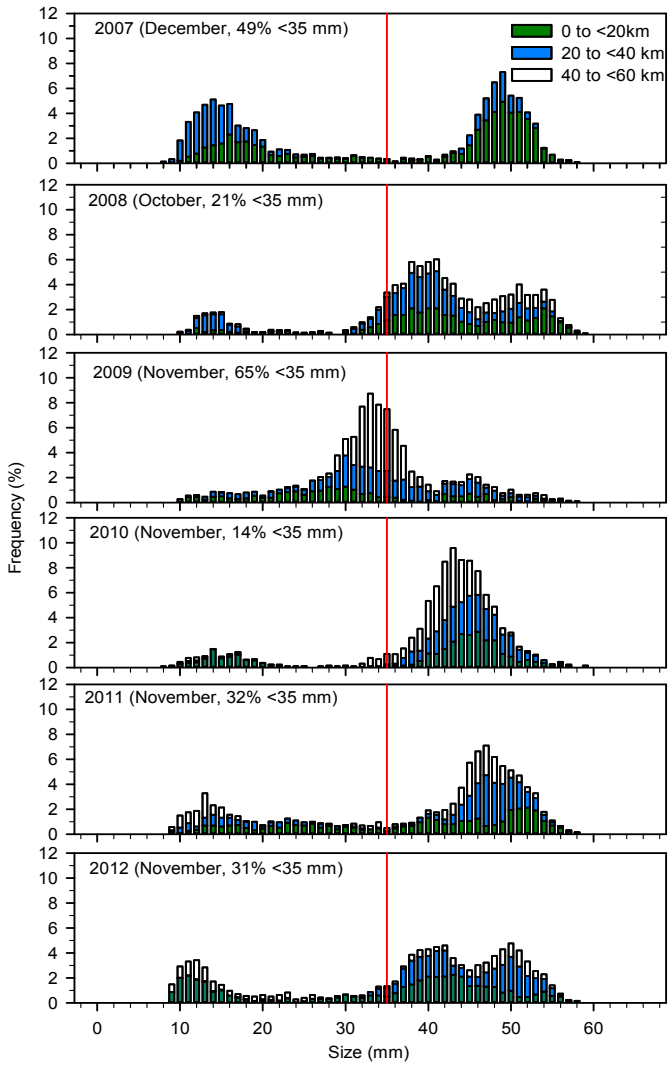

Figure 7-12. Pre-recruit indicator based on presence/absence of pre-recruits in size frequency distributions for 2007 to 2012. Upper left of each graph shows year, month of pre-season survey and percentage of sample below legal minimum size of 35 mm (all samples n~1000).

7.4.3 Economic performance

A Fishery gross margin (FGM) modelling framework was developed by EconSearch to provide an indicator of economic performance of the fishery for pipi (EconSearch 2012b; 2013). Fishery gross margin provides the primary economic performance indicator in the harvest strategy for pipi (Appendix 8).

The FGM indicator was identified as appropriate for the pipi fishery in the absence of capacity (i.e. due to cost), to establish Mean Economic Yield (MEY). Briefly, FGM is calculated as total fishery income less total variable costs, where variable costs are proportionate to fishing effort. The advantages of using FGM include: (i) minimal data requirements limited to price, price elasticity of demand, variable costs and TACC; (ii)

it can be easily calculated and tracked over time to evaluate fishery management targets; and (iii) the TACC can be set at a level below maximum sustainable yield (MSY) to preserve biomass (i.e. conservative TACC) and short-run industry profits (EconSearch 2012b). Assumptions of FGM as an indicator of economic performance of the fishery are that the bait and food price increment by approximately $1 to $1.10/kg for each 100 t change in TACC and that bait and food markets expand as TACC increases.

7.4.4 Discussion of performance indicators for pipi

The fishery for pipi was managed under a TACC from 2007-09 with conservative TACCs from 2009-10 following a period of over-exploitation (Ferguson and Mayfield 2006). From 2009-10, increases in mean annual relative biomass and an increase in the modal size of pipi suggest that the recovery of the resource is occurring.

Size frequency distributions indicate high inter-annual variability in recruitment to the pipi fishery on Younghusband Peninsula as is also the case for other pipi populations (McLachlan et al. 1996). In addition, whilst size frequency distributions provide an indication that recruitment may have occurred, understanding the relative contributions from recruits and pre-recruits is problematic. Consequently, an index of relative biomass of pre-recruits is required and is currently being developed by PIRSA, SARDI and industry.

Variability in recruitment and beach conditions may also contribute to variability in relative biomass of pipi. Consequently, it is important to continue to extend the time-series of estimates of relative biomass and size frequency data. It is important to note that the time-series of estimates of relative biomass that were available to the PFWG was limited to the four year period from 2007-08 to 2010-11.

The harvest strategy and associated performance indicators will be reviewed in 2015. This will allow incorporation of a longer time series of the primary indicator (relative biomass); evaluation of an indicator based on the index of relative biomass of pre-recruits; and further development of the economic performance indicator, FGM (EconSearch 2012b; 2013).

8. BENEFITS AND ADOPTION

The beneficiaries of this project are research, management and industry as stated in the original application:

1. Goolwa Pipi Harvesters Association;
2. Southern Fishermen's Association;
3. Primary Industries and Regions South Australia (Fisheries and Aquaculture);
4. South Australian Research and Development Institute (Aquatic Sciences).

In addition, outputs from this project will also inform research and management of the pipi resource in other jurisdictions, for example, New South Wales, Victoria and Tasmania.

The harvesting strategy (Appendix 8), developed by the PFWG, will benefit research, management and industry by improving the annual TACC setting process through provision of decision rules based on two new biological performance indicators and a new economic performance indicator. In 2012, the harvest strategy for pipi was trialled successfully to inform setting of the TACC for the 2012-13 fishing season for pipi. In 2013, the harvest strategy was formally used to inform setting the TACC for the 2013-14 pipi fishing season. The harvest strategy for pipi will be incorporated into the new management plan for the LCF which is due in 2014.

New information on market prices for pipi from winter-harvesting has informed a discussion on temporal management of the fishery. Winter-harvesting trials conducted in 2010 and 2011 demonstrated that market price was consistently high with small (12 t) and medium winter catches (32 t). Information on winter-harvesting and winter markets for pipi, combined with new information on intra-annual trends in relative biomass (Section 7.1.3) and reproductive biology (Section 7.1.1) informed negotiations among stakeholders which resulted in agreement for winter-harvesting to be conducted using withheld quota in 2012-13 and 2013-14 with a view to introduction of a 12 month season in 2014-15. Additionally, PIRSA and industry are working towards management of the fishery based on financial years with appropriate changes to the timing of research reporting and setting of the TACC. This will provide flexibility for individual fishery businesses.

This study updated understanding of the reproductive biology of pipi in South Australia. Study of the reproductive biology of pipi indicated that (i) the legal minimum

size was conservative (35 mm, ~SAM_{95}), (ii) gonad development occurs throughout winter-spring and (iii) that peak spawning occurs in October-November.

Improved catch and effort reporting was implemented in 2008-09 through modification of the South Australian Catch and Effort Return for Goolwa Cockles (pipi) with several such improvements supported by a review of the South Australian fishery for pipi by the Marine Stewardship Council. Improvements to catch and effort reporting included: (i) catches and effort reported with spatial information (5 km grid); (ii) destination market for catches; (iii) search time; and (iv) the amount of discards. Additionally, information on the destination market for pipi has been used as an input for the FGM model (EconSearch 2013).

The potential for further improvement to the spatial resolution of catch/effort reporting was demonstrated with the development of an iPhone application (Deckhand, Appendix 4). SARDI, PIRSA Fisheries and Aquaculture and industry will benefit from this technology because catch and effort data will be available earlier in the year than previously, potentially allowing earlier TACC setting workshops and more flexibility in timing of the fishing season. This technology has applications for bivalve and other fisheries and has been trialled in the South Australian Southern Rock Lobster Fishery.

The LCF for pipi are currently developing a marketing strategy informed by the report of Ruello and Associates (Appendix 6) conducted as part of this project. Initial work is focussed on appropriate branding and packaging of pipi. The results of this study were presented at a special meeting of the PFWG. The business development study of Ridge Partners (Appendix 7) has provided a framework for development of modified atmosphere packaging and improved marketing of pipi via a cooperative group representing members of the SFA and the GPHA.

The benefits and beneficiaries stated above were aligned with those identified in the original project application. This was accomplished through various project meetings between scientists, fishery managers and stakeholders.

9. FURTHER DEVELOPMENT

A number of activities should be undertaken to further develop pipi research and management. Fishery-independent relative biomass provides a primary performance indicator and presence-absence of pre-recruits from size structures provides a secondary performance indicator. Both indicators are required inputs for setting the annual TACC under the harvest strategy. The current time-series of fishery-independent relative biomass and size structures of pipi on Younghusband Peninsula include a period of recovery of the fishery. Although these indicators have provided insight into recovery of the pipi resource, continuation of the time-series of fishery-independent data is needed.

SARDI, PIRSA Fisheries and Aquaculture and industry have begun development of a new primary indicator based on an index of relative biomass of pre-recruits. The harvest strategy for pipi will be revised in 2015 to evaluate the existing performance indicators in addition to the new indicator based on relative biomass of pre-recruits.

Additional information on destination markets for pipi collected in the modified catch and effort system indicate that the proportion of the total catch of pipi sent to the human consumption market has increased. The pipi stock may be impacted differently when targeting changes because each market has different preferences for size. Consequently, a catch sampling program may provide useful information on size of pipi available to the fishery. The potential exists to standardise data from fisher grading of pipi to provide a simple performance indicator based on size of pipi.

PIRSA Fisheries and Aquaculture and industry have agreed to conduct a wider trial of the Deckhand (Real Time Data Pty Ltd) iPhone based CDR/catch and effort reporting application that was trialled successfully in this project. This wider trial began during the 2012-13. In addition, PIRSA is developing a digital data acquisition system (eCatch) which will accept CDR and catch and effort data across a range of platforms (iPad, iPhone and Android) from service providers contracted by industry. The test database for this system is expected to be completed in 2014.

The LCF for pipi have sought to further develop marketing of pipi and implement key recommendations from the market study conducted by Ruello and Associates during this project. In particular, an application for funding from FRDC has been made by the GPHA to evaluate modified atmosphere packaging of pipi. Further, Colquhoun Consulting Pty. Ltd. have been engaged to develop a business case for a

collaborative industry model for future development, investment, business and operational structure for continued value adding of pipi.

Formal yield per recruit analysis provides an estimate of how growth, natural mortality and fishing interact to determine the best size of pipi animals at which to start fishing them and the most appropriate level of fishing mortality (Haddon 2001). For example, length-based methods (i.e. ELEFAN II; Gayanilo et al. 2005) have been used to estimate growth and mortality of bivalve populations (Herrmann et al. 2009b; 2011). However, uncertainty exists around estimates of growth rates and mortality derived from length-based methods. Ageing based on shell microstructure has the potential to provide reliable age estimates for bivalves (Arneri et al. 1998; Ezgeta-Balic´ et al. 2010). Additionally, seasonal variation in elemental chemistry of pipi shells has the potential to validate ages inferred from modes in length frequency distributions.

Further, continued development of the economic performance indicator FGM will be conducted by EconSearch (EconSearch 2012b).

Data from surveys that are used to provide estimates of the performance indicators are stored in an Access database at SARDI Aquatic Sciences. Additional catch and effort data supplied by the LCF for pipi are stored in the production database, managed by the SARDI Fisheries - Information Services group. Information on markets for pipi during the 2010 and 2011 winter-harvesting trials is held by the Goolwa Pipi Harvester's Association and the Southern Fishermen's Association.

10. PLANNED OUTCOMES

The key outcome of this project is the harvest strategy for pipi (Appendix 8) which provides the framework for monitoring, management and sustainable use of the pipi resource on Younghusband Peninsula. The harvest strategy allows the resource to be exploited for maximum economic value, within the framework of sustainable exploitation. The harvest strategy for pipi will be incorporated into the management plan for the LCF which is due for completion in 2014.

Three performance indicators (fishery-independent relative biomass; presence/absence of pre-recruits; and FGM; EconSearch 2012b) were evaluated by the Pipi Fishery Working Group. The decision rules in the harvest strategy for pipi are based on these indicators. The Harvest strategy for Pipi was trialled successfully for recommending the TACC for the 2011-12 pipi fishing season and adopted formally for recommending the TACC for the 2012-13 season.

Outputs of the project will contribute to long-term profitability because the market for pipi in Australia is sensitive to product volume but potential exists to increase market return through timing the placement of product on the market. For example, placing pipi on the market during the winter fishery closure in South Australia returned prices that were higher than the annual average. Other information provided by this project to inform marketing of pipi includes: (i) differences in price among markets, (ii) differences in price among market days, (iii) market size preferences and (iv) potential for overseas markets.

Management of the fishery is currently moving to a 12 month season based on financial years which will provide flexibility for fishers to respond to market demand throughout the year. Additionally, alignment of the TACC setting process with financial years will facilitate business management for individual pipi fishers.

Ruello and Associates Pty. Ltd. synthesised information from this project and from fisher interviews to provide a market strategy for the LCF for pipi. The market strategy identified opportunities and threats for the fishery and provided a framework for market development (Appendix 6). This study identified modified atmosphere packaging and targeted marketing as having the potential to increase market value and suggested that this could be achieved with a cooperative framework across the LCF for pipi. Ridge Partners used information from the study of Ruello and Associates, combined with other results of this project, to provide a business

development plan to implement modified atmosphere packaging of pipi over a 10 year period using such a cooperative framework (Appendix 7).

Modification of the South Australian Catch and Effort Return For Goolwa Cockles during this project provided improved information on (i) spatial resolution of catches; (ii) destination markets of pipi; (iii) levels of discarding; and (iv) an estimate of fisher search time which may be used to improve estimates of effort. The additional information addressed several recommendations made by the MSC during assessment of the LCF for pipi in 2008. Re-assessment of the LCF for pipi was in progress at the time of writing.

Further development of catch and effort reporting was achieved through development/trialling of Deckhand software (Real Time Data Pty Ltd) for provision of catch and effort data with fine spatial resolution that can be delivered to SARDI in digital format in real time.

During 2012, several presentations on the biological implications of fishing for pipi during the winter fishery closure were made to PIRSA and the PFWG which comprised representatives from PIRSA Fisheries and Aquaculture, SARDI, SFA and GPHA. Additionally, a summary of the final report titled “Supporting Harvest Strategy Development for South Australia’s LCF for Pipi (*Donax deltoides*)” was presented to PIRSA (Fisheries and Aquaculture) in Adelaide on 15 August 2013. A presentation summarising the final report for this project was also given to the Pipi TACC committee which includes PIRSA Fisheries and Aquaculture and members of the SFA and GPHA in August 2013.

A presentation related to this project was given to a National Abalone Workshop which was a component of the project “Improving the performance of CRC fisheries through review and reform of operational procedures, business structures and fisheries management systems” on 26 September 2013, at SARDI Aquatic Sciences, West Beach, Adelaide. The presentation titled “Managing Yield to Maximise Profitability”, summarised relevant FRDC funded research into the South Fishery for pipi with emphasis on research into fishing for the market and integration of biological and economic performance indicators into the harvest strategy for pipi.

11. CONCLUSION

The primary objective of this project was to support the development of the harvest strategy for pipi through the multi-stakeholder PFWG (Objective 7). This was achieved by further development of the biological performance indicator based on fishery-independent relative biomass (Objective 1). Fishery-independent relative biomass was assessed by the PFWG and provides the primary biological performance indicator for the harvest strategy for pipi (Objectives 1 and 6) and presence/absence of pre-recruits and an economic performance indicator based on FGM provide secondary performance indicators (Objective 6). Winter-harvesting trials in 2010 and 2011 allowed the effectiveness of annual temporal closures as a management tool to be assessed by addressing knowledge gaps around reproduction and recruitment of pipi (Objectives 3, 4). This had implications for the value of the fishery because significant improvements in market return were obtained when pipi were placed on the market during winter (Objective 2). Two independent studies provided an assessment of market opportunities (Ruello and Associates) and a strategy for implementing modified atmosphere packaging of pipi through a cooperative approach (Ridge Partners) (Objective 2). The catch and effort reporting log for the fishery for pipi was amended to provide additional information on markets and spatial distribution of catches and method for digital submission of these data was trialled (Objective 5).

Key outputs of this project were biological performance indicators for the pipi fishery that were evaluated by the multi-stakeholder PFWG and used as the basis for decision rules in the harvest strategy for pipi. The harvest strategy and associated performance indicators have been strongly supported by stakeholders. The harvest strategy was used to recommend the TACC for the LCF for pipi for 2012-13 and formally adopted to recommend the TACC for 2013-14 and subsequent seasons.

The harvest strategy relies on three fishery performance indicators that allow for maximising market return within a framework of sustainable exploitation. In particular the biological fishery-independent estimate of relative biomass provides a robust estimate of resource status, whilst the economic indicator, FGM provides a mechanism for incorporating potential market return under a range of TACCs. The harvest strategy for pipi will be incorporated into the management plan for the LCF which is due for completion in 2014.

The Australian market for pipi is sensitive to price but there is potential to improve market return by timing catches throughout the year to meet market demand.

Improved understanding of reproduction and inter-annual trends in relative biomass and recruitment indicated that the pipi resource can be sustainably exploited if the fishing season is extended and aligned with financial years. The 12 month season provides the flexibility for fishers to fish for the market and facilitates business management.

Development of a market strategy for pipi is a priority for the LCF and is informed by the analysis of markets, market opportunities and threats conducted by Ruello and Associates Pty. Ltd. A key finding of this study was the need for targeted marketing with distinctive, regional branding and packaging. In particular, Ruello (2012) identified cooperative marketing through a range of modified atmosphere packaging products for domestic and overseas sale as an important development opportunity for the fishery. The study of Ridge Partners provides a viability assessment of the potential industry development options identified by Ruello and Associates Pty. Ltd. This study of Ridge Partners provides a business case including development, investment and operational structures for implementing modified atmosphere packaging of pipi within a cooperative framework over 10 years.

Improved spatial resolution of catch and effort reporting improves confidence in commercial CPUE as a secondary measure of relative biomass. Development of a digital data acquisition system based on an iPhone platform has the potential to (i) facilitate timely provision of catch and effort data by fishers; (ii) reduce duplication of reporting; and (iii) improve accuracy of reporting.

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13. APPENDIX 1: INTELLECTUAL PROPERTY

Deckhand Software developed by RealData Pty Ltd remains property of RealData Pty Ltd. Other research is for the public domain. The report and any resulting manuscripts are intended for wide dissemination and promotion. All data and statistics presented conform to confidentiality arrangements.

14. APPENDIX 2: STAFF

Project staff:

Greg Ferguson - Principal Investigator (SARDI)

Tom Robinson – Co-investigator (Director Coorong Cockles)

Ben Martin – Field Support (SARDI)

Nick Payne – Field Support (SARDI)

Members of the South Australian Pipi Fishery Working Group:

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James Bennett (PIRSA)

Jonathan McPhail (PIRSA)

Alice Fistr (PIRSA)

Sean Sloan (PIRSA)

Greg Ferguson (SARDI)

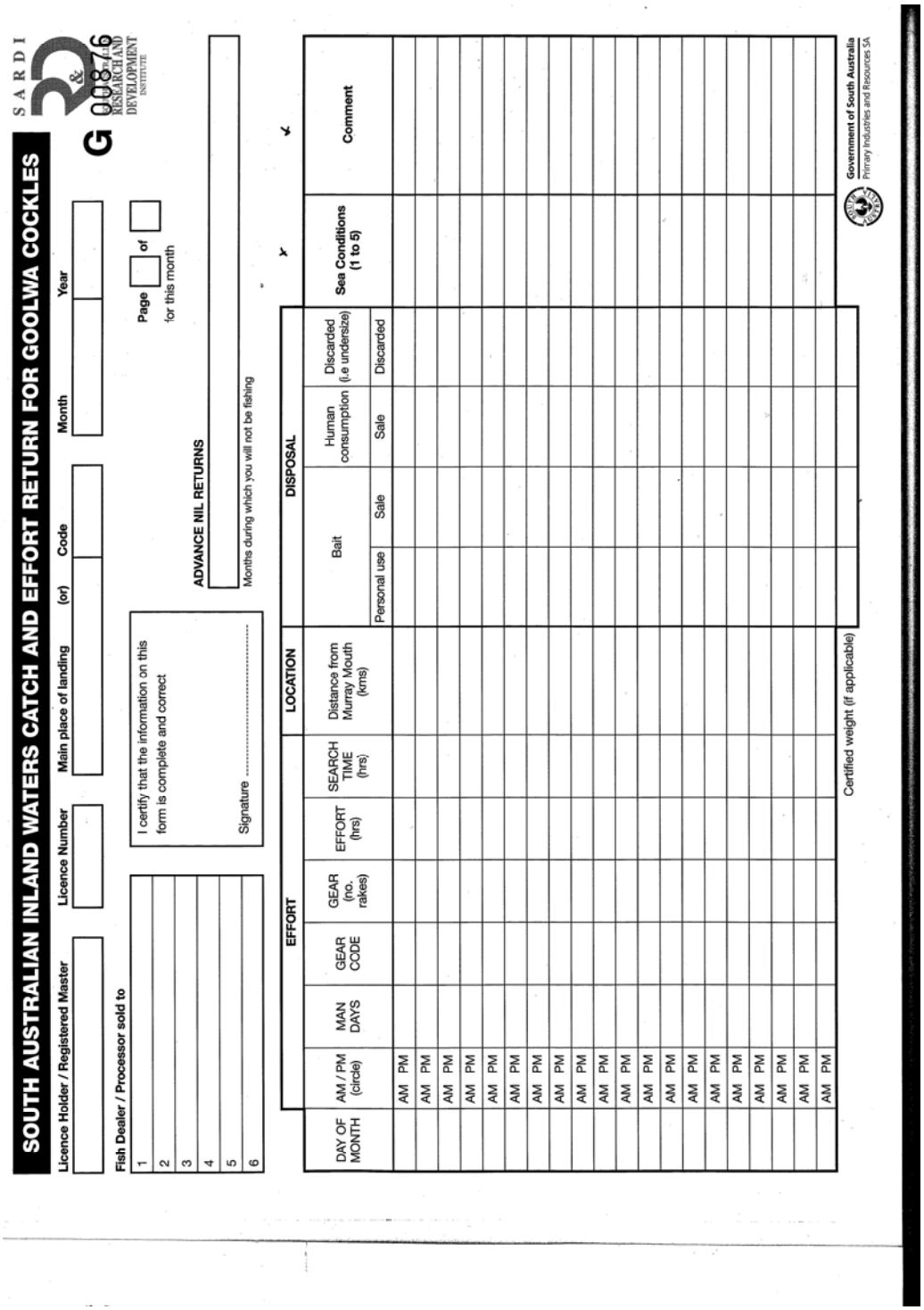
Roger Edwards (Chair, Goolwa Pipi Harvester's Association)

Neil MacDonald (Chair, Southern Fishermen's Association)

Fishers who participated in the winter-harvesting trials:

Greg Kessegian	Robert Brookes
Tom Robinson	Steven Alexander
Darren Hoad	Ross McClure
Chris Wilton	Barry Moore
Rod Ayres	Daryl Edson
Matt Hoad	Nathan Mammone
Steve Jones	

15. APPENDIX 3: MODIFIED CATCH AND EFFORT RETURN FOR PIPI



SOUTH AUSTRALIAN INLAND WATERS CATCH AND EFFORT RETURN FOR GOOLWA COCKLES

SARDI
RESEARCH AND DEVELOPMENT INSTITUTE

G 00876

Licence Holder / Registered Master

Licence Number

Main place of landing (or) Code

Month

Year

Fish Dealer / Processor sold to

1
2
3
4
5
6

I certify that the information on this form is complete and correct

Signature ....

Page ☐ of ☐
for this month

ADVANCE NIL RETURNS

Months during which you will not be fishing

	EFFORT						LOCATION	DISPOSAL					
DAY OF MONTH	AM / PM (circle)	MAN DAYS	GEAR CODE	GEAR (no. rakes)	EFFORT (hrs)	SEARCH TIME (hrs)	Distance from Murray Mouth (kms)	Bait		Human consumption	Discarded (i.e undersize)	**Sea Conditions (1 to 5)**	**Comment**
								Personal use	Sale	Sale	Discarded		
	AM PM												
	AM PM												
	AM PM												
	AM PM												
	AM PM												
	AM PM												
	AM PM												
	AM PM												
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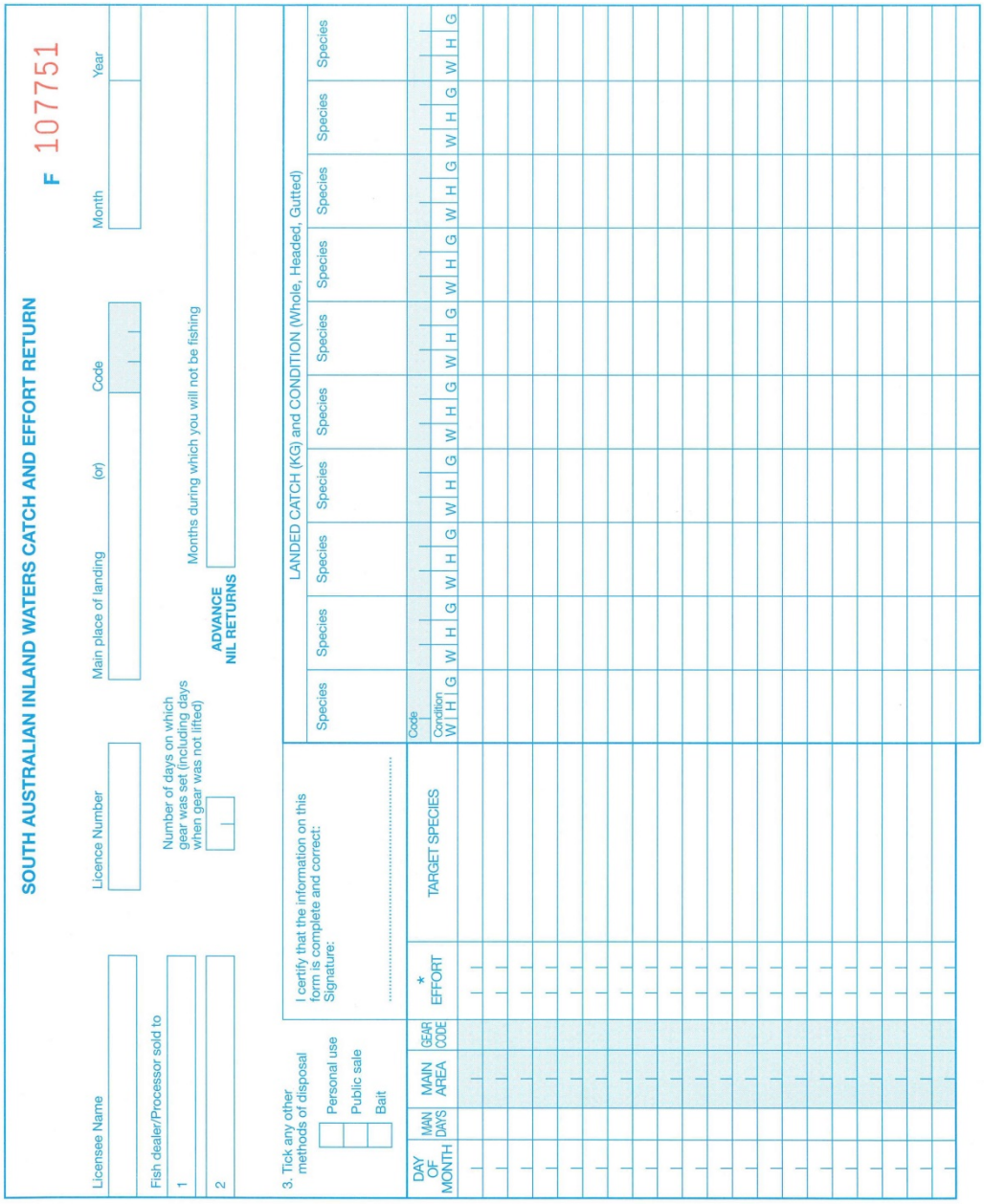
	AM PM												
	AM PM												
	AM PM												
	AM PM												
	AM PM												
	AM PM												
	AM PM												
							Certified weight (if applicable)						

Government of South Australia
Primary Industries and Resources SA

Inland Waters Catch and Effort Return for Goolwa Cockles (pipi) in use from 2008-09 onwards. Modifications made during FRDC project 2008/008 include new information on: search time (hours); location (distance from Murray Mouth); disposal (bait, human consumption, discarded); sea conditions.



SOUTH AUSTRALIAN INLAND WATERS CATCH AND EFFORT RETURN

F 107751

Licensee Name

Licence Number

Main place of landing (or) Code

Month

Year

Fish dealer/Processor sold to

1

2

Number of days on which gear was set (including days when gear was not lifted)

ADVANCE NIL RETURNS

Months during which you will not be fishing

3. Tick any other methods of disposal

☐ Personal use

☐ Public sale

☐ Bait

I certify that the information on this form is complete and correct:

Signature: ....

LANDED CATCH (KG) and CONDITION (Whole, Headed, Gutted)

DAY OF MONTH	MAN DAYS	MAIN AREA	GEAR CODE	* EFFORT	TARGET SPECIES	Species	Species	Species	Species	Species	Species	Species	Species
						Code Condition W H G	W H G	W H G	W H G	W H G	W H G	W H G	W H G

*NB. for set gear (i.e., gill nets, drum nets) Effort = No. of nets x No. of days since last lifted.

The original Inland Waters Catch and Effort Return for all species including Goolwa Cockles (pipi) that was used for reporting catch and effort for pipi prior to 2008-09.

16. APPENDIX 4: MODIFIED DECKHAND DIGITAL CATCH AND EFFORT REPORTING SYSTEM

The aim of Deckhand system is to provide fine resolution catch and effort data to fishers and research/regulatory agencies more quickly than can be achieved with a paper based system. Fine spatial resolution of catch and effort data is achieved using inbuilt GPS locations which provide accurate catch location compared to reporting blocks used. The benefit to fishermen is that the additional information they collect can then be mined to assist with making more informed business decisions.

The Deckhand digital catch and effort reporting system for ipad and iphone platforms has been developed with the input of fishermen from a number of different fisheries in Western Australia (WA). For example, blue swimmer crab (*Portunus armatus*) fishery in Cockburn Sound; West Coast Rock Lobster Fishery; and the Pilbara Trap Fishery.

During a trial in the Lakes and Coorong Fishery for pipi catch and effort data were supplied digitally through the Deckhand system. Catch and effort locations were recorded using latitude/longitude from the GPS unit in the ipad platform. This provided higher spatial resolution than the 5 km fishery reporting blocks currently used in the South Australian Inland Waters Catch and Effort Return for Goolwa Cockles.

An additional feature of the Deckhand system is the potential to update locations of no-fishing zones such as Marine Protected Areas i.e. geo-fencing. Similarly, the system can be used to locate areas temporarily closed to fishing, or to update rolling area closures.

Security of individual fisher data is achieved using similar technology to that used for banking data. Statutory data i.e. specific data required by researchers and regulators is automatically submitted as a packet similar to the data transfer methods used for internet banking. Additionally, a pin number is required when entering data and submitting data.

http://deckhandapp.com/

Example Deckhand screens

The following images show screens from the Deckhand software on an ipad platform during the 2010/2011 pipi fishing trails.

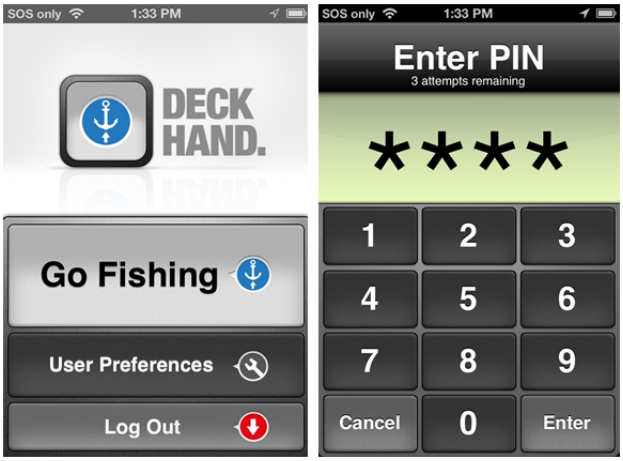


Figure 17-1. Initial screens for Deckhand system: startup (left) and Pin (right).

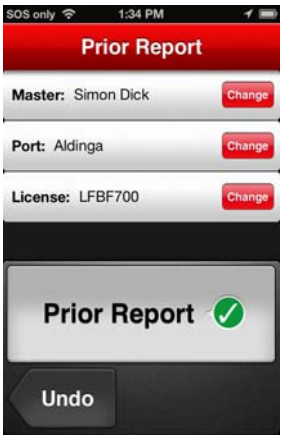


Figure 17-2. Prior reporting screen for PIRSA Catch and Disposal record.

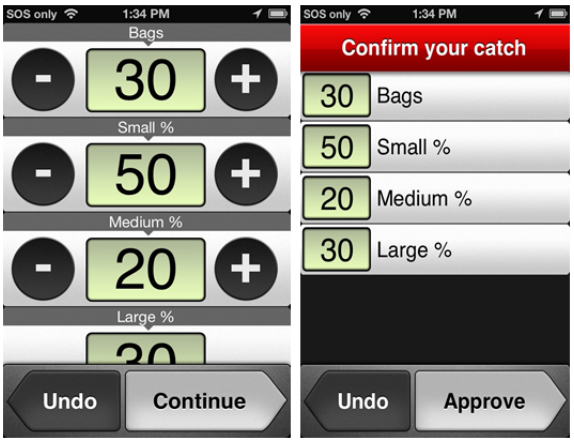


Figure 17-3. Catch reporting (left) and confirmation of catch (right). Each standard bag is 20 kg.

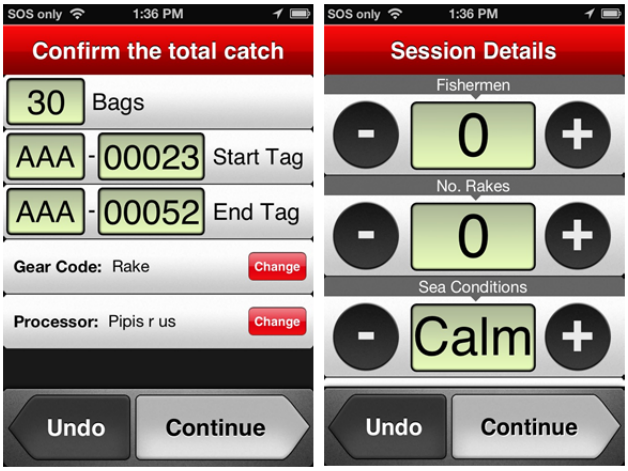


Figure 17-4. Tag numbers for each catch bag (left) and Effort (fishers, rakes) (right).

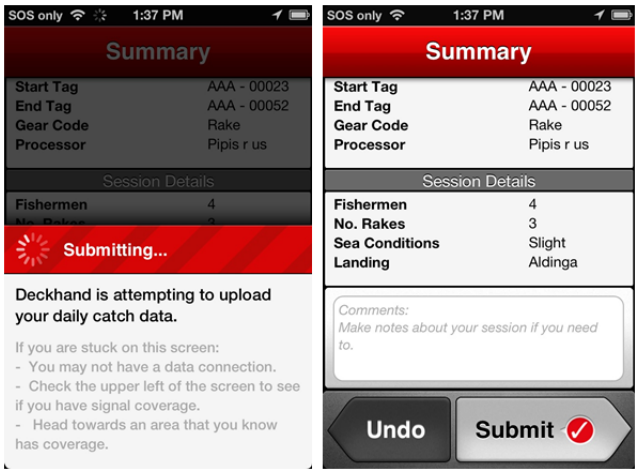


Figure 17-5. Summary information from fishing session.

17. APPENDIX 5: DATA FORMS FOR WINTER-HARVESTING TRIAL

Harvest date	Licence no.	Diggers (names)	Bucket boy (name)	Grader (name)	Location (lat/long, or 5km block)	Research tag numbers	Total catch from fishing (kg)	Total (hours)
						Total catch for day		

Fisher data form used in the winter-harvesting trial in 2011.

Licence Number:
Date harvested:
Date processed:

Size class (mm)	Market 1				Market 2				Market 3				Market 4			
	Location:				Location:				Location:				Location:			
	Weight	Price ($/kg)			Weight	Price ($/kg)			Weight	Price ($/kg)			Weight	Price ($/kg)		
	(kg)	High	Low	Avg	(kg)	High	Low	Avg	(kg)	High	Low	Avg	(kg)	High	Low	Avg
Small																
Medium																
Large																

Comments:

Processor data form used in the winter-harvesting trial in 2011.

18. APPENDIX 6: COORONG PIPI MARKETING STUDY

RUELLO & ASSOCIATES PTY LTD ABN 69 080 268 640

Consulting, Training and Advisory Services

Coorong Pipi Marketing Study

Final Report

Prepared by Ruello & Associates Pty Ltd

Clifton Beach Qld.

For Input To The PIRSA FRDC Project 2008/008

December 2012

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Acronyms and Terminology

ABS	Australian Bureau of Statistics
FRDC	Fisheries Research And Development Corporation
GPHA	Goolwa Pipi Harvesters Association
MAP	Modified Atmosphere Packaging
MSC	Marine Stewardship Council
PIRSA	Primary Industry Resources South Australia
SARDI	South Australian Research and Development Institute
SASQAP	South Australian Shellfish Quality Assurance Program
SFM	Sydney Fish Market
TACC	Total Allowable Commercial Catch

Terminology

Clams Unless otherwise indicated, the word clam is used in this report as a collective term encompassing all pipi, cockles, vongole, and clam species.

Fishmongers Refers to retail fish shops and market outlets that derive most of their income from the sale of fresh and frozen seafood (as distinct from supermarket stores and fish and chips shops)

Executive Summary

The Coorong pipi fishery has operated for many years with selling of bait product locally and interstate, and the sale of loose live or chilled shellfish, of varying food quality, to wholesale distributors in the capital cities. Over the past few years an increasingly large part of the catch has been consigned to the Sydney Fish Market (SFM) for sale by auction.

The declining landings from the Coorong and NSW pipi fisheries in the late 2000's resulted in a fall in national pipi consumption of more than 700 tonnes per annum and also facilitated the market penetration of fresh and frozen New Zealand clams into many Australian restaurants and homes in the past few years.

The substantial increase in the Coorong Total Allowable Commercial Catch in 2011/12 (from 330 to 400 tonnes) and the related 57% increase in supply to the SFM auction with an average price fall of only 13% in that year, provide empirical evidence that the latent demand for (loose) pipis is very strong.

The traditional Coorong pipi fishing business model is facing increasing economic pressure from the growing volumes of Australian and imported clam species and changes in consumer preference to more convenience, quality and value in seafood, as demonstrated by the market success of the modified atmosphere packs (MAP) of mussels and clams over the past five years.

The Coorong pipi industry is too small, fragmented, and ill equipped to re-engage former pipi users and enlist new users to lift pipi consumption back to its former levels, let alone successfully grasp the new opportunities offered by MAP, without major changes to its *status quo*. Continuation of the status quo is most likely to lead to industry stagnation or its "going backwards" in real terms.

An industry collaboration and reform strategy has been proposed to help the Coorong industry reduce costs, improve product quality, distribution, and actively market seafood products effectively and to reduce the fishers' reliance on the lower priced bait market.

The proposed strategy can be summarized as targeted marketing of quality assured premium live and chilled Coorong pipis by a united industry to selected domestic and overseas market segments with creatively tailored promotional activities and Point of Sale materials.

An action plan for industry collaboration and reform with a three-year timeframe has been prepared, along with some preliminary (indicative) costings and likely benefits, for consideration by industry and key South Australian government agencies. The general scope and speed of implementation of this collaboration strategy needs to be discussed and determined by the interested parties, taking account of their financial and human resources.

In year one alone, adoption of the proposed actions could add about 10% to total fishing revenue, about a third of a million dollars, a benefit to cost ratio of 5:1.

I. INTRODUCTION

This marketing study was commissioned by the South Australian Research and Development Institute (SARDI) to gather information on the market situation and market requirements for pipis for input into the Economic Component of the SARDI FRDC project 2008/008 Harvesting Strategy Development For South Australian Lakes and Coorong Fishery for Goolwa Cockles (*Donax deltoides*).

There are about 18 fishers engaged in hand harvesting operations for pipis (Goolwa cockles) along the ocean beach, adjacent to the mouth of the Murray River. These operations require little capital investment and almost all of the fishers operate more or less independently even though they belong to either of two groups: the Goolwa Pipi Harvesters Association and the Southern Fishermen's Association.

The total return to fishers of the 333 and 400 tonnes annual landings of the past two years has been approximately 3 and 3.6 million dollars respectively according to industry sources. The Coorong pipi fishery is in an enviable position whereby it has Marine Stewardship Council sustainable fishery certification, the stock has rebuilt after a period of decline and the fishery managers are considering how the TACC may be lifted in a sustainable and profitable manner.

The three specific objectives of the SARDI-FRDC project relevant to this marketing study were:

No. 2. Identify key market requirements that maximize economic returns from the pipi fishery.

No. 7. Provide a harvesting strategy that is informed on the market demand, market prices and relative biomass and distribution of pipi and reproductive development of pipi

No. 8. Develop a formal harvesting plan for pipi using information from Objectives 1 to 7.

The consultant's brief for this marketing study included the following areas for investigation:

- Supply management ie matching supply to meet market requirements
- Chain structure — current chain opportunities through restructured processing and distribution
- Market development opportunities
- Dealing with competition — enhanced understanding of price points, product quality and supply.
- Strategic lessons from other sectors with similar structures and markets.

1.1. Methodology And Approach To The Project

The project commenced with desk research on earlier work undertaken on pipis, followed by face-to-face meetings with SARDI and PIRSA personnel in Adelaide then meetings with fishers at Goolwa (the Goolwa Pipi Harvesters Association) and at Meningie (Southern Fishermen's Association). These meetings, plus the literature review provided an overview of the fishery's management and research history as well as the contemporary supply and marketing activities and the current relationships between fishers and supply chain partners.

This research on the Coorong fishery and the fishery's management was complemented with desk research on the other clam fisheries in Australia and all available market information obtained from the Sydney Fish Market, Australian Bureau of Agricultural And Resource Economics And Sciences (the Australian Bureau of Statistics' import volumes and price data) and the New Zealand Seafood Industry Council (exports to Australia, volumes and prices).

The markets and supply chains, marketing practices, prices, quality attributes and demand for pipis (and other bivalves) were examined through a combination of telephone interviews, face to face discussion with importers, wholesalers, retailers, restaurateurs and other persons (more than 40 in all) and some personal observations on the marketing of pipis in Sydney, Brisbane and Adelaide (auction activities, wholesale, retail and restaurants).

Because of the limited budget and time frame for the study (mostly late August to early October) much of the work relied on telephone discussion and the study is more a wide ranging one than in-depth investigation.

Report Structure

Product descriptions and the names of different species are important issues because they affect market success now and into the future. This report's Introduction chapter therefore includes a review of the species and product names in the marketplace because they are numerous and somewhat confusing and discussion is difficult without a clear understanding of what species and products are in question.

The middle chapters of the report outline information gathered from personal observations in wholesale and retail seafood outlets, comment from trade interviews and desk research on various qualitative information and quantitative data.

The last few chapters of the report examine two options presented to industry, discuss the strategy recommended for market development through industry reform and outline a broad action plan, with some indicative costings, for proceeding with the recommended strategy.

1.2 Product Names, Descriptions And Labels

Pipis are just one group of bivalve molluscs in the large and varied group of bivalves commonly referred to as clams (or baby clams) in the Anglophone world and ***vongole*** in the Italian language. Pipis were the first clam to be called a vongole in Australia because of their abundance in NSW and the similarity in taste and appearance to the species consumed in Italy.

The name pipi — a Maori word — is the Standard Fish Name of the domestic Australian species known scientifically as ***Donax deltoides***, but it is still commonly referred to as a cockle or the Goolwa cockle in south-eastern Australia. The New Zealand import ***Paphies donacina* (=*Paphies australis*)** is called a pipi (or tua tua) here in Australia and in its home country.

Many other species of bivalve molluscs from various zoological families are also known and sold in Australia as clams or vongole. These include the ***Katelysia*** species from Tasmania and South Australia which were granted the Australian Standard Fish Name of vongole in 2009, a more attractive marketing name than sand cockle or mud cockle as they were, and still are, commonly known.

In recent years Australia has seen the arrival of increasing volumes of New Zealand clams, cockles and pipis and Asian bivalves which are commonly sold under a variety of names as seen in Table 1 which deals only with the common imports.

It is clear from this table that there are many endemic and overseas species of bivalve molluscs, each with several names that are being consumed in various cooked dishes around Australia under the name of clams or vongole and occasionally pipi.

This multitude of species and names has generated some communication problems and confusion throughout the supply chain from fishers to consumer. This is not unusual with seafood trade and consumption in Australia, however it is probably worse with these edible bivalves because most share a strong superficial resemblance with each other, and most people (including many fishmongers would not be able to differentiate them unless they had a labeled collection of shells in front of them.

Unless otherwise indicated, the word clam is used in this report as a collective term encompassing all pipi, cockles, vongole, and clam species.

Table 1. Names of clams sold in Australia.

Origin	Names in use	Scientific name	Comment
S. Aust. NSW & Vic	Pipi Goolwa cockle Vongole	*Donax deltoides*	
S. Australia	Sand cockle SA vongole Live cockle Local cockle	**Three species** *Katelysia peronii* *K. phytiphora* *K. scalarina*	Three species sold as cockle or clam
Tasmania	Tasmanian Vongole Tas. Cockle Tas. Clam	*Katelysia peronii* *K. phytiphora* *K. scalarina* *Venerupis langillierti*	Mostly the *Katelysia* species.
New Zealand	NZ pipi Tua tua	*Paphies donacina*	
New Zealand	Diamond clam Diamond shell Surf clam	*Spisula aequilatera*	Blanched
New Zealand	NZ clam Littleneck clam Littleneck cockle Sand cockle Vongole	*Chione (Austrovenus) stutchburyi*	
New Zealand	Storm clam Storm shell clam	*Mactra murchisoni*	
Vietnam	Large trough shell Clam White clam Vietnamese clam	*Meretrix lyrata (Veneridae)*	
China	Baby Clam	*Venerupis variegata*	Pre-Cooked (boiled)
	Frozen clam	*Ruditapes philippinarum*	

2. PIPI SUPPLY CHAINS, QUALITY AND PRICES

The Coorong pipi harvest is sold for human consumption around the country and in recent years small volumes have been exported to several countries. They have also been sold as bait around the southern half of Australia for many years.

Export sales have been more of an exploratory or trial nature and unprofitable so far, principally because of the high value of the Australian dollar in recent years.

According to fishers, the proportion of pipis going to the bait trade, domestic human consumption trade and overseas sales changes according to the prices on offer and the size of the pipis harvested and so has proven very difficult to forecast. Smaller pipis, unattractive ones (algal discoloration) or pipis not deemed fresh enough for human consumption are typically consigned for bait.

The existence of a pipi bait market has had positive and negative outcomes for the Coorong industry. It has long provided a large outlet despite lower prices, about 25% less than for human food according to industry sources, but it has also been used for pipis deemed not good enough for human consumption on occasions when quality management was apparently insufficient.

SARDI data indicates that the human consumption market has accounted for about half to three quarters of the landings since 2008/09 (G. Ferguson 2012) a noticeable change of situation from the 1990s when bait was the dominant market. This sharp decline in demand for pipi bait has been due to rising prices with falling supply and the price competition from cheaper imported clams according to the bait dealers.

This study deals principally with the domestic marketing situation for product destined for human consumption, hence further discussion of the bait and export market is essentially limited to how these two smaller markets interact with domestic human consumption trade and prices. However, the discussion on marketing principles and practices relating to domestic marketing of seafood in this report is relevant to the bait and export market too.

2.1 The Seafood Supply Chains

Pipis for human consumption are sold by fishers to selected wholesalers intrastate and interstate at agreed prices and they are also consigned to the Sydney Fish Market for sale by auction.

The pipis are then bought by wholesalers, retail fishmongers or by restaurateurs on site at various wholesalers' premises, or at the Sydney auction, or via telephone/fax/email order to selected wholesalers, and finally consumed at home or in the medium to higher priced eateries as shown in Figure 1. Clams have not yet been offered for sale in Australian supermarket stores.

Coorong fishers mostly sell their product independently of each other, predominantly in unbranded lots of loose shellfish, particularly when destined for human consumption. Several bait wholesale distributors however pack pipi bait in small branded packs for retail sale.

In the past few years several fishers have worked together in coordinating their harvesting, selling and distribution activities to reduce volatility in supply and prices and to improve profitability through economy of scale cost reductions.

Nonetheless there has been no ongoing engagement with retailers or restaurateurs or other customer support and most seafood retailers and almost all restaurateurs consulted in Sydney had little understanding of the causes of the declining volumes and rising prices of pipis in the late 2000s or the fishery's Marine Stewardship Council (MSC) certification status. Four of the five Italian restaurateurs consulted were former pipi users and they expressed interest in purchasing again if prices were more predictable and affordable.

As in much of the Australian seafood industry these pipi supply chains are mostly informal and weakly integrated, having grown from arms length business practices (mostly over the phone) where documented or other formal arrangements, and product specifications, are unknown and short term price driven sales or transactional relationships are the norm.

In short there has been little effective supply chain management in the pipi industry and almost all the fishers in Coorong have been passive sellers and become price takers.

The NSW pipi harvesters and the South Australian and Tasmanian clam fishers utilize the same straightforward supply and marketing chains as Coorong fishers (as shown in Figure 1).

Imported clams follow most of the distribution channels utilised by Australian product with the notable exception of the Sydney Fish Market auction (which typically does not handle frozen seafood) but the imported products, frozen or fresh, also end up in restaurants, retail outlets, and homes. Many large retail outlets in Sydney sell a range of imported and Australian clam products.

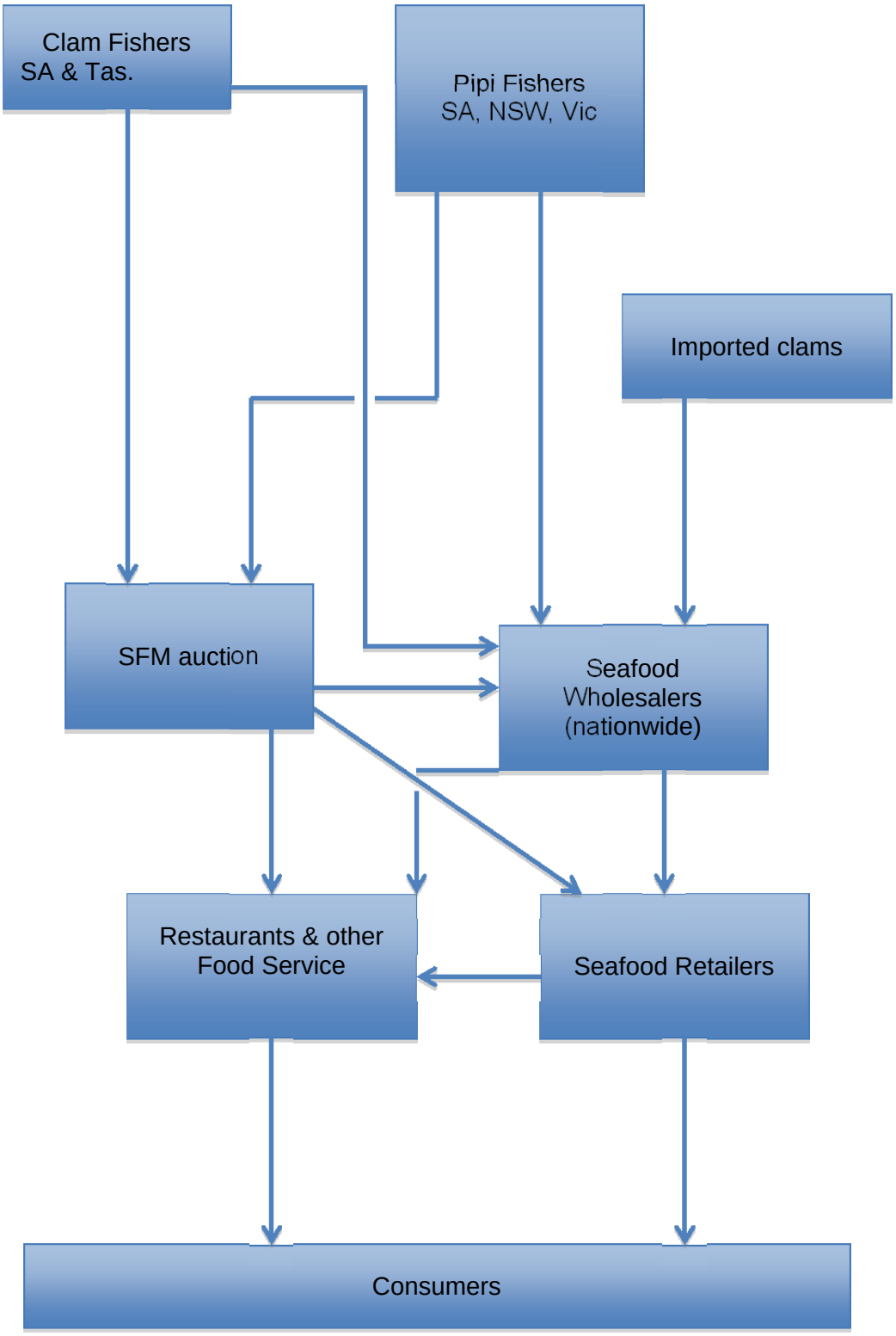

Figure 1. Common supply chains for pipis and other clams.

Most of the vongole from the South Australian and Tasmanian fisheries are also distributed as loose shellfish or in plastic bags inside styrene cases but a small volume of SA vongole are also packed in 1kg vacuum packs in Port Lincoln. These are labelled as cockles by the packer and distributed in Sydney and elsewhere via selected wholesalers where they are sold as cockles, sand cockles or vongole or a combination of those names.

There is no quantitative information on what percentage of pipis are consumed in home and what is eaten out of home in restaurants or elsewhere in the food service trade.

Coorong fishers believe that in the past few years the proportion of pipi sales has varied with supply and prices with the majority of consumption out of home when prices are high and that in home consumption is greater when prices are at medium or low levels.

Sydney is believed to account for about 60% of total consumption with Melbourne about 30% and the balance going to other areas.

Almost all the food service users of clams are restaurants specializing in Chinese, Italian, Spanish, Portuguese cuisine or seafood generally. Price is a major factor influencing the type and number of buyers of clams be they fishmongers or food service outlets: the higher prices prevailing in the late 2000s for Australian clam products (described later in this chapter) has meant that they are typically only bought by businesses with a clientele familiar with these shellfish and prepared to pay the higher price for the Australian product.

2.2. Quality Management and Processing

Most of the Coorong pipis are purged, for de-sanding, in holding tanks prior to sale for human consumption and then distributed loosely packed in plastic fish tubs or held inside plastic bags within a sealed styrene case for air transport. NSW pipis are almost always loosely packed inside the plastic fish tub and consigned to market by road transport.

Trials have been undertaken successfully with modified atmosphere packs of pipis but they have not yet been released onto the market.

Coorong pipi quality (loose product) was described by interviewees as mostly good but somewhat inconsistent, particularly regarding de-sanding and vitality. It was reported that frequently pipis sold as de-sanded were still containing noticeable quantities of sand and that the vitality of live pipis was highly variable.

There are no uniform quality standards or quality assurance programs in the pipi industry in Australia other than those of the mandatory state Shellfish Quality Assurance Programs that relate only to public health and not other product quality parameters. Very little effort has apparently been expended in actual quality management and quality testing by Coorong fishers.

Despite the lower prices in the bait market, it has been a quick and easy selling outlet for pipis particularly when fishers have not wanted to spend much time managing quality or size grading. Bait buyers have apparently been more prepared to take ungraded or poorer quality pipis than buyers for human consumption. The bait market has therefore diminished the fishers' attention to product quality in general and the industry's overall quality image.

Size Grading

Australian pipis are typically size graded according to the Sydney Fish Market specifications (below) but ungraded product (in regard to size) is also common.

Table 2. Sydney Fish Market Size Categories and Coorong industry Size Criteria.

Size Category	SFM count per kg	Coorong industry sizes (mm)
XL Extra Large	<40	> 59
L Large	40-50	50-59
M Medium	50-60	42-49
S Small	>60	35-41

2.3 Pipi Supply and Prices

The Coorong pipi commercial catch was recorded at 1250 tonnes in 2000/2001, remained above 1000 t per annum in the early 2000s but gradually declined to 994 t to in 2006/07 according to SARDI statistics. NSW pipi annual landing volumes were also more than 1000 tonnes in the early 2000s but they too gradually declined over the second half of the decade. Appendix 1 has the detailed history of landings by the NSW and SA fishers.

Average prices, as indicated by Sydney Fish Market auction data, were very low in the early 2000s with a $3.82 per kg average price on the 209 tonnes sold there in 2000/01 that jumped to much higher levels in the past few years with declining volumes and general seafood price inflation. Figure 2 shows the annual volumes and prices recorded at the SFM auction since 2005, a period when SA product outweighed NSW product (These data are tabled in Appendix 2).

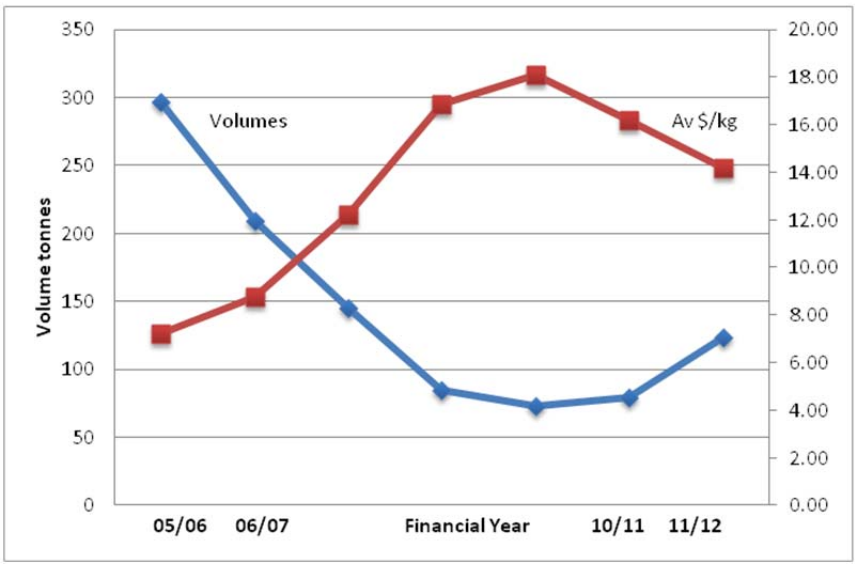

Figure 2. Sydney fish Market auction annual sales volumes and price.

This figure shows a classical supply/demand relationship with prices falling with increasing volumes and rising with lower volumes, volume increased by 57% in 2011/12 over the previous year but average price fell by only 13%.

This recent lift in SFM sales volumes, arising mostly because of the increase in the Coorong TACC from 333t to 400t, indicates that price is not as sensitive to volumes as it has previously been and provided evidence that industry total revenue can increase despite a noticeable fall in average prices.

Pipi prices, as indicated by the SFM auction data, were particularly volatile in the late 2000s as buyers adjusted to rising prices from the falls in aggregate landings from SA and NSW discussed earlier. In winter months when supply is very low, or sometimes nil, prices soar to incredibly high levels. This volatility in SFM supply and prices, coupled with very high prices, above $30 per kilo and sometimes super high above $50 (November 2009 and September 2010) have produced some lasting detrimental outcomes.

Trade interviews indicate that many fishmongers and restaurateurs have lost interest in buying pipis because the price has been unpredictable and often too high to be

used profitably in their business. It was reported that the super high prices at the SFM auction are the result of wholesalers filling special orders for up market Chinese restaurants that are prepared to pay incredible prices to have live pipis for their display tanks for specialty dishes.

Pipi landings and prices show considerable seasonal and daily fluctuations in prices too, as seen in the accompanying figures. Figure 3 below shows landings were highest and prices low in the warmer months and the reverse situation is evident in the colder part of the year.

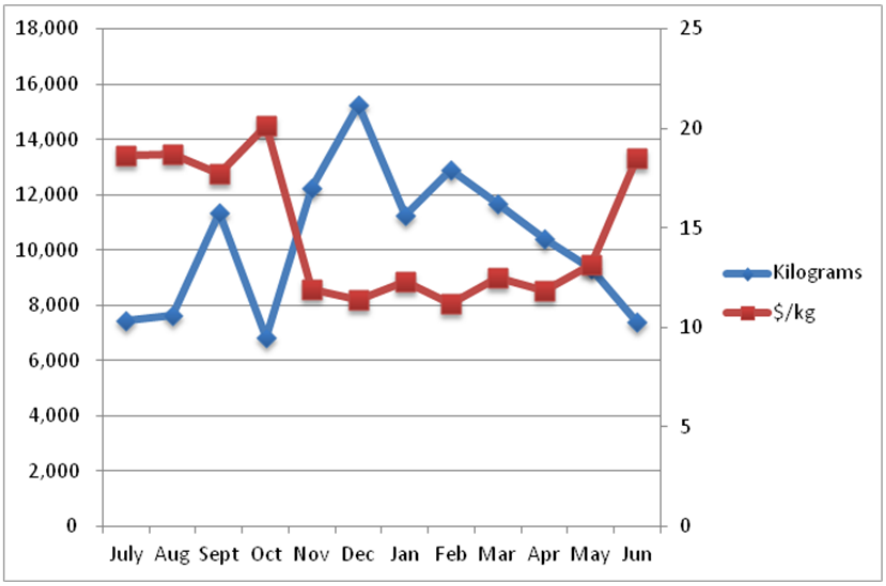

Figure 3. Monthly sales volumes and prices SFM auction 2011/12

This erratic high price situation facilitated the market entry of fresh/chilled New Zealand clams a few years ago and the high prices common over winter have helped the fresh and frozen New Zealand products gain wider distribution and increase their share of Australian clam consumption (as discussed later).

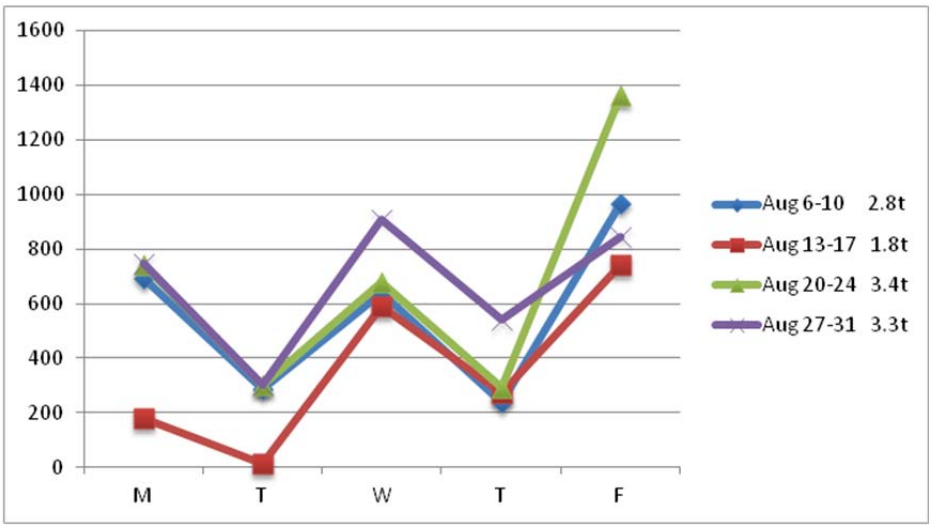

Figure 4. Daily sales volumes (kg) and average prices at SFM auction for four weeks in August 2012.

A lack of information on the quality/vitality of pipis sold makes it difficult to be precise about the influence of day of sale, or size grade, on prices at the SFM auction, however an examination of the daily price data and discussion with regular pipi buyers at the SFM indicate that:

a. Supply volumes are typically lower than average on a Tuesday and Thursday and highest on a Friday as indicated in Figure 4 above. Thursday has a large number of buyers attending the auction and is a strong day for buying as some fishmongers like to stock up then rather than wait for Friday when seafood supply may not be so strong. Thursday therefore warrants consideration regarding supply management as it appears to be a day that could cope with a greater supply of pipis.

b. Vitality is the most important factor influencing price with live pipis attaining best prices for their size category and dead pipis the cheapest. Vitality, or lack of, is often the cause of the “outlier prices” (unexpectedly high or low prices respectively) seen in SFM sales data and highlights the need for sound quality management.

c. There is generally a positive correlation between pipi size and price attained but vitality can override price and larger “weak” pipis can sell for less than noticeably live pipis.

d. The ungraded product category (in regard to size) typically fetches a lower price than graded boxes of a similar sized shellfish.

2.4 Australian Vongole Supply And Prices

The annual landings of *Katelysia* cockles/vongole from Tasmania and South Australia has been low because of the low total allowable commercial catch set for these shellfish.

The low annual landings of these species means that only very small volumes are sold direct to wholesalers or via the Sydney Fish Market auction (Table 3). The prices of these species are not as variable as those seen with pipis because much is sold to wholesalers at more or less steady, relatively high, prices and the auction prices reflect this relatively stable market situation, because buyers visiting the Sydney Fish Market can buy them from wholesalers at a known price and/or they can purchase at the auction sale depending on the perceived value of the goods offered by the two.

Table 3. Sydney Fish Market auction supply and average prices for cockles/vongole (excluding *Anadara* blood cockles). This volume consists mostly of South Australian *Katelysia* species according to the Sydney Fish Market.

Year	2011/12	2010/11	2002/3	2002/01	2000/01
Volume t.	16.2	25.9	5.2	na	4.5
Aver. $/kg	18.74	18.33	$3.52	na	$2.62

A perusal of this table, and Figure 2 (earlier) clearly shows that prices have increased far more over the past twelve years for these clams than they have for pipis.

The South Australian and Tasmanian clams almost always fetch prices above that of pipis because of their very limited supply and strong demand arising from their labelling as vongole, the Italian generic name that attracts trade buyers and consumers who mostly do not know or have forgotten that pipis are also a vongole or clam species.

2.5 Total Clam Supply and Prices In 2011/12

Reliable precise data on imported shellfish volumes and prices are unavailable, for a number of reasons (outlined on the next page). However Table 4 below gives an approximation of the aggregate sales and human consumption of clams in Australia for the 2011/12 year. Also shown are the "landed price" paid by the first buyer in Sydney, eg a wholesaler for Australian produce, or the cost of goods, free in-store price (FIS), paid by an importer.

The volumes for vongole from SA and Tasmania are estimates from the TACC allocated by the state, while import figures are the consultant's best estimates.

Table 4. Sales of Australian and imported clams in Australia 2011/12

Product/ Origin	Sales Volume (tonnes)	Sydney "landed price" $/kg	Comment
Pipis			
S. Aust	~300	14.15 Average SFM auction.	NSW fishery was closed for most of this year.
NSW	16		
Vic.	5-10 ?		
Cockle/clam			
S.Aust	~66	~ 17 FIS	Predominantly loose; small volume MAP
Tas.	~35*		
Fresh clam New Zealand	~100	~11 FIS	These are predominantly blanched diamond clam
Frozen Clam, New Zealand	~200	~8 FIS	Predominantly raw littleneck clams
Frozen clams Asia	? 200	3-4 FIS	Various species, countries & prices

Abbreviations: SFM: Sydney Fish Market
? uncertain
~ approximately
FIS : Free In Store (Price paid by first buyer)

The data in this table indicate that Coorong pipis represented almost all of the pipis consumed in 2011/12 (NSW landings were extremely low because the fishery was closed between December 2011 and June 2012) and almost a third of the national volume of all clam species consumed that year (About another 100 tonnes of Coorong pipi were sold as bait that year according to industry sources).

3. MARKET INTERACTION & COMPETITION WITH IMPORTS

3.1 Imports, Supply, and Prices

New Zealand and Asia are the main sources of imported clams, other countries/regions are responsible for only a few tonnes a year according to trade interviews and the official ABS statistics.

The ABS statistics on imported clams do not correlate at all with the official New Zealand export statistics for Australia and neither correlate with information gained from industry sources or field observations in Sydney, Brisbane and Adelaide. The ABS statistics for Vietnam and China, the main Asian sources, according to the product noted on sale in the south east capital cities listed above, are also inconsistent with industry sourced information.

The information in Table 4 (earlier) therefore represents the consultant's best estimate of the aggregate volumes and average prices prevailing in the past financial year. The reasons behind the inconsistencies between various official data sets and the problems with such data are discussed in Appendix 3.

New Zealand Clam Supply and Prices

There have been at least four New Zealand clam species including the pipi (tua tua) imported to Australia over the past few years, under several proprietary brand names, by at least four importers.

The New Zealand clams are imported as frozen and as fresh/chilled product form in 1kg packs; the frozen product, predominantly littleneck clam, is in a vacuum pack while the pipi, the Diamond Shell and the Trough Shell are imported as blanched fresh product in a Modified Atmosphere Pack with a 28 day shelf life.

The fresh product range commands a much higher unit price than the frozen littleneck as indicated in the previous table, this price differential reflects the Australian preference and strong demand for fresh seafood over the frozen but it is also a function of size too as the littlenecks are invariably small and the other species are invariably much larger, but very well graded into several size grade packs.

The common New Zealand brands Westhaven (principally littleneck clams) and Cloudy Bay (principally diamond shell) both have attractive plastic pouch bags printed with information on the product's provenance, as well as handling and cooking instructions.

The frozen littleneck clams are often removed from the packaging and sold loose while the other clams (fresh) are commonly displayed in retail outlets in the MAP pack, but the shop window display labelling does not indicate that the loose shellfish had come from a frozen pack and consumers presumably assume they are buying a fresh product.

The New Zealand fresh and frozen product range has been well received by retailers and restaurateurs and recording increasing sales volume each year, with little cash investment in promotion other than personal selling by sales representatives/importers. According to trade interviews the number of products,

aggregate volumes and importers are destined to increase significantly in 2012/13 with probably an additional 100 tonnes coming into Australia.

Part of the success of the New Zealand clams, the other imports, and the South Australian 1kg cockle pack from Port Lincoln, relates to the modified atmosphere (or vacuum) packaging. MAP offers the following benefits or features.

- Minimises or prevents contamination and tampering
- Controls gape and weight loss, an important consideration for retail display.
- Branding, provenance, safety, cooking and other communication opportunities for the producer/packer; as seen in Figure 5, next page
- Convenience, for retailer, restaurateur and consumer
- Modern packaging appeals to “new clientele” particularly people who dislike wet seafood (especially in the car).

Chinese and Vietnamese Clams

There are several species of clams packed in China and Vietnam that were noted in various retail outlets and in restaurants during field research. These fall into two categories:

- The distinctive white Vietnamese *Meretrix* clams that are medium sized, cheaper than Australian pipis, and New Zealand littleneck clams but dearer than Chinese (Table 4)
- The Chinese farmed clams that are a colourful looking very cheap medium sized shellfish, not dissimilar to Australian pipis in overall appearance.

The Asian products are more commonly seen in retail stores in areas where there is a significant Asian clientele and they are used in home and in restaurants. They invariably come in an attractive vacuum pack (Figure 5) with considerable amount of information on provenance, handling/storage, and cooking instructions.

A small number of Chinese restaurants were noted that utilize Australian live pipi for higher priced special pipi dishes and the imported clams for ordinary cheaper dishes. The top class Chinese restaurants in Sydney apparently only use live Australian pipis while the cheap Chinese restaurants would not use the Australian pipi because of price.

Figure 6 shows South Australian cockles with an identifying sticker attached.

Figure 5. Two different brands of frozen clams imported from China showing the "back" of one pack and the "front" of the other.

Figure 6. South Australian chilled cockles with a stick on brand label on front of pack.

3.2 Competition in the Clam Trade

The most important direct competition to Australian pipis comes from South Australian and Tasmanian vongole and from the fresh New Zealand clam species, particularly the diamond shell.

In years gone by the NSW pipi was the principal competitor in the marketplace as it is the same species as the Coorong one and an equally well regarded product, but with its low landings in recent years it has been far less important.

The fresh SA and Tasmanian vongole and fresh New Zealand clams are regarded as good quality affordably priced product and seen as equivalent to fresh Australian pipis in various European cuisines such as the classical Italian dish *pasta con vongole* (spaghetti with clams); they are also attractive because the size and overall appearance are similar to those noted in pipis. In economic terms they can be regarded as substitutes for pipis.

The New Zealand littleneck clam is a cheaper product, especially as a frozen bulk pack, and represents a strong price competitor in both the retail and restaurant trade because it too is an attractive tasty clam and the cheapest of the Australian and New Zealand clam products on offer.

The Asian clam products however, all imported frozen, are not considered to be direct competitors to fresh/live Coorong pipis, if market competitors at all in the retail trade, because they are:

- Frozen, not fresh, and seen as inferior to a fresh/live product;
- Product of Asia is perceived by some non Asian shoppers as more “risky”, particularly product packed in China that is so cheap that this apparently raises doubts amongst some people about its safety;
- Moreover, the Asian products are very low priced seafood; shoppers in this low price market segment probably have never been users of Australian pipis because of their much higher price and would be unlikely to buy Australian pipis even if the cheap imports were not available.

Fundamentally however, the success of the New Zealand and Asian clams is based on their perceived high quality, attractive functional packaging, and overall good value.

Market Requirements for Clams

The critical factors affecting market success in a competitive environment (discussed over the previous pages) can be summarized as:

- Attractive/appealing product name, product descriptions and labels
- Vitality/freshness. Live is more prized than fresh/dead and frozen are least desirable/cheapest in Australia;
- Reliably de-sanded;
- Prices predictable/non-volatile and offering good value;
- Plump tasty flesh;
- Consistent product quality that meets specifications;
- Branding that enables clear differentiation, facilitates promotion and engenders customer loyalty;
- Size grading, with several categories and all true to label or specifications;
- Packing and packaging: Small volumes in handy container/packs; loose exposed product is increasingly perceived as inferior and outdated;
- Ongoing communications with supply chain and consumers eg Provision of product information (storage, handling and cooking) and new topical information;
- Food safety, this is mandatory, it is not an option;
- Sustainability of resource. Consumers want to be guilt free when buying seafood. The Coorong pipi fishery has a unique selling point with its MSC certification that has not been utilized with customers or consumers.

Finally it should be noted that the competition for the consumers' dollar comes not just from other species of clams but also other bivalves, many other seafoods and indeed many other goods and services. This makes ongoing communication with customers and promotion essential for any industry.

4. MARKET OUTLOOK AND DEVELOPMENT

The total volume of Australian pipis going to the human consumption market from the Coorong and NSW declined by about 1000 tonnes from the early 2000s to its current level of about 400 tonnes per annum judging from the official catch statistics adjusted for volumes sold as bait.

About 200 tonnes per year of New Zealand clams (100 t fresh and about 100 t frozen/thawed) and 100 tonnes of Australian clams have offset this fall in pipi consumption. There remains an opportunity to regain some 700 tonnes per annum of national pipi consumption (1000 – [200+ 100]). However Australia's population has increased by approximately 15% in the past decade and changing demographics and eating habits have helped strengthen demand for seafood generally so this untapped latent demand for pipis is probably far greater than 800 tonnes per annum, rather than 700 tonnes.

The rise in Coorong TACC from 333 t in 2010/11 to 400 t in 2011/12 contributed to a 57% increase in volume sold at the SFM auction that resulted in an average price fall of just 13%. These sales results over the past two years provide strong empirical evidence that TACC can again be raised substantially with a positive impact on total industry revenue.

The law of supply and demand suggests that prices fall in response to rises in volume, ***assuming that all other factors remain the same***, as they presumably did in 2011/12. So substantial supply increases such as those just described can be effected with similar small falls in average prices with selected changes to the "***other factors***" affecting demand, for example by improving product quality and undertaking promotion to re-engage former users and enlist new ones for the "new improved" Coorong pipis.

Moreover SFM auction sales results and personal observations on the corresponding retail sales in Sydney in September 2012 suggest that there is sufficiently strong demand for loose pipis at a FIS price point of $12-13 per kilogram that enabled retailers to have an attractive pipi offering at about $20 per kilogram in their retail display. These price levels were also seen as attractive for restaurant buyers.

If the prospective expanded TACC for the Coorong fishery can be harvested over a twelve month season rather than the traditional six month season (apparently there are no scientific contra-indications) the large price fluctuations of recent years can be reduced, pipi marketing becomes more predictable and pipis become far more attractive for the entire supply chain from wholesalers to consumers.

It is our considered opinion that industry reform and a change in operating practices from the traditional uncoordinated passive sale of unbranded varying quality product to a collaborative modern marketing approach targeting selected market segments and niche opportunities would enable fishers to profitably utilize an increase in annual TACC of around 25%/100 tonnes from 400 to 500 tonnes.

The introduction of a branded range of MAP packs would open up a whole new era of opportunities both in Australia and abroad and would add substantially more again to the prospects of the Coorong pipi fishery.

The potential sales volumes, prices, and industry revenue cannot be reliably assessed at this time because they depend enormously on how quickly and closely

fishers are prepared to collaborate and on the magnitude of resources a reformed industry is prepared to invest in new product and new market development. However the recent history of the Australian mussel industry with new product development and increased industry collaboration, described in the following chapter (five), is encouraging.

The industry collaboration and reform strategy proposed for the Coorong pipi fishers then follows in Chapter 6.

5. STRATEGIC LESSONS FROM OTHER INDUSTRIES

Three Australian case studies have been selected that provide some valuable lessons relating to industry development.

The Sydney Rock Oyster Industry

This industry has long relied on natural spatfall and consequently was slow in shifting to hatchery bred genetically selected spat ("baby oysters") while the newer Pacific oyster industry quickly adopted and made great use of this technology to grow oysters selected to meet consumer preference for a large clean looking shellfish. The lessons that can be learned from the oyster industry are:

- The need to move with changing consumer preference
- The adoption of new technology produced a seafood product that better satisfied consumer wants and at lower prices that pleased consumers and the farmers alike.

Today Sydney Rock Oyster (SRO) and Pacific oyster farmers work together on many R & D projects, including marketing, because they recognize that collaboration has mutual benefits even if they are marketing different species of oyster in the same marketplace.

Endeavour Prawns

This tropical prawn species had for many years mostly been sold in Queensland or exported to Spain while the Australian dollar was not strong, however when the Australian dollar strengthened overseas demand weakened with the now higher priced Endeavour prawns.

When approached by the fishing companies' sales representatives most Australian retailers outside Queensland were not prepared to restock Endeavour prawns because they were not confident that the fishers would continue with domestic supply once overseas demand picked up again and so Australian fishers frequently still have difficulty selling large volumes of Endeavour prawns domestically.

The lessons here are: (i) overseas marketing is certainly interesting (sales representatives prefer Madrid before Melbourne) but a business cannot rely on just one market at the expense of other markets/customers; (ii) business success thrives on building long term good relationships ("win-win") with a number of diverse customers and spreading the risks; and (iii) not putting "all the eggs in one basket".

Blue Mussel Industry

These bivalve shellfish provide a remarkable model in industry development because 12 years ago Australian mussel farmers were in a similar position to that of the Coorong pipi fishers today: strong individuals mostly with average quality loose wet product competing with each other on price (in what was then a small industry).

A marketing analysis study presented at a national mussel industry strategy meeting in Melbourne in 2000 highlighted the need for a more consistent and better quality product and recommended the adoption of uniform product quality and size grading criteria and standards to be followed with promotion of mussels as an inexpensive tasty shellfish.

These recommendations were adopted and funding (FRDC) was obtained to develop uniform agreed quality standards, a post-harvest Code of Practice, and produce trade and consumer guides for handling mussels. The adoption of these guidelines, and the improvements in mussel quality and handling, was capped off with a media launch in Sydney to promote awareness and strengthen demand for the “new” high quality mussels.

This industry reform was successful and the mussel industry’s output and prices rose steadily and about five years ago they introduced modified atmosphere packaging (MAP) to the Australian marketplace and the industry’s total output continues to grow as the popularity of the MAP product increases (and the proportion of loose wet shellfish sales declines) because the industry continues to promote its premium products with free publicity and other inexpensive promotional initiatives.

Today, national output of mussels is about 4000 tonnes per annum and MAP make up more than 1500 tonnes of this according to industry sources. Mussel farmers across the five producing states now recognize that success has come about because of their widespread attention to quality assurance and reliable size grading in line with the trend for consistently good quality seafood in convenient affordable packs (1 and 5 kilos).

Collaboration amongst mussel farmers over the years has improved so much that they sometimes co-pack for one another and share customers when the need arises because one has an unexpected shortage of supply. Several South Australian mussel farmers are at the forefront and provide an excellent role model in collaboration on uniform quality standards and generic product promotion for the Coorong pipi harvesters.

6. INDUSTRY'S TWO STRATEGIC OPTIONS

There are two fundamental options available for the South Australian pipi industry if it wishes to improve its profitability, particularly in an era of rising TACC:

a. It can continue with the *status quo* of individual fishers selling varying quality product, sometimes in direct price competition with each other

   OR

b. A large group of interested fishers, or the catching sector as a whole, can make a decision to collaborate to reduce costs, access new markets together and raise profitability.

6.1 Option One: Status Quo and Stagnation

If the Coorong industry just stays with the marketing *status quo* it will stagnate, or "go backwards" in real terms, because markets are dynamic and continually changing in some way. Australian and overseas rivals/competitors are well organized, improving their marketing efforts and not just sitting back passively, as outlined below.

NSW pipi stocks are in a recovery phase and production and sales volumes are likely to rise although there is little information available on this.

Victorian pipi landings are also likely to rise over the foreseeable future and will add to aggregate supply even if they are sold in Victoria. Although there is little reliable quantitative information available it seems inevitable that aggregate Australian pipi volumes are going to rise and place downward pressure on average prices.

New Zealand clam product range, volumes and prices have been trending up in the past few years and the increase in volume and number of products and importers is almost certain to continue as the demand for shellfish increases. As indicated earlier fresh New Zealand product and frozen product sold as chilled represents strong competition.

From our discussion with various market intermediaries, New Zealand imports are likely to increase by about 100 tonnes in 2012/13 a volume increase of about 33% on the previous year. This is an emerging business situation that should not just be ignored as it will lead to further erosion of the market share for Coorong pipis.

The bait market for Australian pipis is also facing challenges from a declining interest in pipis as bait because of rising prices. Bait dealers reported that the really keen pipi users are gathering pipis themselves while the casual user was content with other baits or the cheaper imported shellfish. In short, the bait market does not look promising and cannot be relied on as a crutch as it has been by some for too many years.

The one kg pack of South Australian vongole/cockles is the market price leader by virtue of its scarcity/limited volume, the convenient MAP pack, and appealing Italian name. The lack of recognition of the pipi as a vongole remains a market impediment, affecting the acceptance and price of this species, that should be addressed by pipi fishers.

The current low level of collaboration amongst Coorong pipi fishers means that there are relatively high overhead and operating costs and the industry is essentially missing out on economies of scale that could be captured with more collaboration as discussed below under option two.

Over the long term pipi fishers face the ever present prospect of price competition from Australian aquaculture pipis/clams as the prevailing market prices look very tempting for would be clam farmers. In regard to aquaculture it should not be assumed that the "aquaculture product threat" is restricted to Australian nationals; it is equally likely that overseas investors would start the first clam farm in Australia.

In short, with or without a TACC rise, the Coorong pipi industry needs to improve its approach to quality management and marketing and reduce its reliance on the bait trade if it wishes to prosper.

6.2 Option Two: Collaboration, the Way Forward

This option enables cost reduction in fishing and marketing, opens up new product and new market opportunities, here and overseas, and allows industry to jointly promote their products (and industry) in a more cost effective manner and thereby significantly strengthening profitability.

This collaboration strategic option is not an "all or none" one. Ideally a majority of fishers coming from across both organisations (SFA and GPHA) would recognize that the medium to long term benefits of collaboration outweigh any financial cost or immediate concerns they may have but this option also has merit if a substantial number of fishers from both groups, representing a large percentage of the state's TACC for pipi, agree to work together under a regional umbrella organization such as the Coorong Clam Consortium for want of a better name.

Moreover, this option does not require immediate incorporation (or other formal legal entity) or a substantial cash injection for the immediate purchase of a large MAP processing line to start off with. The scope and speed of collaboration should be discussed and determined by interested parties according to their financial and human resources. After all, an MAP product range is just one, albeit an exciting one, of the market opportunities that exists and that warrants consideration.

This strategic pathway can be started with an informal meeting between fishers electing a steering committee to examine the issues and perhaps draft a Memorandum of Understanding which can lead to formal arrangements and capital investment later on when, where and how supporters decide on as the personal and business relationships and trust strengthen.

Fishers present at the PIRSA headquarters on 26th October, for the consultant's presentation on this marketing study, agreed to follow up with an invitation letter to all registered pipi fishers to gauge interest in such collaboration.

Through collaboration fishers can reduce costs of harvesting operations, transport, packaging materials, and other inputs by working collectively rather than individually. For example a consortium of Coorong pipi fishers would be able to negotiate better terms of business (commission charges) with the Sydney Fish Market than individual fishers could.

There are also gains to be made by collaborating (in a legal fashion) on prospective market supply to Sydney to avoid oversupply and auction price collapses and generally by sharing market information related to the SFM and other marketing channel operatives.

As the consortium demonstrates that it is gaining market advantage and tangible net benefits competitive pressures/business imperatives will convince others in the Coorong fishery to join up.

Market development of a range of MAP products for domestic and overseas sale seems more feasible for a consortium than for a single fisher (except for someone with ample funds to go it alone). But as indicated earlier detailed discussion on the why, how and where of entry into MAP processing and marketing is not necessarily an immediate need.

Industry collaboration also widens opportunities for R & D grants and allows for access to cheaper funds or financial assistance for R & D in general (for example a new long life MAP products range) and enables wider geographical penetration of loose and packed pipis.

Moreover a united fishing sector strengthens industry's capacity to negotiate fishing conditions, quota allocation etc with government agencies such as SARDI and PIRSA and the prospects for government and private sector funding for general communication activities and the other promotion exercises needed to strengthen demand for Coorong pipis.

The FRDC and other national departments or Research and Development organizations favour group activities and joint efforts rather than uncoordinated attempts at Research and Development, capacity building, or extension projects. Most, in fact, insist on national collaboration and harmonization in any proposed activity.

Given the growing pressures on local, state and commonwealth governments to constrain commercial fishing activities and expand marine parks and the related need for strong community relations for fishers to retain resource access, a united pipi industry makes good sense as it enables industry to present a better public image than it otherwise could.

6.3 Strategic Direction for Working Together

A strategic direction and a tentative action plan for collaboration has been drafted over the following pages for consideration and discussion by fishers, SARDI and PIRSA.

The Strategy: Targeted marketing of quality assured premium live and chilled Coorong pipi by a united industry to selected domestic and overseas market segments with tailored promotional initiatives.

The Objectives: To raise awareness and demand and thereby strengthen prices for premium quality product for human consumption. This strategy requires a diversion of landings from the bait trade to the more valuable human consumption marketplace and best practice handling of all pipis landed.

The strategy recommended for the four elements of the marketing mix: (i) the Product, (ii) the Place of sale/distribution, (iii) Price and Promotion (also known as the 4 Ps of marketing) follows:

- **The Product Strategy**. Premium quality assured products, tailored to various specifications, packed and marketed under a regional umbrella brand, with or without particular company markings brands or logo.

- **The Price Strategy**. Offer unbeatable value: extraordinary quality and service at ordinary prices, prices close to seemingly similar products (but with less benefits).

- **Place/Distribution Strategy**. Build profitable long term business relations with selected market segments in Australia and selected countries

- **Promotion strategy (Public Relations, publicity, advertising etc)**. Ongoing two-way communication and interaction with consumers, the supply chain and the food media: raise awareness, understanding and satisfaction with Coorong pipi.

These four elements of the marketing mix are interlinked and relate to each other eg price typically varies with each product size grade (and often the place of sale) and may change with some special price activity; likewise a change in a particular product specification or packaging may entail a change in price for a particular product.

The marketplace is dynamic, not static and so the marketing mix needs to be reviewed regularly to ensure it remains relevant and effective.

The proposed consortium's market success will depend on all members adopting a more customer oriented approach and working to uniform quality and size grading standards. New quality control practices will be required to assure customers that the various products will consistently conform to agreed specifications. Promotion to strengthen demand is useless and resources wasted if the product and packaging, or the distribution and delivery, do not meet the customers' expectations.

In short, success will require transformation of the fishers from passive sellers and price takers for ordinary shellfish to more market oriented business people and price makers in the clam trade.

7. ACTION PLAN

An action plan with a timeframe showing the type of activities and preliminary indicative estimates of the financial and human resources needed to successfully implement the strategy follows. The suggested program and timeframe for the proposed consortium is tentative and perhaps a little optimistic, but it is realistic and achievable, and drafted to serve as a starting point for industry discussion.

The plan has be discussed, evaluated and updated by prospective consortium members in the light of the latest market and economic conditions.

7.1 Immediate Action. Negligible Costs

These proposed actions offer substantial benefits at negligible or no cost:

- Read the project report in its entirety to gain an appreciation of the market situation, the plethora of products and names in the marketplace, and other issues facing the industry;
- Decide on Collaboration or Stagnation. A tentative positive decision was reached by industry participants at the Adelaide briefing 25 October.
- Read the SFM daily reports with due care, and learn about the reasons behind the unexpected or “outlier” results;
- Share information on supply, demand and prices; knowledge is power. Manage supply to the SFM auction to avoid gluts, using past historical data (daily/events/seasonal) and any information on emerging trends;
- Grade the pipis for particular market segment users, Small, Medium and Large, avoid Ungraded category as much as possible at the SFM. Small and medium sized are attractive for European cuisine while Large and X Large are more attractive for high priced Chinese dishes;
- Reduce reliance on the bait market, shift volume from Bait to the Buffet table and handle pipis better for human consumption or bait;
- Widen and strengthen Sydney, Melbourne and Brisbane distribution to cover key ethnic restaurants and localities eg Italian, Spanish and not just the high priced Chinese trade. Re-engage with former users of pipis and enlist new ones but note that most restaurateurs are not aware of Coorong pipis whatsoever;
- Look again at Perth, Cairns etc because these smaller cities appear to be substantially “underserved” with Australian clam products; enlist local distributors where needed;
- Explore the SFM direct sales system. Direct sales to nominated buyers at agreed prices, with reduced selling costs for fishers, can be negotiated, with SFM management by the consortium;
- Fishers should become active marketers not passive sellers: visit customers more often for personal selling, initiate or strengthen two way communication and jointly implement inexpensive promotion exercises where possible.

7.2 Immediate And Year One Action. Costs Minimal Or Far Less Than Benefits

- Consortium selects a regional umbrella brand name and labels for SFM and general use. (Generic/regional and company brand names are commonly used together; they are not mutually exclusive).
- Consortium considers product specifications: vitality, meat condition quality parameters, size grades and size gradings; desanding/purging criteria etc with potential adoption of a guarantee for product.
- Consortium lodges a Tactical Research Fund application to FRDC in the February 2013 round for funding for development of a post-harvest Code Of Practice, covering the items above. Industry investment of about $13,000 should be able to attract another $52,000 from FRDC, for a total budget of $65,000 on a 7-8 month project.
- Fishers and Processor/packers re-examine the names and labels on their products: consider the company brand name, on packaging/boxes. New labels to add product descriptions such as foreign names eg vongole, clams, *almejas* (Spanish) etc as needed for the target market segment.
- Consortium evaluates costs and benefits of a new MAP products range and explores avenues for funding via special quota from government allocation, concessionary loan or other financial assistance from regional/state/commonwealth government. See box below.

Indicative Costs Of MAP Machinery

The costs of establishing a centralised modified atmosphere packing facility depend not only on the desired production capacity (packs per hour) but the level of automation desired in its operation. A new machine with automated filling accessories would cost about $400,000 and require a payback period of about 5 years or more. Indicative operating costs for plastic pouches, labour and electricity have been quoted at about 90 cents per kilo pack for current operations.

Another financing option is leasing: perhaps a small machine with manual feed to start with and then replacing it with a larger more automated/ less labour intensive one, bought or leased, as the demand grows.

The MAP range may not initially provide a higher profit per unit weight than loose pipis but it does open up prospective new markets of around 50 tonnes in year one in Australia alone judging from the mussel industry history with MAP products (it gained about 25% additional sales volume, about 1500 tonnes today, in just four years.

- Consortium explores assistance available from the newly announced South Australian Advance Manufacturing program that offers assistance with industry cluster formation (Information from: Matthew Palmer A/Manager Market & Industry Analysis PIRSA).
- Processor/packers consider airfreight wherever possible as it offers better shelf life and a stronger market image. Consider smaller lot sizes such as 10kg packs (instead of 15 or 20) especially when prices are high.

- Invest in Push and Pull promotion of South Australian brand live and chilled pipis to ***push*** the product along the supply chain from fishers to wholesaler/retailers/restaurants so consumers can ***pull*** them out of retail stores and restaurants. Consortium to raise funds and/or contributions/sponsorships of about $60,000 plus for year one program along lines outlined in the Box below.

Year One Promotion Tentative Details. Indicative total cost $60,000 plus

Development of a consortium web site with provenance, handling, preparation, cooking and other information and a facility for ongoing two way communication with customers, consumers and other interested parties.

Publication of provenance, buying, storage and cooking information leaflets for consumers for distribution at Point Of Sale.

Provenance, storage and preparation/cooking information leaflets for wholesalers, retailers and restaurateurs.

Publication of A4 size Point of Sale posters for retailers.

Consortium to plan, and execute opportunistically, free creative publicity and innovative Public Relations activities and industry promotion events. It may be possible to enlist some professional support from the market & Industry Analysis group at PIRSA on this promotional program.

Food media launch function in Sydney for Coorong pipi after the Code Of Practice R & D report is completed and uniform standards are accepted; cost about $10,000 or less with sponsorship support. Additional funding/sponsorship would be required if an MAP product range were to be released here too.

- Consortium should examine its need and capacity for response to an unwarranted malicious scare about the safety of its products (SASQAP apparently only covers a response related to a real food safety or public health incident and may not cover such an incident).
- Consortium to explore costs and benefits of membership of Food SA;
- Consortium should open discussion with SA and Tasmanian cockle producers, and NSW pipi harvesters, to share market information and explore areas of mutual interests and benefits.

Adoption of these suggestions for loose pipis in year one should help lift fishers' total revenue by 10% or more, representing an increase of more than a third of a million dollars, on the fishers revenue for 2011/12. This is a benefit to cost ratio of about 5:1 for year one alone.

7.3 Year Two Action.

- Consortium invests in R & D extending the shelf life of a new product portfolio such as MAP 5kg trade and 1kg packs; ready to cook/RTE (ready to eat) products; consortium invests about $20,000 “seed money” and seeks balance with appropriate R & D funding agencies or other willing partners.
- Consortium examines costs/benefits of more direct sales and shortening some existing supply chains, potentially offering greater returns to the fishers.
- Consortium explores new market segments eg MAP packs can be sold at “farmers markets” or perhaps direct door to door sales via web site.
- Consortium examines options for strategic alliance eg aligning transport/deliveries with other (complementary) seafood product distributors.
- Ongoing investment in communications and promotions about $80k (or more) to cover participation in functions such as Taste SA, Sydney, Melbourne, Sydney and Brisbane food shows and festivals (Sydney’s Crave October festival featured a Clam Bake).

7.4 Longer Term. Year Three And Later

- The Coorong TACC may now be 600 tonnes or more per annum, the consortium has presumably built confidence amongst members, and with customers, so the feasibility of a single desk marketing option should be explored to offer members even greater product and marketing control and better returns to fishers.
- Alternatively the consortium seeks out new distributors to further widen geographical penetration and strengthen demand and prices.
- The consortium is the market leader with loose, MAP and with branded chilled and frozen innovations, perhaps an MAP tray of dozen XL pipis ready to cook or eat.
- The pipi consortium may now be ready to consider a strategic alliance or business partnership with other shellfish groups such as clams, mussels oysters.
- Ecotourism income opportunities can be explored for increased revenue and for delivering better community support as a bonus to the fishers in the industry.
- Ongoing R & D investment and ongoing promotional program; annual investment of about 2-3% of revenue (or more).
- The new Commonwealth marketing levy mechanism (currently in development by the Seafood Cooperative Research Centre and the FRDC) should be in operation and opening up co-funding opportunities for investment in further marketing development.

8. CONCLUSIONS

The fishers in the Coorong pipi fishery have operated along traditional lines with little attention to the progress made elsewhere in seafood processing, distribution and consumption over the past decade.

This fishery however is in an enviable unique situation where it harvests from a healthy expanding stock, has Marine Stewardship Council certification and a fisheries management agency favourably examining the pros and cons for increasing TACC.

If the TACC is increased substantially while fishers continue with their traditional harvesting and selling practices they may or may not gain any increase in net returns. However if the fishers decide to collaborate and become active marketers rather than passive sellers, and continue to work closely with SARDI and PIRSA, the industry can achieve far greater returns with just a small investment of human and capital resources.

The two industry associations representing pipi harvesters now have the challenge to lead their members forward. Pipi fishers only have to look westwards at the remarkable progress made by the mussel farming industry in South Australia and other southern states to see the benefits of collaboration and modern marketing.

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11. APPENDIX

Appendix 1. Annual pipi landings South Australia and NSW*.

Year	SA	NSW	Total tonnes
1999/2000	1085	636	1721
2000/01	1250	671	1921
2001/02	1085	498	1583
2002/03	1187	286	1473
2003/04	1073	526	1599
2004/05	1121	568	1689
2005/06	1062	299	1361
2006/07	994	124	1118
2007/08	607	73	680
2008/09	470	32	502
2009/10	300	na	na
2010/11	330	14	344
2011/12	400	16	416

*Source: Historical data (2000s) from GPHA 2010; 10/11 and later from SA industry and NSW Fisheries respectively.

Appendix 2. Sydney Fish Market sales statistics

Table a. Annual auction sales of pipis Sydney Fish Market

Year	Tonnes	$/kg
11/12	124*	14.15
10/11	79	16.21
09/10	73	18.07
08/09	85	16.84
07/08	NA	12.22
06/07	209	8.77

- NSW Fishery closed for six months Dec-May; sales volume predominantly from South Australia for this financial year.

Table b. SFM auction pipi monthly sales volumes and price 2011/12

Month	Kilograms	$/kg
July	7,439	18.64
Aug	7,652	18.69
Sept	11,327	17.69
Oct	6,860	20.16
Nov	12,261	11.94
Dec	15,271	11.38
Jan	11,245	12.28
Feb	12,878	11.19
Mar	11,680	12.47
Apr	10,432	11.82
May	9,309	13.15
Jun	7,407	18.49

Appendix 3 Import Statistics

The tables below represent two "official" sets of data on cockles/clams coming to Australia from New Zealand. This inconsistency between official data sets and a lack of correlation with the "real situation" is a result of the different names given to particular species as well as the classification of the type of the product (fresh, frozen, dry etc) because a particular product can be given an international statistical code number (see list and discussion below) by one exporter/agent while another will classify the identical product into another category/code.

Similar difficulties with the classification and reliability of official trade statistics on prawns and molluscs were reported in a recent comprehensive study of imported seafood in Australia (Ruello & Associates 2010).

New Zealand "cockle" exports to Australia. N.Z. Seafood Industry Council data.

Year	Volume kg		NZ$/kg
11/12	52,110	All frozen	6.89
10/11	74,208	Frozen except for 400kg fresh	7.15
09/10	19,960	Live chilled or frozen	6.74
08/09	436	Live chilled or frozen	7.80

Australian Bureau of Statistics import data for New Zealand

Year	Import Item	Volume kg	A$/kg
11/12	0307710028 Fresh clams etc see below	0	
	0307790029 Frozen clams etc as below	50,284	2.96
10/11	0307710028	0	
	0307790029	0	

International statistical code numbers for bivalve mollusc products

0307710028 - Live, fresh or chilled clams, cockles & ark shells (families Arcidae, Arcticidae, Mactridae, Mesodesmatidae, Myidae, Semelidae, Solecurtidae, Solenidae, Tridacnidae and Veneridae), whether in shell or not.

0307790029 - Clams, cockles and ark shells (families Arcidae, Arcticidae, Cardiidae, Donacida, Hiatellidae, Mactridae, Mesodesmatidae, Myidae, Semelidae, Solecurtidae, Solenidae, Tridacnidae and Veneridae), frozen, dried, salted, in brine or smoked.

Item number 1605560046 includes prepared or preserved clams and may confuse users when reporting or coding exports/import.

19. APPENDIX 7: COORONG PIPI INDUSTRY DEVELOPMENT OPTIONS

Final Report

Coorong Pipi Industry Development Options

Goolwa Pipi Harvesters Association

and

Southern Fishermans Association

Ridge Partners

June 2013

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Conclusions and Recommendations

Conclusions

The following conclusions have been reached from this study:

1. Recent independent studies confirm that the Lakes & Coorong Pipi Fishery (LCF) and related industry is a relatively small business (~GVP $4 million) with a number of natural and strategic advantages. But this collective fishery business is far from achieving its full commercial potential. Without reform of the fishery's business case, social and investment structures, and value proposition, it will be uncompetitive against emerging market entrants, and will stagnate.

   These reports also highlight the substantial boost to returns that can potentially be achieved through industry restructure, and realignment to market driven strategies and joint investment by license holders driving a united, professional market offer.

2. This study finds that license holders should review both what they do and how they do it. Either way, collaborative action and investment by LCF Pipi license holders to achieve economic scale is critical to the SA Pipi industry achieving market competitiveness and boosting long term enterprise returns. The structure chosen to implement this collaborative framework needs to be cost- effective, commercially focussed, and professionally run.

3. This study finds that a Bolt-On MAP (Modified Atmosphere Packaging) facility collocated at the existing privately operated Port Elliot processing facility will offer the best returns to LCF Pipi license holders over the next 10 years. This Option[1], based on a private company structure, will

   1. Require Year 1 start-up investment funds from Industry of ~$450,000,
   2. Need to receive ~235t of input Pipis in Year 1, rising at ~11% p.a. to ~600t in Year 10,
   3. Pay shareholder license holders a "depot price" of $4.80/kg FOB in Year 1, rising at 3.5% p.a. to ~$6.50/kg in Year 10,
   4. Generate a taxable profit (Earnings before Tax) from Year 4. At the end of Year 4 the pretax shareholder dividend will be ~$0.17/kg of Pipi input, rising to an estimated $2.74/kg in Year 10. This implies, subject to company decisions and performance, that participating shareholders could receive an aggregate pretax cash return (depot price +shareholder dividend) of $5.49/kg in Year 4, and increasing thereafter.
   5. Generate pretax positive cash flow from Year 2, and achieve the cash flow payback point in Year 6.

   Industry will need to inject start-up funds of ~$450,000 for the Bolt-on Option, and ~$950,000 for the Greenfield Option.

4. Collaborative investment by industry members in a range of potential Greenfield facilities (including Meningie, Mount Barker, Goolwa, and Adelaide) will be less profitable and potentially difficult to initiate collaboratively. Mount Barker offers the most attractive location for a Greenfield facility.

[1] The future projections are in nominal dollar terms, not adjusted for inflation.

5. This study finds that a relatively straight forward and cost effective proprietary company structure linked to a robust LCF Pipi governance framework, will best equip license holders and industry to collaborate and co-invest today, to achieve their mutual industry potential tomorrow. This structure would:
    - Require shares in the private company to be held and voted in proportion to quota held,
    - Require shareholders (who are the Members of the company) to commit a minimum 80% of their quota to the company each year, and to commit to comply with company Supply Specifications and QA Programs,
    - Establish a small skills-based Board of three directors elected by Members, comprising:
        - a Chairman (independent initially) responsible for Board leadership, corporate governance, financial integrity and performance, engagement and reporting (to Members, regulators and community),
        - a Director with seafood processing expertise and experience,
        - a Director with marketing and/or seafood marketing expertise and experience.
    - Remunerate directors on terms agreed by Members.

Recommendations

The following recommendations are made for the license holders of the two industry associations participating in the LCF Pipi Fishery.

1. Establish a joint LCF Pipi leadership team to consider this report, gather feedback and interest from all license holders, and agree a way forward – by Sept. 2013,
2. Summarise matters of agreement and potential modification, and present these as an LCF Pipi Development Plan at a joint meeting of interested license holders. Summarise outcomes and communicate these to license holders, stakeholders and regulators – by Oct. 2013,
3. Pass resolutions to proceed with those license holders, investors and stakeholders willing to proceed with the venture and become shareholder investors – by Dec. 2013,
4. Consider the longer term (3-5 years) merger of the 2 existing associations to form a single united LCF Pipi Association,
5. Seek professional legal advice regarding the incorporation of the proposed processing venture entity – by Jan. 2014,
6. Incorporate the company – by Feb. 2014,
7. Establish development plans and strategies with participating license holders – by Feb.-Mar. 2014,
8. Conduct the first general meeting of Members of the new entity – by Mar. 2014.

1. The Development Opportunity

Background

The South Australian Pipi Industry wishes to develop its commercial resource capacity, and returns from fishery and process value adding to consumer markets.

Pipis (also called Goolwa Cockles - *Donax deltoides*) are a major commercial species harvested by 22 license holders (see Appendix 2) in the Lakes and Coorong Fishery (LCF). Other commercial species in the fishery include Bream and Golden Perch, Yellow-eyed Mullet, and Mulloway. The fishery includes the lower lakes of the Murray- Darling Basin, the waters of the Coorong behind Younghusband Peninsula, and coastal waters out to 3 nautical miles between Goolwa and Kingston.

Pipis are harvested seasonally (fishery closed from 1June – 31October) and returned for processing to two main centres – Goolwa in the west and Meningie in the east. The geography of the fishery and related supply chains is currently a key issue limiting the economic performance and development of the Pipi Industry in the state. The Pipi harvest area is identified in yellow in Figure 1.

Figure 1. Pipi Fishery and Processing Logistics

In the last five years LCF Pipi Fishery leaders have undertaken a number of projects to define their development strategies, market options and investment priorities. The key outcomes from these studies,[2] and implications for the 22 license holders are:

[2] **A. 2010** – *FRDC Project 2010/067*, in particular to Develop a formal harvest strategy for Pipi to maximise return from the Pipi fishery, and Provide a harvest strategy for Pipi that is informed by information on market demand, market prices and relative abundance and distribution of Pipi and reproductive development of Pipi.; **B. Sep 2012** - *Lakes and Coorong Pipi Fishery Gross Margin Model Development*, Econsearch Pty Ltd; **C. Nov 2012** – *Coorong Pipi Marketing Study*, Ruello & Associates Pty Ltd; **D. 2011** Value Chain Assessment and Development of the Pipi, Goolwa Pipi Harvesters Assn.

1. A sustainable harvest strategy has been developed to rebuild and maintain the Pipi stock at an appropriate annual TACC (Total Allowable Commercial Catch) and to improve business certainty by incorporating market information. The Pipi Fishery, together with the Golden Perch, Yellow-eyed Mullet and Mulloway Fisheries has been certified with the Marine Stewardship Council (MSC) since June 2008,
2. There are major competitive supply threats from substitute import species (especially New Zealand), emerging Pipi wild fisheries (in NSW, Vic., Tas., WA), and aquaculture sources,
3. New processing techniques, and well-targeted competitor marketing programs will result in lower Pipi category prices, especially for unbranded and undifferentiated product,
4. Increased quota (from 400t to >500t) and season extension are both potentially available to increase LCF Pipi Fishery harvest. But these options will result in lower prices for LCF license holders and a lower proportion of Pipis servicing the higher-margin human consumption segment of the domestic market. A long term historical potential catch quota is in the range of 600-800 tonnes (SARDI 2011).
5. Exports are limited for the foreseeable future by the high Australian currency,
6. There has been little effective supply chain management and product development in the Australian Pipi industry and almost all the fishers in the Coorong have been passive sellers and become price takers. Most fishers sell their product independently of each other as bait locally and interstate, and as loose live or chilled shellfish, of varying food quality, to wholesale distributors in the capital cities.
7. The traditional Coorong Pipi fishing business model is facing increasing economic pressure from changes in consumer preference to more convenience, quality and value in seafood, as demonstrated by the market success of the modified atmosphere packs (MAP) of mussels and clams over the past five years.
8. The Coorong Pipi Industry is small, fragmented and ill equipped to lift consumption back to its former levels, let alone successfully grasp the new opportunities offered by MAP and other value adding techniques, without major changes to its *status quo*. The continuation of the status quo is most likely to lead to industry stagnation or it "going backwards" in real terms and that inaction will mean South Australia and the regional seafood communities will forgo potential economic growth from catch quota increases.

In response to these independent findings noted above, and the potential quota growth on offer, the industry (represented by the two associations Goolwa Pipi Harvesters Association, and Southern Fisherman's Association) in partnership with SARDI[3] and PIRSA, has agreed to investigate product development and industry investment structures needed to maximise industry returns under the new harvest strategy.

This Study

This consultancy and related report will establish and present the business case and an industry collaboration, investment and operating framework to commercialise the initiative.

This study will address two Objectives:

1. Assess and compare the business case for commercial pipi value adding for:
    a. a "Greenfield" (standalone new) operation, and
    b. an "in-house" operation located in existing processing facility.
2. Develop a Pipi industry (licence holder) business framework including investment, business structure and operations, for the preferred value adding process.

[3] These are both agencies of the South Australia State Government. South Australian R&D Institute, a state agency.

The consultant will develop an industry collaboration model covering the business case for the development and the investment, business and operational structures for the value adding initiative.

The industry research will involve direct interviews with representatives of the Goolwa Pipi Harvesters Association (GPHA) and the Southern Fishermen's Association (SFA), to gather additional industry information and canvass the feasibility of options.

Tasks to be undertaken to achieve Objective 1 are:

1. Establish investment and operating costs for a Pipi value adding facility in an existing processing facility,
2. Assess options and breakeven payback period, price and volume scenarios reported,
3. Rank options in terms of potential including costs, potential returns and payback periods,
4. Draft results suitable for presentation to industry for feedback,
5. Finalise results including the recommended option for industry.

Tasks to be undertaken to achieve Objective 2 are:

1. Gather data via desktop research and industry interviews,
2. Consider successful and unsuccessful industry collaboration models and provide to industry for consideration and feedback,
3. Interview industry participants about model options,
4. Draft a business and operating framework from harvest to market and provide to industry for feedback,
5. Recommend a final model for presentation to industry including requirements for success at implementation.

The outputs from the Project are to be described in a professional report, identifying the:

- Viability assessment of a "Greenfield" and "In house Bolt-On" Pipi processing options,
- Description of the recommended business and operational model.

2. The Business Case

Drivers for Improved Returns

The previous studies cited above have identified a number of shortcomings and challenges to be overcome in the development of SA Pipi industry. But these studies also highlight the substantial and untapped commercial potential of the fishery.

In particular, the studies point to a significant potential increase in the scale and value of the fishery, and the consequent boost to returns to all license holders. The key to capturing these gains is proposed to be the adoption of a united collaborative (all LCF Pipi license holders) business model that actively targets the "latent potential", and links strategic existing advantages to market growth in the domestic human consumption market.

This chapter assesses the business case for the joint LCF Pipi Fishery from a commercial perspective.

The consultant has reviewed the available research and undertaken onsite consultation with Pipi license holders in April 2013. These consultations were with active fishers, license holders, quota lessors, quota leasees, and industry leaders across the fishery. Onsite discussions have also been held with Pipi processors in Port Elliot and Meningie.

Seven Drivers

Review of available research, followed by these subsequent discussions, has confirmed a range of plausible development options and drivers are available to capture this increase fishery value and enterprise returns. It has also clarified and quantified the relative attractiveness of each development pathway.

Seven key drivers are considered in Figure 2 for their impact to industry and potential beneficiaries, and likelihood of implementation.

1. Rising consumer interest in and demand for Pipis and substitute seafood species,
2. Rationalisation of multiple existing Pipi harvest and supply chains and brands,
3. Collective investment by license holders in fishery scale, performance and viability,
4. Use of new seafood technologies (eg MAP Modified Atmosphere Packaging),
5. Market differentiation of LCF Pipis and other seafood products through brand and volume,
6. Certified sustainable fishery activities via the MSC,
7. Increase in the annual LCF Pipi Fishery TACC.

Importantly the table identifies external and internal drivers. Some challenges are beyond the control of the industry. For example the license holders, individually or collectively, can have no impact on the level of the A$ compared to competitors exchange rates (eg. NZ$). However the level of collaboration is a variable completely within the ambit and control of the existing license holders and is a key issue that can enable significant advantages across all other drivers.

The issues presented in the table also suggest that each individual driver can be implemented in isolation – industry has the opportunity to cherry pick which drivers it chooses and if/how it turns that into a collaborative "whole of LCF" strategy, or smaller "LCF subset" group development strategy. This flexibility potentially offers industry the opportunity to custom build a comprehensive joint strategy to be implemented over time – as cultural change progresses, investment capacity builds and TACC volume is increased by supportive state regulators.

Figure 2. Business Case Options and Drivers

Business Case Driver	Impacts and Who Benefits	Likelihood
1. Rising consumer interest in and demand for Pipis and substitute seafood species	• Rising demand will increase LCF Pipi sales, but only if the value proposition is superior to competitors, • Increased LCF Pipi sales volume will reduce unit costs and increase gross margins, • Most of the early sales growth and long term margin expansion will be captured by early mover suppliers with low cost supply chains linked to differentiated and branded offers to consumers, • A strong A$ will make export sales less viable, and encourage import competition,	• Very attractive opportunity for LCF license holders, • LCF license holders have a choice – actively take steps to become the first choice supplier of quality Pipis to the domestic seafood market, OR stand by and watch as this market is taken away from them,
2. Rationalisation of multiple existing Pipi harvest and supply chains	• LCF Pipi is a small fishery with a GVP of ~$4 million p.a., • An active quota leasing market across the 976 quota units (22 licences) is already improving harvest efficiency and making all license holders more profitable by reducing average unit costs for harvesting, • However post-harvest down chain activities are currently fragmented, employ low level technologies and likely will result in higher unit costs across the whole fishery compared to leading competitors (eg. NZ),	• There are no geographic or few logistic barriers to fishery and supply chain rationalisation, • Compared to other industries, rationalisation can be easily achieved and offers attractive benefits, • Likelihood uncertain – subject to cultural change,

3. Collective investment by license holders in fishery performance and viability	• Pipi license holders / fishers operate a traditional adversarial production-driven business and governance model. This model (based on two production groups), raises costs for all license holders and has the effect of making the LCF Pipi fishery less competitive in consumer markets.
	• No one benefits unless the model is changed. Returns to all license holders will improve significantly when the adversarial approach by all license holders changes to a collaborative approach under a united and professional leadership, and the production driven strategy is replaced with a market driven approach.
	• Neither group (each with ~40-60% of supply) has the current scale to significantly reduce its unit costs, improve its margins or enterprise viability, increase its market share, boost its offer to seafood consumers, defeat new import competitors, secure access to additional TACC, leverage its existing costs for MSC certification, or move readily to a new business model.
	• As competition increases, the current LCF Pipi Industry will become less viable and stagnate, without adopting a collaborative and market driven business model,
	• One study (Ruello) advised that adoption of a collaborative investment strategy and marketing plan would add 10% to the annual sales value of the fishery (~$750,000) – this is a very attractive prospect.
		• Changing the business/governance model will require:
		  ○ a shift in license holder culture from sharing the current pie, to increasing the size of the pie,
		  ○ open discussion by license holders about and democratic agreement on united leadership of the fishery,
		  ○ incentives for license holders to jointly develop the industry and jointly invest to achieve these goals,
		  ○ a new business model that rewards collaboration and joint investment.
		• The transition to collaboration and increased returns to license holders is very likely if license holders join in open discussion about their collective future.

4. Use new food technologies (eg MAP Modified Atmosphere Packaging)	• Achieve processing efficiency, product line extensions – use more of the fish yield in consumer markets, • Better meet consumers' demands for product quality and performance, • Be more competitive against the price points for imported product and competitor's offers, • Raise and stabilise Pipi sales prices and returns by removing product from domestic fresh markets,	• Benefits available immediately, • Can be implemented immediately by an LCF Pipi Fishery that has the necessary tonnage throughput, investment capacity and corporate leadership,
5. Market differentiation of LCF Pipis and other seafood products	• Reduce fishers existing reliance on the low value-low margin commodity bait market, • Establish consumer recognition of and loyalty to LCF's Pipi product offer and a regional Coorong brand,	• Benefits available immediately, • Attainable if a united branding strategy is adopted,
6. Certified sustainable fishery (MSC)	• License holders already invest in this superior accreditation program. But they are not yet leveraging this into targeted consumer markets with branded high - value products,	• Benefits from this driver are very likely and attainable if a united branding strategy is adopted,
7. Increase in the annual Fishery TACC	• Increase in sustainable supply of wild harvest landings from existing 400t up to 600t, (up 40-50%) • Reduce the unit costs of harvest, processing and distribution for all license holders and operators, • Increase the direct (via fisher enterprises) and indirect (via freight companies and other input suppliers) economic contribution of the LCF Pipi Fishery to the regional and state economy.	• Very attractive option available over time, • A united national brand and strategy required, • Positions LCF as the premium, low cost market leader.

Business Case Analysis

Scenarios and Options

The background discussion for this report noted the unique geography for the LCF Pipi Fishery, with a significant portion of the Pipi harvest currently delivered and processed on opposite sides of the lower lakes – this distance by road between Goolwa and Meningie is approximately 150 klms and takes 90 minutes to drive. While this separation is a relevant factor in the investment and logistic planning for any proposed single joint value adding scenario, it is clear from consultation that this modest geographic distance is also a very strong social and cultural barrier to effective communication, trust and greater collaboration between all license holders. This divide is most evident between the two associations that represent Member license holders through respective governance arrangements. All proposed industry development scenarios must establish realistic strategies to overcome this social barrier to commercial collaboration.

An interactive 10 Year financial model has been developed by the consultant to assess the potential viability and financial performance of two value adding scenarios identified in the Terms of Reference:

1. An "In house Bolt-On" processing option where the supply chain passes through a single joint stand-alone processing facility collocated with an existing processing facility. A governance framework would also be incorporated into the arrangements for the facility on mutually beneficial terms.
2. A "Greenfield" processing option where the supply chain passes through a new single stand-alone processing facility. Governance arrangements would be custom built for this scenario.

There are multiple plausible Business Case Options available under each of these two Development Scenarios. Each option offers broad advantages and disadvantages; many are common across the six options identified.

Figure 3. Development Scenarios and Business Case Options

Scenario	Business Case Options	Advantages	Disadvantages
1. Bolt-On Scenario at an Existing Pipi/Seafood Facility	1. At the existing processing facility in Port Elliot/Goolwa Pipi Marketing Co.	• Existing capital and operating equipment and supply chain in place, • Existing staff, admin systems and management capacity in place, • Enables prompt transition to new supply chain and governance arrangements, • Access to Adelaide airport/port services,	• Potential lack of scale in existing facilities, • Integration of new technologies /MAP facilities may not be readily aligned or be cost effective, • Existing facility and corporate structure may not have capacity to expand to meet needs of whole industry,
	2. At an existing processing facility in Meningie,	As above, plus: • Better access to national highway and related logistics,	As above, plus: • More remote access to Adelaide airport/port services,
2. Greenfield Scenario at a new Pipi/Seafood Facility	3. New facility on the western side of lakes at Goolwa/Port Elliot,	• Opportunity to establish collaborative business model in a new processing facility with governance framework, • Access to Adelaide airport and services,	• Need for industry leadership to negotiate and establish a robust collaborative joint investment structure, • Additional time required to design and establish new purpose built processing facility, • Potentially higher commercial charge rates to access regional or urban industrial sites, • Potential loss of existing processing expertise and management capacity.
	4. New facility on the eastern side of lakes at Meningie,	• Opportunity to establish collaborative business model in a new processing facility with governance framework, • Access to national highway and logistics,	
	5. New facility at an appropriate regional centre, potentially including Mt Barker, or Murray Bridge,	• Opportunity to establish collaborative business model in a new processing facility, with governance framework, • Better access to Adelaide airport / logistics, • Access to larger regional services and industrial facilities,	
	6. New facility adjacent Adelaide Airport,	• Opportunity to establish collaborative business model in a new processing facility, with governance framework, • Access to a skilled urban labour pool, • Access to competitive utilities and services, • Access to national air and sea freight hub,	

Clearly, a number of the six Business Case Options listed above will result in similar operating outcomes and financial performances. There are also other variables that will impact the viability of each option (eg. the delivered price of water and electricity to each urban or regional facility site). Where relevant this variability can be dealt with by the financial model under targeted sensitivity analysis, later in the study.

The detailed analysis undertaken in the financial model therefore considers the two most likely options (one from each scenario) for the collaborative facility. These options are:

Option 1: **Bolt-On processing facility at the existing processing facility in Port Elliot**, a regional centre proximate to Goolwa,

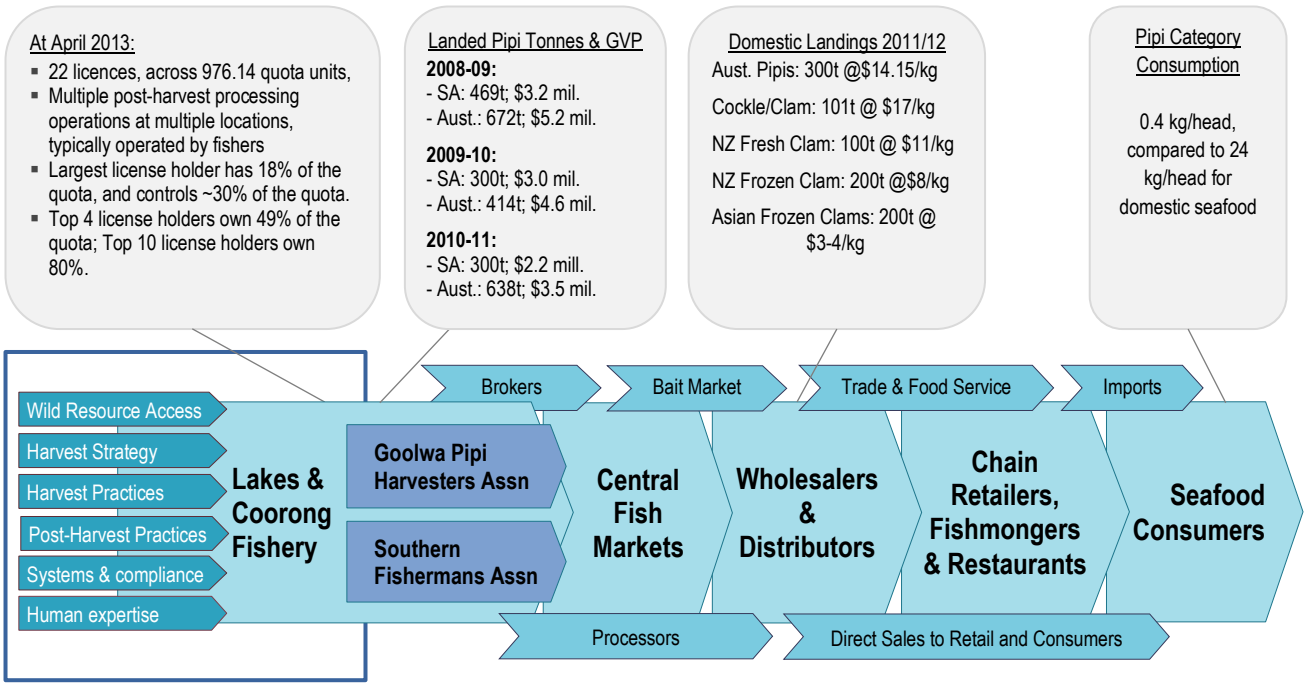
Option 2: **Greenfield processing facility at Mt Barker**, a significant regional centre that is the most advantageously positioned for road access to both sides of the lakes, and with immediate access to highway logistics and Adelaide airport/port logistic networks and services.

The financial model considers, in detail, the investment and operating costs for the two preferred scenario options for Pipi value adding (ie. processing and branding), the investment required to launch and operate each preferred option, and the operating costs for each option. The financial performance of the preferred option in each scenario is then assessed via breakeven payback analysis, and price and volume sensitivities.

Common Supply Chain

The two scenarios and each of their respective options will integrate with the broader seafood supply chain and competitive seafood / bait market environment. This structure is as illustrated in Figure 4, which is based on data drawn from the available reports, ABARES (Federal Government) statistics, and industry advice.

Figure 4. Australian Pipi Industry Supply Chain



Common Baseline Assumptions

There are a number of Baseline operating variables (harvest, processing, product, investment, market, volume, price, etc) that will largely determine the financial viability of the proposed value adding facility. These Baseline Operating Assumptions apply to all Business Case Options. Figure 5 summarises these variables.

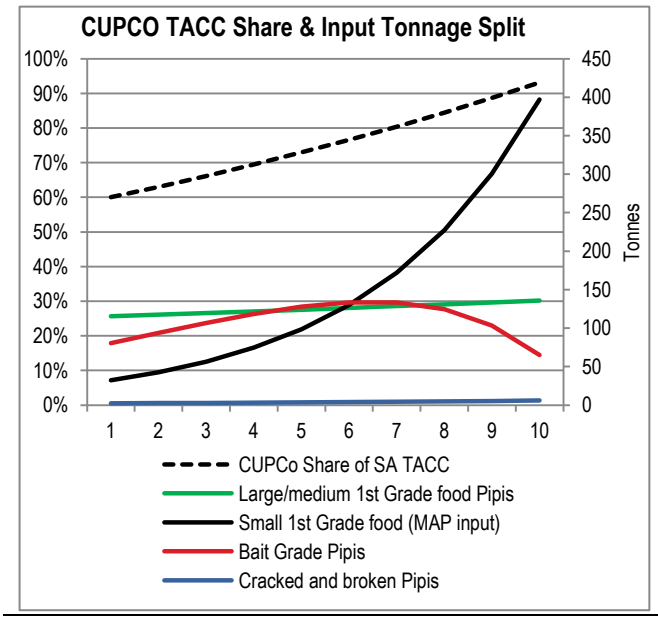
In each scenario and preferred Option the joint interests of LCF Pipi license holder shareholders and joint processing facility are assumed to be managed via a single commercially focused corporate entity (initially styled CUPCo – Coorong United Pipi Company Pty Ltd) owned and controlled by these shareholders.

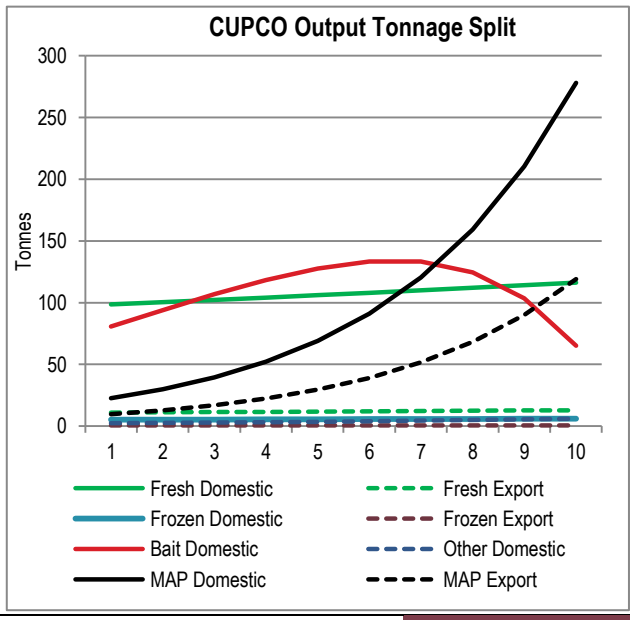
Figure 5. Baseline Operating Assumptions

Assumption	Description of the Assumption
1. Fishery TACC	Existing 400 tonnes, rising to potential 600 tonnes over 7-10 years,
2. CUPCo Contract	• Coorong United Pipi Company Pty Ltd (CUPCo) is established by LCF Pipi license holder shareholders with equity held on both sides of the lakes, broadly in proportion to harvest shares, • Mission is to create consumer excellence in seafood from LCF (may add other LCF species in longer term), • Establishes a Coorong MSC certified brand to market main product lines in all domestic and export markets, • Produces 3 Pipi product lines (all MSC certified) - fresh, frozen, and MAP for domestic and export. Bait sold locally. • Shareholders must agree to supply minimum percentage (~80%) of quota holding to the joint CUPCo business, • Implements proprietary QA scheme from beach to plate - all suppliers must agree to participate and comply, • Only accepts wild or aquaculture product that meets the specifications defined in its QA scheme, • Applies for grant/support funds from state/Federal Gov't to build its MSC QA scheme and Coorong Seafood Brand.
3. CUPCo share of TACC	~60% of the TACC in the first year will be dedicated to the joint CUPCo processing facility. CUPCO's share of TACC will rise to ~95% over 7-10 years. This assumption is based of analysis (see Appendix 2) of existing license holdings and their respective supply arrangements and motivations (discussed during the consultation process).
4. Processing Input Specification Matrix	CUPCO will establish a Pipi input specification matrix for acceptable product from LCF wild catch license holders or aquaculturists. "Out-of-Spec" Pipis not meeting the requirements of this matrix will not be accepted for processing. The matrix will define A grade, B grade, C grade and D grade product line specifications to meet market needs. The split of input tonnage across lines will change over time. The matrix will be directly linked to CUPCOs proprietary QA system.
5. Pipi Buying Price	CUPCO will offer an FOB Pipi Buying Price/Kg for QA certified input product at two depot locations – one in each of Goolwa, and Meningie. This standard price will cover all product received, and be supported with fixed trading terms. CUPCo will take ownership of the product at the depot and be responsible for transfer to the processing facility and any related weight losses in transit. The nominal buying price will rise year to year, estimated in the model at 3.5% p.a.
6. Processing Output	CUPCO Board and Management will determine the target markets that offer best return for the available product. This will be a mix of five market segments – Fresh, Frozen, MAP, Bait, and Cracked & Broken. Each product line will service a defined market segment (export or domestic) for which the model assumes a specific CIF sale price, and annual nominal increase at 3.0% p.a. As CUPCO's share of TACC increases, Bait sales will be replaced with human consumption lines, especially MAP products to domestic and export customers.

The Baseline data assumes the following trends over the first 10 years of the joint processing facility. Detailed Baseline Model analyses are presented in Appendix 1.

Figure 6. Baseline Operating Assumption Trends





Both scenarios and all options for the joint processing facility will assume common input tonnages, buying price and output selling prices. Therefore any difference in financial performance between options tested under the model will be due to cost changes - for investment capital, financing loans, depreciation, logistics, and site specific expenses.

Baseline Employment Assumptions

Both scenarios and all options for the joint processing facility will employ a standard complement of employees contractors and directors.

Employees will be retained on a rate per kilogram of throughput basis, for positions in:

- Grading and desanding,
- Packing,
- MAP line work,
- Operations Management (including performance incentives).

An employee will be retained on an annual salary package for truck driving and general duties.

Contractors will be retained on contracted annual rates to fill part time and strategic roles, including:

- Routine mechanical/site maintenance,
- Office/accounts/admin,
- Market and supply chain related activities.

The Company Board will be remunerated as determined by the company's shareholders at a general meeting. A total cost to the company of $59,000 is assumed for board and related expenses in the first year.

All employment and contract rates (excluding incentivised packages) are assumed to increase at 3.5% p. a.

Baseline Governance Assumptions

The choice of governance framework for the joint LCF Pipi venture is critical to the overall commercial viability of the proposed venture, and to engagement of license holders in this success.

The common business entity proposed for all options is a Proprietary Company, with a cost effective board and commercial approach to the market opportunity previously identified in this report. This incorporated governance framework strikes a balance between the need for market driven and cost effective commercial outcomes, and the need to establish trust by initially engaging all quota holders for mutual advantage.

The main terms of this proposed governance framework are described below.

Figure 7. Baseline Governance Assumptions

Assumption	Description of the Assumption
1. CUPCo Inc.	Coorong United Pipi Company Pty Ltd, a proprietary company limited by shares under The Corporations Act 2001,
2. Memorandum and Articles of Association	Specific corporate objectives and powers need to be defined by shareholders for the company, embedded in the Constitution, and ratified by Members of the company at the first general meeting. These matters need to be strongly aligned with the Vision and Mission of the company as defined in its Strategic Plan and related documents.
3. Member Shareholders	Membership in the company will require a quota holder to commit a minimum of 80.0% of his/her LCF Pipi license quota units to the company's Committed Quota Pool. Directors will issue shares to each Member in the proportion that his/her total committed quota units is to the total number of quota units in the Committed Quota Pool.
4. Directors	The Members will appoint a skills-based Board of Management comprising three directors – being two Appointed Directors and a Standing Chairman. The 2 Appointed Directors (each of whom has previously accepted a nomination as director) will be current holders of LCF Pipi quota and shareholders of the company. Appointed directors will be appointed for a two year term, and will have portfolio responsibilities within the Board of Management, respectively:

	• Pipi and/or seafood processing expertise and experience, • Marketing and/or seafood marketing expertise and experience, The directors of the company may appoint one of themselves to the office of Managing Director for such period, and on such terms and remuneration as the directors resolve. A Managing Director so appointed shall be answerable to the Board in respect of all powers exercised on behalf of the directors. The positions of Chairman and Managing Director shall not be held simultaneously by the same person. The company shall establish an appropriate Directors and Officers Insurance Policy.
5. Chairman	The Members will elect an individual as an interim standing chairman to chair all general meetings of Members for the first 2 years after the company is incorporated. After the expiry of the interim period, Members will elect a standing chairman for successive 2 year terms. The chairman may hold shares in the company but need not. The chairman shall have portfolio responsibilities on the Board of Management, including: • Board leadership and corporate governance, • Financial integrity and performance, • Engagement with and Reporting to Members, regulators and community,
6. Powers of Directors	The business of the company is to be managed by or under the direction of the directors, as a Board of Management led by the chairman. The directors may exercise all powers of the company except any power that under the Corporations Act or under the company's constitution is required to be exercised only pursuant to or after the passing of a resolution of the Members of the company in general meeting.
7. Meetings of Directors	The chairman and directors shall meet periodically as the company's Board of Management. A quorum for a meeting of directors will be all directors of the company, to be present in person or by electronic means for the entire meeting. Directors must establish a Register of Conflicts of Interests and declare any changes to these interests at each meeting of directors. A resolution of directors must be passed by a majority of directors. The chairman shall have one vote as a director, but no additional casting vote as chairman. The directors may from time to time by resolution delegate any of their powers to: • The Managing Director, • Any director of the company, • Any committee or committees of directors of the company, • Any other person employed by the company or retained as an agent or representative of the company, In delegating such powers directors may impose such conditions, limitations and qualifications as they may think fit.
8. Minutes	The chairman shall ensure a copy of the Minutes of all meetings of Members or directors, including all resolutions considered, shall be recorded, signed and filed in the company records.
9. Call on Shares	The directors may make calls upon the Members in respect of any money unpaid on the shares of the Members. In addition and with the resolution of Members at general meeting, the directors may call for additional financing from Members on terms agreed by Members at a general meeting. If a sum called in respect of shares is not paid by the date appointed, default interest shall be payable at a preset rate determined from time to time by directors. A Member shall only be entitled to vote at a general meeting for shares held for which all monies owing to the company have been paid.
10. Quorum	The quorum for a General Meeting (including Annual General Meeting) of the company's Members will be 70% of all Members attending in person or via approved proxy. Where a quorum is not achieved at a general meeting of Members within one hour of the notified time, the chairman shall postpone the meeting to an appropriate time.
11. Voting	A resolution put to the vote at a general meeting of Members may be decided on a majority show of hands, unless a poll is demanded. A resolution will be passed where it is supported by a majority of Members who hold more than 51% of the company's shares for which all monies have been paid.
12. Proxy Votes	A Member who is entitled to attend and cast a vote at a general meeting may appoint a person as the Member's proxy to attend and vote for the Member at that general meeting. Before a vote is taken the chairman must inform the general meeting whether any proxy votes have been received and how the proxy votes are to be cast.
13. Directors Remuneration	The Members shall determine by resolution from time to time, the remuneration and reimbursable expenses for the chairman and directors.
14. Dividends	The directors may as they think fit and from time to time from profits available, determine that a dividend is payable and fix the amount, timing, payment method, and franking arrangements. The directors may choose to provide incentives to Members to invest in the company by providing more attractive dividend arrangements to such Members.
15. Transfer or Sale of Shares	Directors may, as they think fit, issue, transfer, cancel, convert or otherwise deal with shares in the company, but at all times satisfying the requirements of Assumption 3 above. A Member wishing to reduce or sell a shareholding must provide written details of the proposed transaction to directors at least 28 days prior to the transaction. No transfer of shares shall be registered unless it is first approved by the directors by resolution to that effect. All share transfers and stamping of same, must be in accordance with any applicable state legislation.

Timing

The recent consultation process confirms that stakeholders wish to progress operational and governance changes in the next 3-6 months. The governance matters can be progressively developed by joint representatives working with license holders.

However from a risk management perspective it will be desirable to test the operational capability, product outputs and market acceptance of the proposed MAP technology applied to LCF Pipis. An interim pilot processing stage (with initial funding) will be beneficial in identifying these risks.

3. Financial Analysis of Key Options

Two Options have been identified as preferred processing opportunities for the joint facility. These are:

- Option 1: Bolt-On processing facility at the existing processing facility in Port Elliot,
- Option 2: Greenfield processing facility at Mt Barker.

Assumptions

Conservative assumptions for these options have been tested using a custom built interactive financial model.

Figure 8. Key Option Assumptions

Assumption	Option 1 – Bolt-On Facility at Port Elliot	Option 2. – Greenfield Facility at Mt Barker
1. Structure	CUPCo will lease (3-5 year contract) access to the existing processing plant; lease pieces of plant from the operator; and purchase additional equipment, including a MAP facility (Yr 1), MAP hopper (Yr 5), and refrigerated light truck (Yr 1).	CUPCo will lease (5-7 year contract) access to an existing industrial building; and purchase and install all equipment and plant including a MAP facility (from Yr 1), MAP hopper (from Yr 5), and refrigerated light truck (from Yr 1).
2. Lease charges	In Year 1 the annual lease charges for building access and equipment will be $99,500.	The annual lease charges for building access and equipment (from third party suppliers) will be $134,500
3. Capital costs	10 Year capital cost to CUPCO will be $777,228, of which $200,000 (Year 5) and $127,228 (Year 8) is funded from cash flow. The balance will be financed (on P+I terms) via a bank loan at 12% over 9 years.	10 Year capital cost to CUPCO will be $1.28m, of which $200,000 (Year 5) and $127,228 (Year 8) is funded from cash flow. The balance will be financed (on P+I terms) via a bank loan at 12% over 9 years.
4. Management and employees	The existing management team and staff will be contracted to run the joint facility, based on performance incentives.	CUPCo will hire an experienced management team and staff to operate the business.
5. Freight and Logistics	CUPCO will purchase and operate a dedicated refrigerated light truck to transfer: • Harvested Pipis from two depots (Goolwa and Meningie) to the facility, and • Finished products from the facility to logistics hubs in Adelaide and elsewhere.	
6. License Holder Engagement	CUPCo will establish a communication strategy to ensure all license holders are aware of the market offer available from the company, and the related benefits derived from becoming a shareholder.	
7. Marketing and Consumer Data	CUPCO will retain expert contractors to work with Directors and Management to implement a targeted marking program.	

Profit and Loss

The financial model (supplied with this report) provides the detailed analyses of both profit and cash flow for both of the preferred processing options.

The Year 1 Profit & Loss forecasts for each option are presented in Figure 9.

The data confirms that from Year 1 the Greenfield Option at Mt Barker will incur higher unit costs and lower margins than the Bolt-On Option. The freight savings (of ~$12,000 in Year 1) per year available from the Mt Barker site will be more than swallowed up by that site's higher costs for facility access charges, depreciation and interest payments.

Over the 10 year period, The Bolt-on Option will accrue an estimated $4.6 million in pretax profits, and the Mt Barker Greenfield Option will accrue and estimated $3.8 million in pretax profits. This variance results from differences in costs for facility access charges, depreciation and interest payments.

Figure 9. Year 1 CUPCo Profit & Loss Forecast

CUPCo PTY LTD PROFIT & LOSS FORECAST				
YEAR 1 ONLY			OPTION 1. Bolt On	OPTION 2. Greenfield
REVENUE	Sales	Domestic	1,978,001	1,978,001
		Export	251,586	251,586
	Other	Bank interest	400	400
		Total Revenue	$ 2,229,988	$ 2,229,988
EXPENDITURE	Purchase of Pipis		1,128,960	1,128,960
	Employment		387,990	387,990
	Facilities		114,500	149,500
	Depreciation		46,790	71,790
	Freight		300,620	288,620
	Processing Costs		228,515	228,515
	Other Expenses		161,000	161,000
	GST Adjustment		-154,202	-207,202
		Total Expenditure	$ 2,214,172	$ 2,209,172
Earnings before INTEREST & TAX			$ 15,815	$ 20,815
Interest payments			-54,000	-114,000
PROFIT BEFORE TAX			-$38,185	-$93,185

Cash Flow

Over the whole 10 year analysis period, the projected cash flows for the Port Elliot Bolt-On facility (Option 1) provide a superior financial return to that of the Mt Barker Greenfield Option facility (Option 2).

The forecast respective returns and financial performance are summarised in Figure 10.

Figure 10. 10 Year CUPCO Cash Flow Forecast

CUPCo PTY LTD CASH FLOW FORECAST											
10 YEAR Analysis	Year	1	2	3	4	5	6	7	8	9	10
OPTION 1. Bolt On Facility at Port Elliot											
A. Operating Cash Flow		-91,597	125,343	167,644	274,447	411,508	606,385	817,067	1,114,892	1,515,792	2,015,391
B. Investing Cash Flow		-450,000	0	0	0	-200,000	0	0	-127,228	0	0
C. Financing Cash Flow		-81,995	-81,995	-81,995	-81,995	-81,995	-81,995	-81,995	-81,995	-81,995	0
Net Cash Flow		**-623,592**	**43,348**	**85,649**	**192,452**	**129,513**	**524,390**	**735,072**	**905,669**	**1,433,798**	**2,015,391**
Nominal Cummulative Cash Flow		-623,592	-580,244	-494,594	-302,143	-172,630	351,761	1,086,833	1,992,502	3,426,299	5,441,690
Cashflow Breakeven Payback							Early Yr 6				
Net Present Value @ 18% Discount Rate			**1,084,948**					135,677			
Internal Rate of Retrun			**41%**								
OPTION 2. Greenfield Facility at Mt Barker											
A. Operating Cash Flow		92,605	154,538	150,256	255,858	391,642	585,158	794,387	1,090,659	1,489,896	1,987,712
B. Investing Cash Flow		-950,000	0	0	0	-200,000	0	0	-127,228	0	0
C. Financing Cash Flow		-173,100	-173,100	-173,100	-173,100	-173,100	-173,100	-173,100	-173,100	-173,100	0
Net Cash Flow		**-1,030,495**	**-18,562**	**-22,845**	**82,758**	**18,542**	**412,058**	**621,286**	**790,330**	**1,316,796**	**1,987,712**
Nominal Cummulative Cash Flow		-1,030,495	-1,049,057	-1,071,902	-989,144	-970,603	-558,545	62,741	853,072	2,169,868	4,157,579
Cashflow Breakeven Payback								Mid Yr 7			
Net Present Value @ 18% Discount Rate			**384,850**							5,068	
Internal Rate of Retrun			**24%**								

Based on the pretax data above, the model financial estimates that:

- The Port Elliot Bolt-On Option will achieve a positive cash flow from Year 2, and nominal cash flow payback early in Year 6. The Greenfield Option will achieve a positive cash flow in Year 4, and nominal cash flow payback in mid Year 7,

- At a project discount rate of 18%, the Port Elliot Bolt-On Option will achieve a Net Present Value (NPV) of $1.1 million over 10 years, with the NPV turning positive in Year 7. The Greenfield Option will achieve an NPV of $0.4m over 10 years, with the NPV turning positive in Year 9,
- The Bolt-On Option achieves an Internal Rate of Return (IRR) of 41%; the Greenfield Option 24%.

Preferred Option

Figure 3 described six potential Business Case Options for the LCF Pipi processing facility, and related governance framework. The financial analyses presented here and in the financial model suggest that both the Port Elliot Bolt-on Option and the Mt Barker Greenfield Option are potentially viable over a 10 year horizon.

However the Port Elliot Bolt – On Option is the most financially attractive to CUPCo shareholders over this timeframe. A ranking of the financial viability of the various options is therefore as follows:

Figure 11. Summary of Business Case Options

Rank	Bolt-On Processing Facility	Greenfield Processing Facility	Comment
Most Attractive	Port Elliot		This Business Case Option offers: • an existing scalable processing facility, • significant and proximate committed harvest volume to support start-up, • an existing staff and management capability, • proximity to markets and logistics. The financial analyses confirm that all shareholders will potentially receive a higher return on investment from this option than all other options over the next 10 years.
	Meningie	Mount Barker / Murray Bridge	These options are less financially attractive than a Bolt-On facility at Port Elliot. • A potential Bolt-On facility at Meningie will be less attractive than the Bolt-On Option at Port Elliot due to the latter's lack of operating scale and small existing capacity, • Any Greenfield facility will require greater start-up capital and therefore will be less attractive than the two Bolt-On Options. • Mount Barker is logistically more accessible for all harvest tonnage and therefore financially more attractive than Murray Bridge.
Least Attractive		Meningie, Port Elliot/Goolwa, Adelaide	These options are less attractive at three levels: • no access to existing seafood processing facilities and therefore higher start-up capital requirements (all sites), • Meningie offers lesser harvest volume commitments to underpin start-up and greater freight distances, • Adelaide offers potentially better access to labour, but this benefit is more than offset by greater costs for processing site access The financial analysis confirms that in general, Greenfield options are less financially attractive than Bolt-On options. The need to secure proximate committed harvest volume and ship product greater distances will make a Greenfield Option at Meningie less viable.

These financial results do not consider the additional non-financial risks or benefits that each of the options may encounter as a result of fishery regulation, corporate governance, operational logistics, market dynamics, and other non-financial impacts.

Sensitivity Analyses

Any investment by quota-holding shareholders in the proposed processing venture must be guided by understanding of their personal circumstances. Professional advice should be sought regarding any potential investment. However the proposed venture is also sensitive to a number of key financial and social variables.

While it is very difficult to quantify investor's personal sensitivity to social and community risks associated with the proposed collaborative venture, it is possible to estimate the financial impact on the venture (and therefore CUPCo shareholders) of some key operating and financial variables.

The following discussion summarises the sensitivity of the preferred Option (Bolt-On Facility at Port Elliot) to selected variables over the 10 year period. For each sensitivity, the data illustrates the unit of impact (either NPV value, or IRR %), and the quality of the return (green is acceptable, red is unacceptable). Note that where "Year 1" variables are used, the model escalates these and related impacts across the whole 10 year period to determine project sensitivity.

Sensitivity 1. CUPCO Share of TACC in Year 1 v's Year 1 Pipi Buying Price $/kg

		NPV					Year 1 Pipi Buying Price/kg at Plant Door								
	Tonnes	$ 1,084,948	$ 3.00	$ 3.50	$ 4.00	$ 4.50	$ 4.75	$ 5.00	$ 5.10	$ 5.20	$ 5.30	$ 5.40	$ 5.50	$ 5.60	$ 5.70
	100	25%	- 372,485	- 746,028	- 1,119,571	- 1,493,114	- 1,679,886	- 1,866,657	- 1,941,366	- 2,016,075	- 2,090,783	- 2,165,492	- 2,240,201	- 2,314,909	- 2,389,618
CUPCO	120	30%	296,779	- 151,473	- 599,725	- 1,047,977	- 1,272,102	- 1,496,228	- 1,585,879	- 1,675,529	- 1,765,180	- 1,854,830	- 1,944,480	- 2,034,131	- 2,123,781
Share	140	35%	966,043	443,082	- 79,878	- 602,839	- 864,319	- 1,125,799	- 1,230,391	- 1,334,984	- 1,439,576	- 1,544,168	- 1,648,760	- 1,753,352	- 1,857,944
of TACC	160	40%	1,635,307	1,037,637	439,968	- 157,701	- 456,536	- 755,370	- 874,904	- 994,438	- 1,113,972	- 1,233,506	- 1,353,039	- 1,472,573	- 1,592,107
in Yr 1	180	45%	2,304,570	1,632,192	959,815	287,437	- 48,752	- 384,941	- 519,417	- 653,892	- 788,368	- 922,843	- 1,057,319	- 1,191,794	- 1,326,270
	200	50%	2,973,834	2,226,747	1,479,661	732,574	359,031	- 14,512	- 163,929	- 313,347	- 462,764	- 612,181	- 761,598	- 911,016	- 1,060,433
	220	55%	3,643,098	2,821,302	1,999,507	1,177,712	766,815	355,917	191,558	27,199	- 137,160	- 301,519	- 465,878	- 630,237	- 794,596
	240	60%	4,312,361	3,415,858	2,519,354	1,622,850	1,174,598	726,346	547,045	367,745	188,444	9,143	- 170,158	- 349,458	- 528,759
	260	65%	4,974,550	4,004,059	3,033,568	2,063,077	1,577,831	1,092,585	898,487	704,389	510,291	316,192	122,094	- 72,004	- 266,102
	280	70%	5,547,130	4,511,792	3,476,455	2,441,117	1,923,448	1,405,779	1,198,711	991,644	784,576	577,509	370,441	163,373	- 43,694
	320	80%	6,410,288	5,275,308	4,140,329	3,005,350	2,437,860	1,870,370	1,643,374	1,416,378	1,189,383	962,387	735,391	508,395	281,399
	360	90%	6,939,810	5,742,884	4,545,959	3,349,034	2,750,571	2,152,109	1,912,723	1,673,338	1,433,953	1,194,568	955,183	715,798	476,413
	400	100%	7,163,263	5,940,121	4,716,979	3,493,837	2,882,266	2,270,695	2,026,067	1,781,438	1,536,810	1,292,182	1,047,553	802,925	558,296

		IRR					Year 1 Pipi Buying Price/kg at Plant Door								
	Tonnes	41%	$ 3.00	$ 3.50	$ 4.00	$ 4.50	$ 4.75	$ 5.00	$ 5.10	$ 5.20	$ 5.30	$ 5.40	$ 5.50	$ 5.60	$ 5.70
	100	25%	10%	1%	-8%	-19%	#NUM!	-34%	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!	#NUM!
CUPCO	120	30%	25%	15%	5%	-6%	-11%	-18%	-21%	-24%	#NUM!	#NUM!	#NUM!	#NUM!	-44%
Share	140	35%	**41%**	28%	16%	5%	-1%	-7%	-9%	-12%	-15%	-18%	-21%	-25%	#NUM!
of TACC	160	40%	60%	**42%**	28%	15%	8%	2%	0%	-3%	-6%	-9%	-12%	-15%	-18%
in Yr 1	180	45%	85%	59%	**39%**	24%	17%	10%	7%	5%	2%	-1%	-4%	-7%	-10%
	200	50%	121%	80%	53%	**34%**	25%	18%	15%	12%	9%	6%	3%	0%	-3%
	220	55%	180%	108%	69%	44%	**34%**	25%	22%	19%	15%	12%	9%	6%	2%
	240	60%	288%	150%	90%	56%	43%	**33%**	29%	25%	22%	18%	15%	11%	8%
	260	65%	543%	218%	117%	69%	54%	41%	**36%**	32%	28%	24%	20%	17%	13%
	280	70%	1815%	341%	155%	86%	65%	49%	44%	**39%**	34%	30%	25%	21%	17%
	320	80%	#NUM!	1996%	309%	133%	95%	68%	60%	53%	**46%**	40%	34%	29%	24%
	360	90%	#NUM!	#NUM!	978%	221%	139%	93%	80%	68%	59%	**50%**	42%	35%	29%
	400	100%	#NUM!	#NUM!	#NUM!	394%	200%	118%	98%	81%	68%	57%	48%	39%	32%

Across the two tables presented above, this sensitivity provides estimates of both NPV and IRR for the same variables – *Year 1 Share of LCF TACC*, and *Year 1 Pipi Buying Price*. Note that cells recording "#NUM!" identify financial assumptions where the IRR formula has been unable to estimate the impact.

Conclusion: The project will need to achieve at least 45-50% of the *LCF Pipi TACC in Year 1* to sustain a viable business and pay $4.75 per kg for Pipis from Year 1. A level of 55% of TACC will start to deliver favourable economies of scale and enable higher payments to Pipi suppliers and shareholders while maintaining adequate returns on investment for CUPCo. A higher Year 1 share of TACC is very attractive to the company and to shareholders - this suggests the company will be well advised to try to maximise its engagement with potential suppliers and shareholders at the first opportunity.

Sensitivity 2. Commercial Bank Loan Rate

The project has been structured to enable CUPCo to borrow loan funds (ie. bank debt) on behalf of its shareholders for essential capital items.

Note that Directors also have the option to call for shareholders to fund capital expenditure directly by contributing private funds to CUPCo (in proportion to shares held) for these capital requirements. In that case shareholders would clearly require a more stable and larger dividend stream.

	NPV					Year 1 Pipi Buying Price/kg at Plant Door								
	$ 1,084,948	$ 3.00	$ 4.00	$ 4.50	$ 4.75	$ 4.80	$ 4.90	$ 5.00	$ 5.10	$ 5.20	$ 5.30	$ 5.40	$ 5.50	$ 5.60
	8.0%	4,357,969	2,564,961	1,668,458	1,220,206	1,130,555	951,255	771,954	592,653	413,352	234,052	54,751	- 124,550	- 303,851
	8.3%	4,355,237	2,562,229	1,665,725	1,217,473	1,127,823	948,522	769,222	589,921	410,620	231,319	52,018	- 127,282	- 306,583
	8.5%	4,352,488	2,559,481	1,662,977	1,214,725	1,125,075	945,774	766,473	587,172	407,872	228,571	49,270	- 130,031	- 309,331
Bank	8.8%	4,349,724	2,556,716	1,660,213	1,211,961	1,122,310	943,010	763,709	584,408	405,107	225,807	46,506	- 132,795	- 312,096
Loan	9.0%	4,346,944	2,553,936	1,657,432	1,209,181	1,119,530	940,229	760,929	581,628	402,327	223,026	43,726	- 135,575	- 314,876
Rate	10.5%	4,329,931	2,536,924	1,640,420	1,192,168	1,102,518	923,217	743,916	564,616	385,315	206,014	26,713	- 152,587	- 331,888
	11.0%	4,324,136	2,531,128	1,634,625	1,186,373	1,096,722	917,422	738,121	558,820	379,519	200,219	20,918	- 158,383	- 337,684
	11.5%	4,318,279	2,525,272	1,628,768	1,180,516	1,090,866	911,565	732,264	552,963	373,663	194,362	15,061	- 164,240	- 343,541
	12.0%	4,312,361	2,519,354	1,622,850	1,174,598	1,084,948	905,647	726,346	547,045	367,745	188,444	9,143	- 170,158	- 349,458
	12.5%	4,306,383	2,513,376	1,616,872	1,168,620	1,078,970	899,669	720,368	541,067	361,767	182,466	3,165	- 176,136	- 355,436
	13.0%	4,300,345	2,507,338	1,610,834	1,162,582	1,072,932	893,631	714,330	535,029	355,729	176,428	- 2,873	- 182,174	- 361,474
	13.5%	4,294,248	2,501,241	1,604,737	1,156,485	1,066,835	887,534	708,233	528,932	349,632	170,331	- 8,970	- 188,271	- 367,571
	14.0%	4,288,093	2,495,085	1,598,581	1,150,329	1,060,679	881,378	702,077	522,777	343,476	164,175	- 15,126	- 194,426	- 373,727
	14.5%	4,281,879	2,488,871	1,592,368	1,144,116	1,054,465	875,165	695,864	516,563	337,262	157,962	- 21,339	- 200,640	- 379,941

Conclusion: The analysis suggests that, under forecast debt loads, the project will become sensitive to commercial interest rates only when *Year 1 Pipi Buying Prices* are above $5.30/kg.

Sensitivity 3. Fresh Market Exposure

The trend analyses (See Figure 6) presented earlier in this report confirm the proposed move from bait product to fresh market human consumption products, and the introduction of MAP consumer lines.

The two data tables below assess the impacts of this move.

	NPV					Year 1 Pipi Buying Price/kg at Plant Door								
	$ 1,084,948	$ 3.00	$ 3.25	$ 3.50	$ 3.75	$ 4.00	$ 4.25	$ 4.50	$ 4.75	$ 5.00	$ 5.25	$ 5.50	$ 5.75	$ 6.00
	10%	1,848,476	1,400,224	951,973	503,721	55,469	- 392,783	- 841,035	- 1,289,287	- 1,737,539	- 2,185,791	- 2,634,043	- 3,082,294	- 3,530,546
	20%	2,138,345	1,690,093	1,241,841	793,589	345,338	- 102,914	- 551,166	- 999,418	- 1,447,670	- 1,895,922	- 2,344,174	- 2,792,426	- 3,240,677
	30%	2,428,214	1,979,962	1,531,710	1,083,458	635,206	186,955	- 261,297	- 709,549	- 1,157,801	- 1,606,053	- 2,054,305	- 2,502,557	- 2,950,809
% Share to	40%	2,718,083	2,269,831	1,821,579	1,373,327	925,075	476,823	28,571	- 419,680	- 867,932	- 1,316,184	- 1,764,436	- 2,212,688	- 2,660,940
Fresh Market	45%	2,863,017	2,414,765	1,966,513	1,518,262	1,070,010	621,758	173,506	- 274,746	- 722,998	- 1,171,250	- 1,619,502	- 2,067,754	- 2,516,005
in Year 1	50%	3,007,952	2,559,700	2,111,448	1,663,196	1,214,944	766,692	318,440	- 129,812	- 578,063	- 1,026,315	- 1,474,567	- 1,922,819	- 2,371,071
	55%	3,152,886	2,704,634	2,256,382	1,808,130	1,359,878	911,627	463,375	15,123	- 433,129	- 881,381	- 1,329,633	- 1,777,885	- 2,226,137
	60%	3,297,820	2,849,569	2,401,317	1,953,065	1,504,813	1,056,561	608,309	160,057	- 288,195	- 736,447	- 1,184,698	- 1,632,950	- 2,081,202
	65%	3,442,755	2,994,503	2,546,251	2,097,999	1,649,747	1,201,495	753,244	304,992	- 143,260	- 591,512	- 1,039,764	- 1,488,016	- 1,936,268
	70%	3,587,689	3,139,437	2,691,185	2,242,934	1,794,682	1,346,430	898,178	449,926	1,674	- 446,578	- 894,830	- 1,343,081	- 1,791,333
	75%	3,732,624	3,284,372	2,836,120	2,387,868	1,939,616	1,491,364	1,043,112	594,860	146,609	- 301,643	- 749,895	- 1,198,147	- 1,646,399
	80%	3,877,558	3,429,306	2,981,054	2,532,802	2,084,551	1,636,299	1,188,047	739,795	291,543	- 156,709	- 604,961	- 1,053,213	- 1,501,465
	85%	4,022,492	3,574,241	3,125,989	2,677,737	2,229,485	1,781,233	1,332,981	884,729	436,477	- 11,774	- 460,026	- 908,278	- 1,356,530
	90%	4,167,427	3,719,175	3,270,923	2,822,671	2,374,419	1,926,167	1,477,916	1,029,664	581,412	133,160	- 315,092	- 763,344	- 1,211,596
	100%	4,457,296	4,009,044	3,560,792	3,112,540	2,664,288	2,216,036	1,767,784	1,319,533	871,281	423,029	- 25,223	- 473,475	- 921,727

Conclusion: A strategy to increase tonnage output of fresh consumer products will boost CUPCo viability and returns to shareholders. In the absence of changes in other revenue streams, a minimum 40-45% *Share of Fresh Market* content is required to support *Year 1 Pipi Buying Prices* of $4.50/kg.

	NPV					Year 1 Pipi Buying Price/kg at Plant Door								
	$ 1,084,948	$ 3.00	$ 3.25	$ 3.50	$ 3.75	$ 4.00	$ 4.25	$ 4.50	$ 4.75	$ 5.00	$ 5.25	$ 5.50	$ 5.75	$ 6.00
	0%	2,525,082	2,076,830	1,628,578	1,180,326	732,074	283,822	- 164,430	- 612,681	- 1,060,933	- 1,509,185	- 1,957,437	- 2,405,689	- 2,853,941
	1%	2,652,745	2,204,493	1,756,241	1,307,989	859,737	411,485	- 36,767	- 485,019	- 933,270	- 1,381,522	- 1,829,774	- 2,278,026	- 2,726,278
	2%	2,780,407	2,332,156	1,883,904	1,435,652	987,400	539,148	90,896	- 357,356	- 805,608	- 1,253,860	- 1,702,111	- 2,150,363	- 2,598,615
% Share to B Grade	3%	2,908,070	2,459,818	2,011,566	1,563,315	1,115,063	666,811	218,559	- 229,693	- 677,945	- 1,126,197	- 1,574,449	- 2,022,700	- 2,470,952
Pipi - MAP Market	4%	3,035,733	2,587,481	2,139,229	1,690,977	1,242,726	794,474	346,222	- 102,030	- 550,282	- 998,534	- 1,446,786	- 1,895,038	- 2,343,290
in Year 1	5%	3,163,396	2,715,144	2,266,892	1,818,640	1,370,388	922,136	473,885	25,633	- 422,619	- 870,871	- 1,319,123	- 1,767,375	- 2,215,627
	6%	3,291,059	2,842,807	2,394,555	1,946,303	1,498,051	1,049,799	601,547	153,296	- 294,956	- 743,208	- 1,191,460	- 1,639,712	- 2,087,964
	7%	3,418,722	2,970,470	2,522,218	2,073,966	1,625,714	1,177,462	729,210	280,958	- 167,294	- 615,545	- 1,063,797	- 1,512,049	- 1,960,301
	8%	3,546,384	3,098,132	2,649,881	2,201,629	1,753,377	1,305,125	856,873	408,621	- 39,631	- 487,883	- 936,134	- 1,384,386	- 1,832,638
	9%	3,674,047	3,225,795	2,777,543	2,329,292	1,881,040	1,432,788	984,536	536,284	88,032	- 360,220	- 808,472	- 1,256,724	- 1,704,975
	10%	3,801,710	3,353,458	2,905,206	2,456,954	2,008,702	1,560,451	1,112,199	663,947	215,695	- 232,557	- 680,809	- 1,129,061	- 1,577,313
	15%	4,440,024	3,991,772	3,543,520	3,095,268	2,647,017	2,198,765	1,750,513	1,302,261	854,009	405,757	- 42,495	- 490,747	- 938,999
	20%	5,078,338	4,630,086	4,181,834	3,733,583	3,285,331	2,837,079	2,388,827	1,940,575	1,492,323	1,044,071	595,819	147,567	- 300,684
	25%	5,716,652	5,268,400	4,820,149	4,371,897	3,923,645	3,475,393	3,027,141	2,578,889	2,130,637	1,682,385	1,234,133	785,882	337,630
	30%	6,354,966	5,906,715	5,458,463	5,010,211	4,561,959	4,113,707	3,665,455	3,217,203	2,768,951	2,320,699	1,872,448	1,424,196	975,944

Conclusion: An increasing share of *Year 1 MAP Market* input to and output from the processing facility will boost CUPCo viability and shareholder returns. The sensitivity table above suggests that the input share of *B Grade Pipis – Small 1st Grade Pipis* (the QA receival specification that drives MAP processed products) will achieve operating scale at a level of 10-15% of total input receival weight at the CUPCO processing facility. and should be maintained above that level. The data suggests that above this level CUPCo is increasingly able to pay higher returns (beach price plus dividend) to license holders.

Appendices

Appendix 1. Detailed Common Baseline Data

Feasibility Analysis - Coorong United Pipi Co

							Year ending June 30th	1	2	3	4	5	6	7	8	9	10
1	**A. Common Input Assumptions**				*Yr 1*	*Growth/Yr*											
2	SA Pipi Fishery TACC				**400**	+6.0%	*tonnes*	400	424	449	476	505	535	567	601	638	676
3	**CUPCo Share of SA TACC**				**60%**	+7.0%	*%*	**60%**	**64%**	**69%**	**74%**	**79%**	**84%**	**90%**	**96%**	**100%**	**100%**
4				**Total CUPCo TACC**			*tonnes*	**240**	**272**	**309**	**350**	**397**	**450**	**511**	**579**	**638**	**676**
5	Share of CUPCo TACC from Goolwa holders					60%	*tonnes*	**144**	**163**	**185**	**210**	**238**	**270**	**307**	**348**	**383**	**405**
6	Share of CUPCo TACC from Meningie holders					40%	*tonnes*	**96**	**109**	**123**	**140**	**159**	**180**	**204**	**232**	**255**	**270**
7																	
8	Weight loss at beach and in road transit				2%	+.0%	*%*	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
9	**CUPCo Received Tonnage - at processing centre**						*tonnes*	**235**	**267**	**303**	**343**	**389**	**441**	**501**	**568**	**625**	**662**
10																	
11	Weight loss in purging				2%	+.0%	*%*	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
12	**CUPCo Input Tonnage**						*tonnes*	**230.5**	**261.4**	**296.5**	**336.3**	**381.4**	**432.6**	**490.7**	**556.5**	**612.3**	**649.0**
13																	
14	**CUPCo Input Tonnage Specification Matrix**				*Yr 1 Share*	*Growth/Yr*											
15	**A grade Pipis**	Large/medium 1st Grade food Pipis			50%	-8.5%	*%*	50%	46%	42%	38%	35%	32%	29%	27%	25%	22%
16	**B grade Pipis**	Small 1st Grade food (MAP input)			14%	+18.8%	*%*	14%	17%	20%	23%	28%	33%	39%	47%	55%	66%
17	**C grade Pipis**	Bait Grade Pipis			35%		*%*	35%	37%	37%	37%	36%	34%	30%	26%	19%	11%
18	**D grade Pipis**	Cracked and broken Pipis			1%	+.0%	*%*	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
19					*100%*		*%*	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
20																	
21	A grade Pipis	Large/medium 1st Grade food Pipis					*tonnes*	115.2	119.6	124.1	128.8	133.7	138.7	144.0	149.4	150.4	145.9
22	B grade Pipis	Small 1st Grade food (MAP input)					*tonnes*	32.3	43.5	58.5	78.8	106.2	143.0	192.6	259.5	339.0	426.7
23	C grade Pipis	Bait Grade Pipis					*tonnes*	80.7	95.7	110.9	125.3	137.7	146.5	149.2	142.1	116.8	70.0
24	D grade Pipis	Cracked and broken Pipis					*tonnes*	2.3	2.6	3.0	3.4	3.8	4.3	4.9	5.6	6.1	6.5
25				**Total CUPCo Input Tonnage**			*tonnes*	**230.5**	**261.4**	**296.5**	**336.3**	**381.4**	**432.6**	**490.7**	**556.5**	**612.3**	**649.0**
26																	
27	**B. Common Output Assumptions**																
28	Product to Market				*Market*	*Tonnes Split*											
29	Fresh Market		**95%**	of A Grade	Fresh Domestic	90%	*tonnes*	98.5	102.3	106.1	110.1	114.3	118.6	123.1	127.8	128.6	124.7
30					Fresh Export	*10%*	*tonnes*	10.9	11.4	11.8	12.2	12.7	13.2	13.7	14.2	14.3	13.9
31	Frozen Market		5%	of A Grade	Frozen Domestic	90%	*tonnes*	5.2	5.4	5.6	5.8	6.0	6.2	6.5	6.7	6.8	6.6
32					Frozen Export	*10%*	*tonnes*	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8	0.7
33	MAP Market		100%	of B Grade	MAP Domestic	70%	*tonnes*	22.6	30.4	41.0	55.2	74.3	100.1	134.8	181.6	237.3	298.7
34					MAP Export	*30%*	*tonnes*	9.7	13.0	17.6	23.7	31.9	42.9	57.8	77.8	101.7	128.0
35	Bait Market		100%	of C Grade	Bait Domestic	*100%*	*tonnes*	80.7	95.7	110.9	125.3	137.7	146.5	149.2	142.1	116.8	70.0
36	Cracked & Broken Market		100%	of D Grade	Other Domestic	*100%*	*tonnes*	2.3	2.6	3.0	3.4	3.8	4.3	4.9	5.6	6.1	6.5
37				**Total CUPCo Output Tonnage**			*tonnes*	**230.5**	**261.4**	**296.5**	**336.3**	**381.4**	**432.6**	**490.7**	**556.5**	**612.3**	**649.0**
38																	
39	Output Tonnage split by **Product**			Fresh Market			*%*	48%	43%	40%	36%	33%	30%	28%	26%	23%	21%
40				Frozen Market			*%*	3%	2%	2%	2%	2%	2%	1%	1%	1%	1%
41				MAP Market			*%*	14%	17%	20%	23%	28%	33%	39%	47%	55%	66%
42				Bait Market			*%*	35%	37%	37%	37%	36%	34%	30%	26%	19%	11%
43				Other Market (Cracked & Broken)			*%*	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
44							*%*	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
45	Output Tonnage split by **Market**			Domestic			*%*	91%	90%	90%	89%	88%	87%	85%	83%	81%	78%
46				Export			*%*	9%	10%	10%	11%	12%	13%	15%	17%	19%	22%
47							*%*	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
48																	
49	**C. Common Price Assumptions**				*Yr 1 Nominal*	*Growth/Yr*											
50	Pipi Buying Price	at Hindmarsh Is Depot and Meningie Depot			**$ 4.50**	+3.0%	*$/kg IQF*	$ 4.50	$ 4.64	$ 4.77	$ 4.92	$ 5.06	$ 5.22	$ 5.37	$ 5.53	$ 5.70	$ 5.87
51																	
52	Selling prices	Annual Growth Rate for all Selling Prices															
53		Domestic		Fresh	$ 11.00	+3.0%	*$/kg DP*	$ 11.00	$ 11.33	$ 11.67	$ 12.02	$ 12.38	$ 12.75	$ 13.13	$ 13.53	$ 13.93	$ 14.35
54				Frozen	$ 6.00	+3.0%	*$/kg DP*	$ 6.00	$ 6.18	$ 6.37	$ 6.56	$ 6.75	$ 6.96	$ 7.16	$ 7.38	$ 7.60	$ 7.83
55				MAP	$ 13.00	+3.0%	*$/kg DP*	$ 13.00	$ 13.39	$ 13.79	$ 14.21	$ 14.63	$ 15.07	$ 15.52	$ 15.99	$ 16.47	$ 16.96
56				Bait	$ 7.00	+3.0%	*$/kg DP*	$ 7.00	$ 7.21	$ 7.43	$ 7.65	$ 7.88	$ 8.11	$ 8.36	$ 8.61	$ 8.87	$ 9.13
57				Other	$ 2.00	+3.0%	*$/kg DP*	$ 2.00	$ 2.06	$ 2.12	$ 2.19	$ 2.25	$ 2.32	$ 2.39	$ 2.46	$ 2.53	$ 2.61
58		Export		Fresh	$ 12.00	+3.0%	*$/kg DP*	$ 12.00	$ 12.36	$ 12.73	$ 13.11	$ 13.51	$ 13.91	$ 14.33	$ 14.76	$ 15.20	$ 15.66
59				Frozen	$ 7.00	+3.0%	*$/kg DP*	$ 7.00	$ 7.21	$ 7.43	$ 7.65	$ 7.88	$ 8.11	$ 8.36	$ 8.61	$ 8.87	$ 9.13
60				MAP	$ 12.00	+3.0%	*$/kg DP*	$ 12.00	$ 12.36	$ 12.73	$ 13.11	$ 13.51	$ 13.91	$ 14.33	$ 14.76	$ 15.20	$ 15.66

											Year ending June 30th	1	2	3	4	5	6	7	8	9	10
	D. Common Employment Assumptions																				
							Yr 1	Increase	Yr 1	Yr 1											
1	**Employees**		Kg		Hours		Base/Hr	p.a.	Super	Workcover											
2	Grading & Desanding	to process	1,000	in	3		$ 25.00	+3.5%	+9.25%	+5.0%	$/kg	$ 0.086	$ 0.089	$ 0.092	$ 0.095	$ 0.099	$ 0.102	$ 0.106	$ 0.109	$ 0.113	$ 0.117
3	Packing	to process	1,000	in	7		$ 25.00	+3.5%	+9.25%	+5.0%	$/kg	$ 0.201	$ 0.208	$ 0.215	$ 0.223	$ 0.230	$ 0.238	$ 0.247	$ 0.255	$ 0.264	$ 0.274
4	MAP Line Worker/s		1,000	in	10		$ 25.00	+3.5%	+9.25%	+5.0%	$/kg	$ 0.287	$ 0.297	$ 0.307	$ 0.318	$ 0.329	$ 0.341	$ 0.353	$ 0.365	$ 0.378	$ 0.391
5	Operations Manager	Contracted rate - @ Rec'd Wt					$ 0.50	-6.0%	+9.25%	+5.0%	$/kg	$ 0.574	$ 0.539	$ 0.507	$ 0.476	$ 0.448	$ 0.421	$ 0.396	$ 0.372	$ 0.350	$ 0.329
6							Salary														
7	Truck Driver / General				Contract		$30,000	+3.5%			$	$ 30,000	$ 31,050	$ 32,137	$ 33,262	$ 34,426	$ 35,631	$ 36,878	$ 38,168	$ 39,504	$ 40,887
8																					
9	**Contractors**																				
10	Routine mechanical/site maintenance				Contract		$30,000	+3.5%			$	$ 30,000	$ 31,050	$ 32,137	$ 33,262	$ 34,426	$ 35,631	$ 36,878	$ 38,168	$ 39,504	$ 40,887
11	Office / Accounts / Admin Employees				Contract		$35,000	+3.5%			$	$ 36,225	$ 36,225	$ 37,493	$ 38,805	$ 40,163	$ 41,569	$ 43,024	$ 44,530	$ 46,088	$ 47,701
12	Market Experts / Contractors				Contract		$80,000	+3.5%			$	$ 82,800	$ 82,800	$ 85,698	$ 88,697	$ 91,802	$ 95,015	$ 98,340	$ 101,782	$ 105,345	$ 109,032
13																					
14	**CUPCo Board**																				
15	1 Independent Chair				Contract		$20,000	+3.5%	to run meetings		$	$ 20,000	$ 20,700	$ 21,425	$ 22,174	$ 22,950	$ 23,754	$ 24,585	$ 25,446	$ 26,336	$ 27,258
16	2 Industry Directors				Contract		$24,000	+3.5%	total		$	$ 24,000	$ 24,840	$ 25,709	$ 26,609	$ 27,541	$ 28,504	$ 29,502	$ 30,535	$ 31,603	$ 32,710
17	1 Managing Director / Operations Mgr				Contract		$ -	+3.5%	incl. bonus		$	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
18	Board expenses incl. D&O Insurance				Contract		$15,000	+3.5%			$	$ 15,000	$ 15,525	$ 16,068	$ 16,631	$ 17,213	$ 17,815	$ 18,439	$ 19,084	$ 19,752	$ 20,443
19	Board Total										$	$ 59,000	$ 61,065	$ 63,202	$ 65,414	$ 67,704	$ 70,073	$ 72,526	$ 75,064	$ 77,692	$ 80,411

Appendix 2. Lakes & Coorong Fishery Pipi License Holders

Lakes & Coorong Pipi Fishery Public Register 30 May 2013 from PIRSA Public Register 30May2013

Pipi License Authority	Pipi License Holder		License Holder Address			Pipi Quota Units	Pipi Quota Share Actual	Pipi Quota Share Cummulative	Pipi License Status	Year 1 Est. Minimum Quota % Committed to CUPCo	CUPCo Committed Quota Pool	Year 1 CUPCo Tonnage at TACC of 400	No of CUPCo SHARES HELD If Total No of Shares 581	Potential Shareholder Capital Injection Bolt-On $ 450,000	Potential Shareholder Capital Injection Greenfield $ 950,000
L45	Hoad	Darren J.	PO Box 1047	Goolwa, SA	5214	172.82	18%	18%	Active	80%	138	57	138	$ 107,084	$ 226,067
L08	Wilton	Chris S.	PO Box 370	Port Elliot, SA	5212	149.06	15%	33%	Active	80%	119	49	119	$ 92,362	$ 194,987
L20	Kessegian	Debra	PO Box 644	Goolwa, SA	5214	100.00	10%	43%	Active	80%	80	33	80	$ 61,963	$ 130,811
L44	Ayres	Rodney S.	645 Port Elliot Rd	Port Elliot, SA	5212	60.11	6%	49%	Active	80%	48	20	48	$ 37,246	$ 78,630
L30	Edson	Daryl H.	17 Allen St	Meningie, SA	5264	58.67	6%	55%	Active	.0%	0	0	0	$ -	$ -
L29	Moore	Barry L.	PO Box 424	Kingston SE SA	5275	54.47	6%	61%	Active	.0%	0	0	0	$ -	$ -
L36	Brooks	Robert S.	PO Box 53	Meningie, SA	5264	47.30	5%	66%	Active	.0%	0	0	0	$ -	$ -
L27	Kessegian	Krikor	PO Box 268	Mount Gambier	5290	46.83	5%	71%	Active	80%	37	15	37	$ 29,017	$ 61,259
L15	Backen	David	PO Box 863	Port Lincoln, SA	5606	42.22	4%	75%	Active	80%	34	14	34	$ 26,161	$ 55,228
L10	Jolly	Michael G.	PO Box 54	Goolwa, SA	5214	40.75	4%	79%	Active	80%	33	13	33	$ 25,250	$ 53,305
L13	Hera-Singh	Gary I.	PO Box 263	Meningie, SA	5264	31.83	3%	82%	Active	80%	25	10	25	$ 19,723	$ 41,637
L14	Wilton	Chris S.	PO Box 370	Port Elliot, SA	5212	23.45	2%	85%	Active	80%	19	8	19	$ 14,530	$ 30,675
L47	Hoad	Matthew J.	PO Box 166	Meningie, SA	5264	23.12	2%	87%	Active	80%	18	8	18	$ 14,326	$ 30,243
L41	Hoad	Timothy S.	PO Box 762	Murray Bridge, SA	5253	21.28	2%	89%	Active	80%	17	7	17	$ 13,186	$ 27,837
L38	Alexander	Steve	c/- Post Office	Meningie, SA	5264	20.67	2%	91%	Active	.0%	0	0	0	$ -	$ -
L19	Mammone	Nathan C.	PO Box 196	Meningie, SA	5264	16.44	2%	93%	Active	.0%	0	0	0	$ -	$ -
L31	Phillips	Adrian K.	PO Box 561	Strathalbyn SA	5255	14.77	2%	95%	Active	80%	12	5	12	$ 9,152	$ 19,321
L18	Modra	Raymond T.	PO Box 215	Meningie, SA	5264	14.47	1%	96%	Active	.0%	0	0	0	$ -	$ -
L03	Hill	Glendan D.	PO Box 113	Meningie, SA	5264	9.47	1%	97%	Active	.0%	0	0	0	$ -	$ -
L26	Lucieer	Trevor J.	1 Edward St	Meningie, SA	5214	9.47	1%	98%	Active	.0%	0	0	0	$ -	$ -
L33	Richards	Timothy C.	19 Falkner St	Meningie, SA	5264	9.47	1%	99%	Active	.0%	0	0	0	$ -	$ -
L35	Brooks	Brian A.	PO Box 201	Meningie, SA	5264	9.47	1%	100%	Active	.0%	0	0	0	$ -	$ -
					Total Active Units	**976.14**	**100%**			**Committed Investor Units**	**581**	**238**	**581**	**$ 450,000**	**$ 950,000**
										Share of Total Fishery Units	**60%**	**60%**			

Appendix 3. Option 1 (Bolt-On at Port Elliot) Financial Analysis

61	**OPTION 1. Bolt on Processing at Port Elliot**															
62	**PROFIT & LOSS**															
63	**REVENUE**					*Basis*			*These sales figures assume this is the net CIF based on sales price after discounts*							
64	Sales	Domestic	Fresh			*CIF*	$	1,083,907	1,136,961	1,192,612	1,250,987	1,312,218	1,376,447	1,443,820	1,514,491	1,588,620	1,666,378
65			Frozen			*CIF*	$	31,117	32,640	34,238	35,913	37,671	39,515	41,449	43,478	45,606	47,839
66			MAP			*CIF*	$	293,652	399,760	544,208	740,851	1,008,549	1,372,976	1,869,084	2,544,456	3,463,864	4,715,491
67			Bait			*CIF*	$	564,715	677,441	792,972	905,568	1,006,367	1,082,100	1,113,322	1,071,971	918,024	594,898
68			Other			*CIF*	$	4,610	5,285	6,058	6,945	7,962	9,128	10,464	11,996	13,752	15,765
69			Total Domestic Market			*CIF*	$	1,978,001	2,252,087	2,570,088	2,940,264	3,372,767	3,880,166	4,478,139	5,186,391	6,029,867	7,040,370
70		Export	Fresh			*CIF*	$	131,383	137,813	144,559	151,635	159,057	166,842	175,009	183,575	192,560	201,985
71			Frozen			*CIF*	$	4,034	4,231	4,438	4,655	4,883	5,122	5,373	5,636	5,912	6,201
72			MAP			*CIF*	$	116,170	158,147	215,291	293,084	398,986	543,155	739,418	1,006,598	1,370,320	1,865,469
73			Total Export Market			*CIF*	$	251,586	300,191	364,288	449,374	562,926	715,120	919,799	1,195,808	1,568,792	2,073,655
74				**Total Sales Revenue**		*CIF*	$	**2,229,588**	**2,552,278**	**2,934,376**	**3,389,638**	**3,935,694**	**4,595,286**	**5,397,939**	**6,382,200**	**7,598,659**	**9,114,025**
75	Other Revenue	Bank interest					$	400	400	400	400	400	400	400	400	400	400
76		Grants received					$	0	0	0	0	0	0	0	0	0	0
77				**TOTAL REVENUE**			$	**2,229,988**	**2,552,678**	**2,934,776**	**3,390,038**	**3,936,094**	**4,595,686**	**5,398,339**	**6,382,600**	**7,599,059**	**9,114,425**
78																	
79	**EXPENDITURE**	*including GST*															
80	**Purchase of Pipis**		*single site plant for all CUPCo purging and processing*				$	1,128,960	1,300,511	1,498,130	1,725,779	1,988,019	2,290,109	2,638,102	3,038,975	3,500,763	4,032,721
81	**Employment**																
82	Employees	Grading & Desanding		*based on kg Received at CUPCO*			$	20,235	23,310	26,852	30,933	35,633	41,048	47,285	54,470	62,747	72,282
83		Packing		*based on kg Output at CUPCO*			$	46,271	53,303	61,402	70,732	81,481	93,862	108,125	124,555	143,482	165,284
84		Truck Driver / General		*based on Annual Salary*			$	30,000	31,050	32,137	33,262	34,426	35,631	36,878	38,168	39,504	40,887
85		MAP Line Worker/s		*based on kg Output at CUPCO*			$	9,254	12,659	17,317	23,689	32,405	44,329	60,640	82,952	113,474	155,226
86		Operations Mgt		*Package Value based on kg Output*			$	132,204	138,314	144,707	151,396	158,393	165,714	173,373	181,387	189,770	198,542
87					Total Employee Costs		$	237,965	258,636	282,416	310,011	342,338	380,583	426,300	481,532	548,977	632,221
88	Contractors	Routine mechanical / site maintenance					$	30,000	31,050	32,137	33,262	34,426	35,631	36,878	38,168	39,504	40,887
89		Office / Accounts / Admin Employees					$	36,225	36,225	37,493	38,805	40,163	41,569	43,024	44,530	46,088	47,701
90		Market Experts / Contractors					$	82,800	82,800	85,698	88,697	91,802	95,015	98,340	101,782	105,345	109,032
91					Total Contractor Costs		$	149,025	150,075	155,328	160,764	166,391	172,215	178,242	184,480	190,937	197,620
92					*Yr 1*	*Growth/Yr*											
93	Staff Training				$ 1,000	+3.5%	$	1,000	1,035	1,071	1,109	1,148	1,188	1,229	1,272	1,317	1,363
94				**Total Employment Costs**			$	**387,990**	**409,746**	**438,814**	**471,884**	**509,876**	**553,985**	**605,772**	**667,285**	**741,231**	**831,204**
95	**Facility & Equipment**				*Yr 1*	*Growth/Yr*											
96	Facility Lease of Pt Elliot building only				$ 50,000	+3.5%	$	50,000	51,750	53,561	55,436	57,376	59,384	61,463	63,614	65,840	68,145
97	Equipment		Grader		$ 3,000	+3.5%	$	3,000	3,105	3,214	3,326	3,443	3,563	3,688	3,817	3,950	4,089
98	(all hired from Coorong Cockles Pty Ltd)		Fork lift		$ 5,000	+3.5%	$	5,000	5,175	5,356	5,544	5,738	5,938	6,146	6,361	6,584	6,814
99			Tanks - 3 Tonne		$ 20,000	+3.5%	$	20,000	20,700	21,425	22,174	22,950	23,754	24,585	25,446	26,336	27,258
100			Freezers		$ 15,000	+3.5%	$	15,000	15,525	16,068	16,631	17,213	17,815	18,439	19,084	19,752	20,443
101			Miscellanous		$ 5,000	+3.5%	$	5,000	5,175	5,356	5,544	5,738	5,938	6,146	6,361	6,584	6,814
102			Office equipment		$ 1,500	+3.5%	$	1,500	1,553	1,607	1,663	1,721	1,782	1,844	1,908	1,975	2,044
103					Total Equipment hire Costs		$	49,500	51,233	53,026	54,882	56,802	58,790	60,848	62,978	65,182	67,463
104	Maintenance Consumables				$ 15,000	+3.5%	$	15,000	15,525	16,068	16,631	17,213	17,815	18,439	19,084	19,752	20,443
105				**Total Facility & Equipment Costs**			$	**114,500**	**118,508**	**122,655**	**126,948**	**131,391**	**135,990**	**140,750**	**145,676**	**150,775**	**156,052**
106	**Depreciation**																
107	MAP Facility	*owned by CUPCo*		*CAPEX Cost*	*Dep'n Rate*	*Life*											
108	Building Annex (to be added)			$ 50,000	+5.0%	*20yrs*	$	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500
109	MAP Machine			$ 300,000	+10.0%	*10yrs*	$	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000	30,000
110	MAP -autofeed hopper from Yr 5			$ 200,000	+10.0%	*10yrs*	$	0	0	0	0	20,000	20,000	20,000	20,000	20,000	20,000
111	Refrigerated Truck			$ 100,000	+14.3%	*7yrs*	$	14,290	14,290	14,290	14,290	14,290	14,290	14,290	14,290	14,290	14,290
112				**Total Depreciation**			$	**46,790**	**46,790**	**46,790**	**46,790**	**66,790**	**66,790**	**66,790**	**66,790**	**66,790**	**66,790**
113	**Freight & Storage**																
114	Freight - Road	*CUPCo truck costs excluding driver wages and oncosts*															
115	All Pipi Input Product		*Rtn Trips / Yr*	*klms/Trip*	*Yr 1 $/klm*	*$ Growth/Yr*											
116	Port Elliot to Hindmarsh Is Depot Return		300	40	$ 1.0000	+3.5%	$	12,000	12,420	12,855	13,305	13,770	14,252	14,751	15,267	15,802	16,355
117	Port Elliot to Meningie Depot Return		300	330	$ 1.0000	+3.5%	$	99,000	102,465	106,051	109,763	113,605	117,581	121,696	125,956	130,364	134,927
118		Trusk Klms/yr	111,000		*Avg tonnes per Hindmarsh Is trip*		*t*	*0.5*	*0.5*	*0.6*	*0.7*	*0.7*	*0.8*	*0.9*	*1.0*	*1.1*	*1.3*
119					*Avg tonnes per Meningie trip*		*t*	*0.3*	*0.4*	*0.4*	*0.4*	*0.5*	*0.5*	*0.6*	*0.7*	*0.8*	*0.8*
120	All Output Tonnage																
121	Port Elliot to Adelaide Airport Return		150	210	$ 1.0000	+3.5%	$	31,500	32,603	33,744	34,925	36,147	37,412	38,722	40,077	41,479	42,931
122		Truck Klms/yr	31,500		*Avg tonnes trucked to Adelaide per trip*		*t*	*1.5*	*1.7*	*1.9*	*2.1*	*2.4*	*2.6*	*2.9*	*3.3*	*3.6*	*4.0*
123	Avg TOTAL Truck Klms per day		475		Total Road Freight		$	142,500	147,488	152,650	157,992	163,522	169,245	175,169	181,300	187,645	194,213
124	Freight - Air	*human food product lines only*					$										
125	Domestic	From Adelaide to Sydney/Melbourne			$ 1.0000	+3.5%	$	126,312	140,228	157,506	179,286	207,125	243,148	290,252	352,400	435,002	545,454
126	Export	Ex Adelaide			$ 1.5000	+3.5%	$	31,808	38,086	46,379	57,416	72,187	92,049	118,859	155,150	204,394	271,332
127					Total Air Freight		$	158,120	178,314	203,885	236,702	279,312	335,197	409,111	507,551	639,396	816,787
128				**Total Freight Costs**			$	**300,620**	**325,801**	**356,535**	**394,694**	**442,834**	**504,442**	**584,280**	**688,851**	**827,041**	**1,010,999**

129	**Processing Costs**															
130	Bags, Packaging, Cleaning, Waste, Consumables				*Yr 1. $/kg*	*Growth/Yr*										
131		Fresh	Domestic		$ 0.750	+3.5%	$	73,903	77,896	82,106	86,543	91,219	96,149	101,345	106,821	112,594	118,678
132			Export		$ 0.750	+3.5%	$	8,211	8,655	9,123	9,616	10,135	10,683	11,261	11,869	12,510	13,186
133		Frozen	Domestic		$ 0.500	+3.5%	$	2,593	2,733	2,881	3,037	3,201	3,374	3,556	3,748	3,951	4,164
134			Export		$ 0.500	+3.5%	$	288	304	320	337	356	375	395	416	439	463
135		MAP	Domestic		$ 1.250	+3.5%	$	28,236	38,625	52,837	72,278	98,873	135,252	185,018	253,095	346,220	473,611
136			Export		$ 1.250	+3.5%	$	12,101	16,554	22,644	30,976	42,374	57,965	79,293	108,469	148,380	202,976
137		Bait & Other	Domestic		$ 0.050	+3.5%	$	4,034	4,862	5,719	6,563	7,329	7,919	8,187	7,921	6,816	4,439
138	Electricity & Gas		*$/kg processed*		$ 0.300	+3.5%	$	69,149	79,656	91,760	105,704	121,766	140,269	161,584	186,137	214,422	247,004
139	QA and Audits		*$/year - Year 1*		$ 30,000	+3.5%	$	30,000	31,050	32,137	33,262	34,426	35,631	36,878	38,168	39,504	40,887
140			**Total Processing Costs**				$	**228,515**	**260,336**	**299,528**	**348,316**	**409,679**	**487,617**	**587,516**	**716,645**	**884,836**	**1,105,408**
141	**Other Expenses**				*Yr 1*	*Growth/Yr*											
142	Audit and Accounting support				$ 11,000	+3.5%	$	11,000	11,385	11,783	12,196	12,623	13,065	13,522	13,995	14,485	14,992
143	Bank Fees				$ 4,000	+3.5%	$	4,000	4,140	4,285	4,435	4,590	4,751	4,917	5,089	5,267	5,452
144	Board Contracts and Expenses		*per Employment sheet*				$	59,000	61,065	63,202	65,414	67,704	70,073	72,526	75,064	77,692	80,411
145	Business Insurance				$ 25,000	+3.5%	$	25,000	25,875	26,781	27,718	28,688	29,692	30,731	31,807	32,920	34,072
146	Marketing expenses, engageme		*Promo brochures, websites*		$ 25,000	+3.5%	$	25,000	25,875	26,781	27,718	28,688	29,692	30,731	31,807	32,920	34,072
147	Safety & Protective Clothing				$ 1,000	+3.5%	$	1,000	1,035	1,071	1,109	1,148	1,188	1,229	1,272	1,317	1,363
148	Staff Amenities				$ 1,000	+3.5%	$	1,000	1,035	1,071	1,109	1,148	1,188	1,229	1,272	1,317	1,363
149	Phone, post & IT				$ 10,000	+3.5%	$	10,000	10,350	10,712	11,087	11,475	11,877	12,293	12,723	13,168	13,629
150	Travel				$ 10,000	+3.5%	$	10,000	10,350	10,712	11,087	11,475	11,877	12,293	12,723	13,168	13,629
151	Legal				$ 10,000	+3.5%	$	10,000	10,350	10,712	11,087	11,475	11,877	12,293	12,723	13,168	13,629
152	Industry Engagement & Memberships				$ 5,000	+3.5%	$	5,000	5,175	5,356	5,544	5,738	5,938	6,146	6,361	6,584	6,814
153			**Total Other Expenses**				$	**161,000**	**166,635**	**172,467**	**178,504**	**184,751**	**191,217**	**197,910**	**204,837**	**212,006**	**219,426**
154	**GST Adjustment**																
155	GST Received with Income (outgoing)		*(No GST charged on Sales)*				$	36	36	36	36	36	36	36	36	36	36
156	GST Paid with Expenses (incoming)		*(GST credits received)*				$	154,239	121,034	130,568	142,001	174,097	173,094	194,597	233,423	256,813	302,099
157			**GST Net Effect**				$	**-154,202**	**-120,997**	**-130,532**	**-141,965**	**-174,060**	**-173,058**	**-194,561**	**-233,386**	**-256,776**	**-302,063**
158			**TOTAL EXPENDITURE**				$	**2,214,172**	**2,628,327**	**2,934,919**	**3,292,914**	**3,733,341**	**4,230,151**	**4,821,120**	**5,529,059**	**6,383,442**	**7,422,600**
159	**NET PROFIT before Interest and Tax**						$	**15,815**	**- 75,649**	**- 143**	**97,125**	**202,753**	**365,535**	**577,219**	**853,541**	**1,215,616**	**1,691,825**
160	Less		Interest Payments					-54,000	-50,345	-46,252	-41,668	-36,533	-30,783	-24,342	-17,128	-9,049	0
161	**NET PROFIT before Tax**							**- 38,185**	**- 125,995**	**- 46,395**	**55,457**	**166,220**	**334,752**	**552,877**	**836,413**	**1,206,567**	**1,691,825**
162						$/kg of input		-$ 0.16	-$ 0.48	-$ 0.16	$ 0.17	$ 0.46	$ 0.83	$ 1.24	$ 1.68	$ 2.18	$ 2.74
163	**CASH FLOW**																
164	**A. Operating Activity**																
165	Operating Cash Flow		Total Revenue				$	2,229,988	2,552,678	2,934,776	3,390,038	3,936,094	4,595,686	5,398,339	6,382,600	7,599,059	9,114,425
166		*less*	Total Expenditure				$	2,368,375	2,474,125	2,813,922	3,162,382	3,591,376	4,056,090	4,648,062	5,334,498	6,150,056	7,165,824
167		*add back*	Depreciation				$	46,790	46,790	46,790	46,790	66,790	66,790	66,790	66,790	66,790	66,790
168			**Operating Cash Flow**				$	**- 91,597**	**125,343**	**167,644**	**274,447**	**411,508**	**606,385**	**817,067**	**1,114,892**	**1,515,792**	**2,015,391**
169																	
170	**B. Investing Activity**		*CAPEX*	*Asset life*	*Escal'n/Yr*												
171	Building Annex (to be added)		$ 50,000	*40yrs*			$	-50,000	0	0	0	0	0	0	0	0	0
172	MAP Machine		$ 300,000	*10yrs*			$	-300,000	0	0	0	0	0	0	0	0	0
173	MAP -autofeed hopper from Yr 5			*10yrs*			$	0	0	0	0	-200,000	0	0	0	0	0
174	CUPCo Refrigerated Vehicle		$ 100,000	*7yrs*	+3.5%		$	-100,000	0	0	0	0	0	0	-127,228	0	0
175	*(assume nil salvage values)*		$ 450,000														
176			**Investing Cash Flow**					**- 450,000**	**-**	**-**	**-**	**- 200,000**	**-**	**-**	**- 127,228**	**-**	**-**
177					*Interest monthly at*												
178	**C. Financing Activity**		*Loan Amount*	*Term Years*	*Rate p.a.*												
179	Private CUPCo S'holder loan		$ 450,000	9	**+12.0%**		$										
180			Total Repayment on Term Loan				$	-81,995	-81,995	-81,995	-81,995	-81,995	-81,995	-81,995	-81,995	-81,995	
181		comprising:	Interest component				$	-54,000	-50,345	-46,252	-41,668	-36,533	-30,783	-24,342	-17,128	-9,049	
182			Principle component				$	-27,995	-31,650	-35,743	-40,327	-45,462	-51,212	-57,653	-64,867	-72,946	
183			**Financing Cash Flow**				$	**- 81,995**	**- 81,995**	**- 81,995**	**- 81,995**	**- 81,995**	**- 81,995**	**- 81,995**	**- 81,995**	**- 81,995**	**-**
184																	
185																	
186	**NET CASH FLOW** before tax							**- 623,592**	**43,348**	**85,649**	**192,452**	**129,513**	**524,390**	**735,072**	**905,669**	**1,433,798**	**2,015,391**
187																	
188	**Project Performance (after interest but before any tax payment)**							**Discount Rate pretax**		**18%**		**Net Present Value**		**$ 1,084,948**			
189												**Internal Rate of Return**		**41%**			
190																	

20. APPENDIX 8: HARVEST STRATEGY FOR THE LAKES AND COORONG FISHERY FOR PIPI

Pipi Fishery Working Group Draft Terms of Reference

1. Background

A working group has been established by Primary Industries and Regions South Australia (PIRSA) Fisheries and Aquaculture to work collaboratively in the development of a new harvest strategy for the Pipi fishery. Both industry associations, the Goolwa Pipi Harvester's Association (GPHA) and the Southern Fishermen's Association (SFA), as well as PIRSA have identified a need for a revised formal harvest strategy with defined objectives, performance indicators, reference points and decision rules for the Pipi fishery.

2. Membership

Membership of the Working Group comprises:

Independent Chair

- Richard Stevens

PIRSA

- Sean Sloan
- Alice Fistr
- Mark Spencer/James Bennett

SARDI

- Dr Greg Ferguson

Industry

- Roger Edwards
- Neil MacDonald

Other persons may be invited to attend the meetings at the request of the Chairperson to provide advice and assistance where necessary.

3. Roles and Responsibilities

Primary responsibilities of the working group are to develop recommendations for consideration by the Executive Director of PIRSA Fisheries and Aquaculture on:

- A harvest strategy for the Pipi fishery that provides clear guidance in recommending an annual TACC for the 2012/13 season and beyond;
- An appropriate timeframe for the setting of TACC;

In addition to this the working group will be asked to:

- Review the objectives, performance indicators, reference points and decision rules for the Pipi fishery;
- Review current seasonal arrangements in place in the Pipi fishery;

The working group will provide advice to PIRSA Fisheries and Aquaculture on the development of a harvest strategy which is to be implemented in the 2012/13 season, noting that:

- Development of the harvest strategy must engage the wider industry via the representatives from the two industry associations;
- The working group will work collaboratively in the development of the harvest strategy

In addressing the terms of reference, the working group will take account of the objectives of the Fisheries Management Act 2007 as well as the following criteria:

- Ecologically sustainable development of the Pipi resource;
- Business certainty and viability;
- Profitability of licence holders

The working group members have been chosen for their skills, knowledge and expertise in the fishery, rather than advocating their personal views or views of any interest group. As such, members are required to act in the best interests of the fishery and to participate in discussions and offer advice in an objective and impartial manner.

The working group members should be prepared to negotiate outcomes that are consistent with the principles of biological and economic sustainability and, as much as possible, reach a consensus on these outcomes. They should also commit to progressing issues and achieving outcomes, not postponing them unnecessarily.

Membership of the working group provides for collaboration between industry, PIRSA and SARDI for developing an effective harvest strategy that assists with the rebuilding of the fishery in terms of biological and economic sustainability.

4. Timeframes

The working group will have an initial meeting in December 2011 to consider these Terms of Reference and other relevant documentation with the view of ensuring that all members have a clear understanding of:

- The scope and purpose of the review;
- The steps required and their timeframes for development and implementation of the harvest strategy

The working group is expected to provide a report to the Executive Director of PIRSA Fisheries and Aquaculture with recommendations for the development of the Pipi harvest strategy by 31 May 2012 for implementation in the 2012/13 Pipi season.

5. Meeting Arrangements

There is no meeting schedule at this stage for the working group

Where practicable, Mr Spencer will forward the agenda, together with documents that relate to the working group, to members no longer than five days prior to meetings.

Mr Spencer will record outcomes of each meeting and, subject to the Chair's approval, forward these no longer than five working days after the meeting to Mr Edwards and Mr MacDonald, Executive Officers for the Lakes and Coorong Fishery, for circulation to industry (working group members and other licence holders).

Harvest Strategy for the Lakes and Coorong Fishery for pipi

Primary Industries and Regions South Australia

Fisheries and Aquaculture

2012

15.1 Overview Statement

The purpose of the harvest strategy is to ensure that the pipi fishery is fished on a sustainable basis in accordance with the objects of the *Fisheries Management Act 2007*. This harvest strategy for the pipi fishery has been developed using the best available information, during a period of stock rebuilding following a period of stock decline. As such, this harvest strategy will be reviewed in three years time.

Pipi, *Donax deltoides*, are bivalve molluscs occurring along the south coast of Australia from Eyre Peninsula to Kingston in South Australia (King 1976; King 1985). Pipi prefer high energy surf beaches where they filter feed from the water column and the Coorong beaches provide high quality habitat (McLachlan and Hesp 1984). The population in the Coorong probably represents the largest single stock abundance of this species in Australia (King 1976).

Pipi are generally referred to as 'dribble spawners' however, in South Australia, the peak spawning period for pipi occurs in September-October of each year (King 1976; 1985). Large natural fluctuations in abundance are a feature of pipi populations worldwide and appear to be characteristic of the South Australian population (Coe 1955; King 1976; McLachlan et al. 1996; Murray-Jones 1999). Fluctuations may be driven by environmental factors such as wind, or associated hydrological conditions, during the larval phase (King 1976; 1985). While smaller freshwater flows are through to be beneficial to pipi spawning by providing nutrients, periods of high river discharge may be potential causes of widespread mortalities (King 1985; Saenger and Keyte 1990; Murray-Jones and Johnson 2003). Growth of pipi is rapid during the first 15 months of life. The size at which 50% of pipi from the Coorong were sexually mature is 36 mm, which occurred at approximately 13 months of age (King 1976; 1985).

The pipi fishery developed from primarily supplying the bait market to increasingly targeting live product for the human consumption market. This resulted in a shift to targeting larger pipi for the human consumption market and a demand for improved quality of product to meet statutory requirements under the national Food Safety Standards (FSANZ).

The pipi fishery increased to a peak of 1,250 tonnes in 2002/03, with annual catches remaining stable for five years before declining steeply. Catch per unit effort (CPUE) declined from 1996/97. An individual transferable quota management system was introduced for the 2007/2008 fishing season and constrained catch for the first time in the 2009/10 fishing season. Targeting of larger sized pipi for the human consumption

market resulted in a degree of uncertainty around CPUE as an index of relative abundance. Consequently, development of a new index of relative biomass using fishery-independent sampling began in 2007/08 and has been applied since.

To meet demands for improved management decision making, techniques for assessment of pipi stock status continue to be developed, including a method which aims to provide an index of relative biomass of pre-recruits. It is intended that a new indicator based on an index of relative biomass of pre-recruits will replace the current indicator that is based on length-frequency distributions (presence/absence of pre-recruits). Data from fishery-independent surveys will be reviewed after three years to develop an index of relative biomass of pre-recruits and to determine whether it should be integrated into this harvest strategy.

The economic component of this harvest strategy requires development over time which will need some financial investment from industry. Ongoing review of economic performance of the fishery will be required, especially in the early stages of its development.

PIRSA will manage this harvest strategy, in consultation with industry, in the absence of a formal committee process. The development of a formal management committee for pipis may be considered in the future.

15.2 Framework for annual decision-making process

This harvest strategy provides a structured framework for decision making that pursues the ecologically sustainable development objectives of the Fisheries Management Act 2007. This decision making framework involves three main steps and will be undertaken each year prior to the start of the new fishing season. The primary aim of this harvest strategy is to continue to rebuild pipi stocks and ensure that the pipi resource is harvested within ecologically sustainable limits, in accordance with the objectives set out in the strategy.

Step 1 uses biological performance indicators to assess the current status of the pipi fishery.

Step 2 uses fishery economic performance indicators and market price estimates to analyse economic returns over a range of sustainable TACC levels and includes an opportunity for industry to provide structured and direct input on the impacts of external factors on expected future prices over a range of TACCs.

It should be noted that use of economic returns in decision making is new and untested in the pipi fishery and therefore will be subject to annual review for at least 3 years until use of economic measures is accepted as adding value to the management of the fishery and to the industry.

Step 3 uses reference points and decision rules to guide the TACC setting process to ensure the pipi resource is harvested within ecologically sustainable limits and also to maximise economic returns from the fishery within those limits.

The decision rules used in this framework are based on results from fishery-independent sampling; they state that a specific response will be triggered in terms of TACC adjustment based on fishery performance. In addition, the rules utilise estimates of maximum economic return to potentially further modify the TACC.

The resulting TACC that meets the decision rules will then be recommended to the Minister (or delegate) for the upcoming season by PIRSA Fisheries and Aquaculture. The Minister (or delegate) has responsibility for determining the value of a quota unit on an annual basis and setting the TACC under the Fisheries Management (Lakes and Coorong Fishery) Regulations 2009.

15.3 Objectives

The harvest strategy has the following objectives:

1. Maintain a target pipi relative biomass above 10 kg/4.5 m² and not less than 8 kg/4.5 m²;
2. Ensuring that the pipi relative biomass does not drop below 4 kg/4.5 m²;
3. Maximise Fishery Gross Margin as set out in section 1.6.1.

Note: the figure of 8 kg/4.5 m² has been chosen as it represents a conservative level of relative biomass that would allow continued rebuilding. The figure of 4 kg/4.5 m² represents a historically low level of biomass that may result in a risk of recruitment overfishing.

The harvest strategy aims to achieve these objectives via the following strategies:

1. Promote rebuilding of the stock to historically sustainable levels by setting an appropriate annual TACC;
2. Sustainability of the pipi fishery;
    a. Provide management decisions responsive to changes in relative biomass of pipi (fishery-independent catch rates) and the presence/absence of pre-recruits into the fishery,
3. Improved business certainty and viability;
    b. Implement decision rules to provide greater certainty to the annual TACC decision making process for all stakeholders,
    c. TACC is only altered in years when fishery conditions have significantly changed such as a substantial rise or fall in relative biomass (from fishery-independent surveys),
    d. Facilitate structured industry input into the decision making process
4. Profitability;
    e. TACC to be set at a level that maximises returns for the fishery within biologically sustainable limits.

15.4 Biological performance indicators

To ensure that the pipi resource is harvested within ecologically sustainable limits, performance of the fishery will be assessed annually. This assessment will be undertaken using the primary biological indicator as the main factor to influence TACC decision making, balanced against the values of the secondary indicator. The secondary indicator and additional indicators can also be used to further assess sustainability of the pipi resource at current levels of harvesting. The single primary indicator is relative biomass of adult pipi, until such time as a method for collecting a quantitative measure of pre-recruit (undersize) relative biomass has been developed. The aim is to have an additional indicator of relative biomass of pre-recruits developed and implemented in three years time.

15.4.1 Primary biological performance indicator

The primary biological performance indicator for this fishery is **fishery-independent relative biomass of legal-sized pipi** (kilograms per 4.5 m²), because it provides representative estimates of pipi stock relative biomass, and therefore overall changes

in stock size. The method for estimating fishery-independent relative biomass of legal-sized pipi is described in Ward et al (2010). Fishery-independent relative biomass has been estimated for four years. It is recognised as a reliable and well-understood measure of fishery performance.

Fishery-independent relative biomass is estimated by research fishing across the fishing ground along Younghusband Peninsula (0-60 km south-east from the Murray Mouth). Surveys are conducted at the start, middle, and end of each fishing season. Individual transects are located at permanent sites located at 2 km intervals along the 60 km fishing ground. i.e. 10 transects are located within each of three 20 km sections of beach. In each survey: (i) efficiency of individual fishers is estimated to allow variability in fisher efficiency to be measured/standardised (Day 1); (ii) variability in relative biomass within sites is estimated (Day 2); and (iii) variability in relative biomass between days is estimated (Days 1 and 3). The final fishery-independent relative biomass for a given year is calculated by combining relative biomass from each transect from (Days 1 and 3), from all of the pre, mid and post season surveys. Spatial and temporal trends in fishery-independent relative biomass are presented in the annual pre-season stock status presentation for pipi and will also be included in fishery stock assessment reports for pipi. From 2012/13, it is intended to produce estimates of fishery-independent relative biomass at quarterly intervals.

15.4.2 Secondary biological performance indicator

The secondary biological performance indicator is population size structure based on length frequencies from fishery-independent surveys. During one day of each survey, length frequency samples will be collected at 2 km intervals along Younghusband Peninsula (0-60 km south-east from Murray Mouth) using a fine mesh (10 mm) net. Data are aggregated into three 20 km sections of beach. Size-frequency distributions provide: (i) information on legal and sub-legal sized pipi; (ii) an indication of the **presence/absence of pre-recruits** to the fishery, and (iii) assist with determining whether the fishery is being exploited at a sustainable level. Trends in this indicator are summarised both spatially and temporally and presented in the annual pre-season stock status of pipi as well as in fishery stock assessment reports for pipi.

The purpose of the secondary performance indicator is to understand recruitment and provide information into future overall stock size.

15.4.3 Additional performance measures

Four additional biological performance measures will be used to assess the status of the fishery:

1. Catch vs TACC;
2. CPUE (fishery dependent);
3. Pre-recruit relative biomass index (to be developed);
4. Seasonality and spatial abundance.

However, these additional performance measures do not trigger a specific response in this harvest strategy and are not explicitly used in TACC decision-making for the fishery. Catch and commercial CPUE provide the only long-term (27 years) data available for assessing the performance of the fishery. Commercial catch and CPUE as measures of relative biomass are influenced by: (i) differences among fishers in reporting of effort, (ii) changes in fisher practices due to targeting product for new markets i.e. human consumption, and (iii) changes in fisher practices under quota management.

Methods to estimate fishery-independent relative biomass of pre-recruits are to be developed and evaluated during the 2012/13 and subsequent pipi fishing seasons. A time-line of relative biomass of pre-recruits will provide a more robust biological performance indicator than length frequency data alone and will allow comparisons between years.

15.5 Reference points for biological performance indicators

In this harvest strategy, reference points have been developed for the primary biological performance indicator, which is fishery-independent relative biomass of legal size pipi. These reference points provide a benchmark against which the performance of the fishery can be assessed.

15.2.1 Primary biological performance indicator

A modified ‘traffic light’ method will be used to inform the current status of the fishery relative to a target relative biomass reference range, where ‘blue’ is above the target range, ‘green’ is within the target range and ’red’ is below the target range (see Figure 1).

Target reference point

The target reference point will be reached if the average annual fishery-independent relative biomass of legal-sized pipi is greater than or equal to 10 kg/4.5 m². This will allow the fishery to be exploited at historically sustainable levels.

Limit reference point

A lower limit reference point will be breached if the average annual fishery-independent relative biomass of legal-sized pipi falls below 4 kg/4.5 m². At this level there is a significant risk of spawning stock being insufficient to ensure sustainable levels of recruitment (i.e. recruitment overfishing). Should relative biomass fall below this level, the fishery will be closed.

In the event that closure of the fishery occurs, the Minister or their delegate will determine when fishery performance is at a sufficient level for commercial fishing operations to recommence and at what level an initial TACC will be set. Fishery-independent sampling will be continued during fishery closure to determine when fishery performance meets the decision rules to reopen the fishery. By following the decision rules, a precautionary approach to setting the TACC will be taken to ensure that fishery-independent relative biomass does not fall back below the limit reference point of 4 kg/4.5 m².

However, this harvest strategy aims to avoid the average annual fishery-independent relative biomass falling below 8 kg/4.5 m² as it represents a conservative level of biomass.

15.2.2 Secondary biological performance indicator

Until a method for determining the relative biomass of pre-recruits is developed (approximately 2015) the presence/absence of pre-recruits will be used as a secondary biological performance indicator. In this harvest strategy, the presence/absence of pre-recruits will be used in TACC decision making where the primary indicator of relative biomass of legal sized pipi lies in the bottom of the ‘green’ range using the traffic light method.

If pre-recruits are present, i.e. they represent at least 30% of the overall length frequency, a decision to increase to the top level of the ‘green’ range will be considered. If pre-recruits are absent (i.e. less than 30%) a decision for the TACC to remain in the lower part of the ‘green’ range for the upcoming season will be considered.

15.2.3 Economic performance indicators

The primary economic objective of the harvest strategy is to ensure that sustainable harvest levels maximise Fishery Gross Margin (FGM) as a proxy for maximum economic yield (MEY) from the pipi resource. Measuring MEY requires sophisticated modelling tools which are cost prohibitive in this case.

FGM is considered to be an acceptable proxy given that large shifts in capital investment in the fishery are not expected in the future and changes in harvest rates over different TACC levels are expected to be marginal to the analysis.

To achieve this objective, the current and expected economic performance of the fishery will be assessed.

Primary economic performance indicator

The key economic indicator for the pipi fishery is FGM, which is the total commercial catch multiplied by the (actual or estimated) net market price averaged across all market segments, less fishery and operator costs that vary with the TACC level.

The measure will be used to assess historical performance and estimate future performance under alternative future TACC scenarios. The FGM assessment will be undertaken by an independent economic research provider and reported on annually to be considered as part of the TACC setting process.

The key variable business costs used to determine FGM include:

1. fuel, oil and grease for the boat and vehicles;
2. provisions;
3. crew payments;
4. fishing equipment, purchase and repairs;
5. repairs and maintenance (boats and vehicles).

15.2.4 Industry Input

Estimating future economic performance is imprecise and is unlikely to provide an exact answer. Measuring FGM requires interpretation and sensitivity assessments due to the influences of various external factors that cannot be predicted about the future. While estimates of volumes and costs can be made with greater certainty, future price is particularly uncertain.

The annual FGM assessment will be undertaken via an industry survey to provide factual and credible evidence to support the impacts of external factors on expected future prices over a range of TACCs in the estimation of FGM each year in the decision making process (as part of Step 2 of Part 1.7 of this harvest strategy).

The external factors to be considered by the independent economic provider include, but are not limited to:

1. Market failures;
2. fluctuations in the Australian dollar and other currencies;
3. imports;
4. aquaculture products;
5. new processing techniques;
6. impacts of marketing programs;
7. timing of harvest;
8. other factors impacting on price (logistics costs, fluctuations in supply of product from other jurisdictions);
9. fluctuations in fuel prices;
10. high-grading.

15.6 Reference points for economic performance indicators

In this harvest strategy, absolute economic reference points and targets have not been developed as it is neither sensible nor possible to specify the range of outcomes that the fishery should or should not be operated in. This is because shifts in market prices, costs, and TACCs over time mean that maximum FGM and potential FGM range are not static.

The critical economic consideration in setting the TACC, however, will involve determining a catch level that will maximise the primary economic performance indicator (FGM).

15.7 Primary economic performance indicator

This harvest strategy includes a ‘target’ reference measurement of maximising FGM. The absolute target level will change every year as prices and variable costs

inevitably change with market conditions. This has implications for TACC setting, as maximising FGM over time will require annual assessment against the biologically acceptable TACC. The use of the FGM in the decision rules may result in TACCs different to those set on purely biological grounds.

Given uncertainty about future prices, price sensitivity analysis will be undertaken by the independent economic provider through the economic analysis around expected future FGM estimates to inform the TACC setting process, in line with the decision rules.

To offer some buffer against instability associated with annual TACC changes driven by changes in FGM, and also to allow for uncertainty around future price estimates, (assuming no change in TACC is required for biological reasons), changes in TACC based on the FGM indicator will only occur if the change in TACC is expected to increase FGM by more than 1.5%. This threshold is based on what quota holders consider worthwhile and may be subject to change.

A model to measure FGM will be developed to incorporate relevant price, price elasticity of demand, variable costs, and TACC information and will be refined with industry input. To provide good data for the model, the annual FGM assessment will review a number of considerations including variable costs estimates, split in market segment between human consumption and bait, and the price-volume relationship (price sensitivity) as markets change over time.

15.8 Decision rules for setting TACC

The decision rules used in this harvest strategy have been designed to provide clear guidance to the TACC setting process by defining how estimates of fishery-independent relative biomass of legal-sized pipi, presence/absence of pre-recruits and maximising FGM for pipi should be interpreted when adjusting the TACC. These rules are structured around: (i) relative biomass; and (ii) FGM increments of 1.5% so as to avoid annual adjustments as a result of minor fluctuations in (i) relative biomass and (ii) expected economic performance.

A diagrammatic representation of the rules utilised in the harvest strategy is shown in Figure 1.

Figure 1. Decision rules table

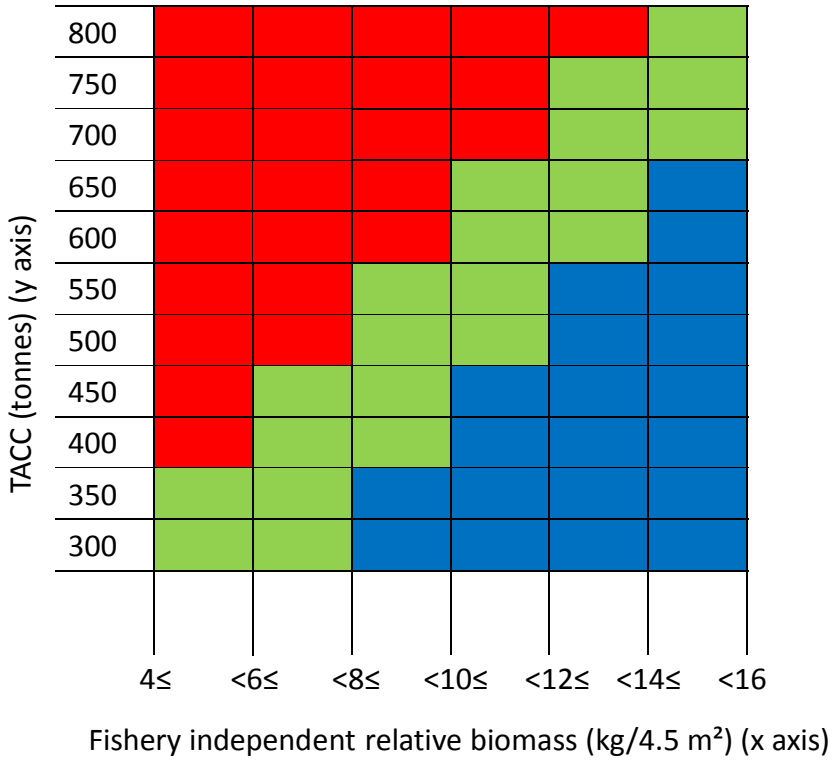


Figure 1: Fishery-independent relative biomass of legal-sized pipi from previous season (x-axis) determines the following season's maximum total allowable commercial catch (TACC) (y-axis) for the pipi fishery with incorporated economic information. The 'green' range indicates the target level of TACC given the estimate of fishery-independent relative biomass. The 'blue' range indicates that the TACC is below the target level, while the 'red' range indicates that the TACC is above the target level, given the estimate of fishery-independent relative biomass. Note: the TACC figure on the y-axis represents the maximum TACC that could be set in a given year.

Table Error! No text of specified style in document.**-1.** Decision rules for the harvest strategy for Lakes and Coorong Fishery for pipi.

Increase in TACC

TACC is raised when the following conditions are met in any given year:

By up to 50 t when the fishery-independent relative biomass (legal sized) has increased by one level on the x-axis; or

By up to 100 t when the fishery-independent relative biomass (legal sized) has increased two or more levels on the x-axis; or

By up to 50 t when the fishery-independent relative biomass (legal sized) is in the 'blue' range and you have not increased on the x-axis; **and**

Fishery Gross Margin is expected to increase by at least 1.5% with an increase in TACC.

Or By up to 50 t when the fishery-independent relative biomass (legal sized) is in the 'green' range (x-axis) and pre-recruits are present (greater than or equal to 30%); **and**

The new TACC will remain in the 'green' range; **and**

Fishery Gross Margin is expected to increase by at least 1.5% with an increase in TACC.

Note: the increases of 50 t or 100 t are considered biologically acceptable and will be recommended unless the FGM suggests that the TACC should not increase the full increment.

No change to TACC

TACC remains unadjusted when the following conditions are met in any given year:

Fishery-independent relative biomass (legal sized) is in the 'blue' or 'green' range; **and**

Fishery Gross Margin is not expected to increase by at least 1.5% from a higher TACC.

Or Fishery-independent relative biomass (legal sized) is in the 'green' range and there is an absence (less than 30%) of pre recruits;

Or Where pre-recruits are present (pre-recruits comprise greater than or equal to 30% in length frequency distribution), and the fishery-independent relative biomass (legal sized) is above the target reference point of 10 kg/4.5m², but the fishery-independent relative biomass is in the 'red' range one level away (x-axis) from the green range.

Decrease in TACC

TACC is dropped to the corresponding 'green' range immediately below when the following conditions are met in any given year:

Fishery-independent relative biomass (legal sized) is in the 'red' range and pre-recruits are not present (less than 30%);

Or Where pre-recruits are present (greater than or equal to 30%), but the fishery-independent relative biomass is below the target reference point of 10 kg/4.5m²;

Or Where pre-recruits are present (greater than or equal to 30%), but the fishery-independent relative biomass is above the target reference point of 10 kg/4.5m², and relative biomass is two or more levels away from the green range (x-axis);

Or Fishery Gross Margin is expected to increase by at least 1.5% with a decrease in TACC.

15.9 TACC decision making process and timelines

The decision making process will be undertaken each year prior to the start of the fishing season as follows: by PIRSA and includes the following steps:

1. Industry will be provided with the opportunity to receive a verbal presentation of stock status report with fishery-independent relative biomass (legal size) and pre-recruit data from the research provider and a report of maximum FGM estimates by 1 May each year. PIRSA will then convene an annual meeting of the Lakes and Coorong Pipi Fishery Working Group to consider the information on the biological and economic performance indicators and feedback from industry. The usefulness of FGM in TACC decision making will also be assessed at this meeting for the first three years;
2. PIRSA will provide recommendations to the Minister or their delegate in enough time to allow industry to be notified of the TACC at least four weeks prior to the commencement of the upcoming fishing season.

A comprehensive review of this harvest strategy will be undertaken after three years to:

1. Determine the appropriateness of performance indicators set out in the harvest strategy, how they are measured and how they are used in fishery assessments, including a review of the development of a method to measure fishery-independent relative biomass of pre-recruits;
2. Review the appropriateness of the relationship between fishery-independent relative biomass of legal-sized pipi and TACC, and review recommended TACCs;
3. Review the appropriateness of all reference points.

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