THE PROSPECTS FOR MARKETING MEATMEAL FOR INCLUSION IN INDONESIAN AQUACULTURE DIETS

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The Australian Renderers Association and Dr Kevin Williams of CSIRO Marine Research generously gave permission to use the paper presented to its 4th International Symposium on Animal Nutrition, Protein, Fats & the Environment, 24-26 September 1997 "Fishmeal Replacement in Aquaculture Diet using Rendered Protein Meals" by K C Williams, G L Allan, D M Smith and C G Barlow as Appendix 1.

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SUMMARY

1) Australia typically produces around 450,000 tonnes of meatmeal per annum.

2) The most reliable estimate of global aquafeed production is probably of 4.25 million tonnes in 1994 with projections of up to 7.5 million tonnes by 2000. Around 25% of compounded aquafeeds are consumed by prawns at around US$1,000 per tonne and 40% by carnivorous type finfish at around US$500 per tonne. Compounded feeds for carnivorous finfish and prawns contain from 50 to 70% by weight of fishery product (fishmeals and fish oils) according to Williams et al (Appendix 1).

3) World production of fishmeal in 1993 was 6.26 million tonnes and has been at best static since 1989 on account of the limitations of capture fishery capacity. It is estimated that in 1995 prawn and salmonids diets alone accounted for 697,000 tonnes. Since only 30% of fishmeal production is available for export, continued expansion of aquaculture will require alternative protein sources (Williams - Appendix 1).

4) The pressure on fishmeal supplies is reflected in current world fishmeal prices that have seen fishmeal prices rise from $960 to $1300 per tonne following the shortfall in production in Peru arising from El Nino effects (Smith - Appendix 2).

5) A price of A$1300 per tonne for 70% protein fishmeal is equivalent to A$1860 per tonne for its protein. By contrast a price of A$450 per tonne for 50% protein meatmeal is equivalent to A$900 per tonne for its protein.

6) So, with:

- the price of meatmeal protein at 50% that of fishmeal;
- global compounded aquafeed forecast to reach 7.5m tonnes by 2000;
- *Australian aquaculture research showing that meatmeal can replace 50% of fishmeal in prawn diets that normally contain 60% fishmeal; 100% of the fishmeal in Barramundi diets and 60% of the fishmeal in silver perch diets (Williams et al Appendix 1, Smith Appendix 2;*
- the good amino acid profile of meatmeal
- its excellent content of minerals, unsaturated fats and cholesterol and gelatine;

The prospects for its use in aquafeeds are excellent.

7) The 120,000 tonne per annum prawn sector of the Indonesian aquaculture industry is wholly focussed on export. Even a 20% rate of inclusion of meatmeal in the country's estimated 240,000 tonne per annum of prawn diets would demand 48,000 tonnes of meatmeal. At least several of the large prawn producers in Indonesia have major expansion plans. The total annual use of aquafeeds in Indonesia is estimated at 400,000 to 500,000 tonnes.

8) The Indonesian prawn industry has a huge profit potential given costs of production quoted at less than US$5 per kilogram and achievable factory door prices of US$8.50 to US$9.00 per kilogram.

9) Although at this stage meatmeal would be sold into Indonesia exclusively on its protein component, its reported cholesterol content of 0.1% to 0.15%, phosphorus, unsaturated fatty acids, gelatine, and possibly lecithins and other lipids are valuable constituents in aquaculture diets give 50% protein meal a present notional value of A$625+ to A$662.5+ per tonne and should substantially enhance its value in the future.

10) The first step towards realising the potential of meatmeal in aquaculture will be to raise its protein to around 55% or higher in order to maintain the protein density of compounded prawn diets (see Smith Appendix 2).

11) Apart from the need to produce 55+% protein meatmeal, its fat content is likely to impose the greatest limitation to its use in prawn diets on account of the inability of prawns to utilise the approximately 50% of its fat that is saturated. Nonetheless it is likely that 10% fat will be acceptable, at least for 30% inclusion inclusion in prawn diets. Higher fat levels may prove acceptable for meal at lower inclusion rates.

12) Since it is disastrous to feed rancid diets in aquaculture and since anti-oxidants are routinely added to fishmeals to prevent rancidity, anti-oxidants should be added to meatmeal and data should be provided to clients by renderers on the oxidative stability of their meatmeals (Smith Appendix 2).

13) Since prawn diets normally contain between 1 and 2% of phosphorus it will generally be wasteful to supply meatmeal with greater than 5% of phosphorus in meatmeal where it is to be used at 20% of diets and 3% where it is to be used at 30% of diets.

14) Renderers will need to supply greater details of their product specifications if they are to market effectively to the sophisticated aquafeeds industry. These specifications are likely to include

- protein content,

- amino acid profile,
- fat less than 11%,
- added anti-oxidant and specified oxidative stability,
- ash less than 22%,
- low moisture,
- specified phosphorus, calcium, cholesterol, pepsin digestibility, particle size and gelatine content,
- indicated lipid profile,
- whole wool and hair content of zero

15) It is strongly recommended that renderers sell their meatmeal on protein contents determined over actual production runs or load-outs. They should not sell on minimum protein contents set for stockfeed registration purposes since these are minimum figures whose use will result in renderers foregoing profit and feedmillers wasting protein.

16) Renderers might consider grinding their meatmeal for aquaculture through a 1.2mm screen, provided that they can do so without heat damage to the protein (Smith Appendix 2)

17) Although microbiological status of meatmeal was not raised as an issue during the study, it is one that could develop considering the extremely high hygiene standards maintained in Indonesian prawn processing plants. The results of microbiological testing done by renderers for other industries may prove useful in selling meatmeal for aquaculture.

18) It is emphasised that the specifications of meatmeal produced within individual rendering plants are very consistent. However there are considerable variations in specifications between rendering plants. Advantage should be taken of this in developing associations between individual Australian renderers and aquafeed millers. The specifications of most of the meatmeals produced in Australia are included in the "Directory of Australian Renderers".

19) Renderers should take advantage of the concerns of clients of aquaculture about BSE by emphasising that Australian meatmeal is BSE free. Consignments should be accompanied by certification that they are free from BSE.

20) Meatmeal containing porcine raw material should not be sold to Indonesia or other Moslem countries.

21) There is a strong onus on sellers of meatmeal to verify the credit worthiness of prospective buyers in Indonesia at present. Sellers should take account of the present encumbrances in setting up letters of credit in Indonesia, including interest rates of up to 45%. They should verify the acceptability of particular Indonesian banks issuing letters of credit to their Australian banks receiving them.

22) It is evident that the excellent prospects to market meatmeal to Indonesian aquaculture reflect global opportunities in that industry. It is therefore suggested that renderers intending to market their meatmeal to prospective aquafeeds industries should begin by selecting the country among those with large or growing aquaculture industries that they can best service and work comfortably in. Other prospective countries include Thailand, Japan, Taiwan, the Philippines, Malaysia, China, Bangladesh and India. Furthermore industrial aquaculture in several of these is longer established than that of Indonesia and there is no reason to believe the opportunities in their aquaculture industries are any less than in Indonesia's.

23) The production of 55%+ protein meatmeal will be accompanied by the production of around half of that as a high ash meal equivalent to "blood & bone" for which the best marketing prospect appears to be as a fortified "blood & bone" fertiliser.

24) The "Directory of Australian Renderers" was perceived by Indonesian industry as extremely valuable and it is recommended that it be upgraded to include fuller details of the specifications of meatmeal produced by individual renderers and that an information article explaining the value and virtues of meatmeal be included in it.

25) Eight major recommendations are made to Australian renderers in connection with the marketing of their meatmeal for aquafeeds with respect to:

- 55+% protein, low ash and low fat meatmeal for aquaculture,
- Developing high ash fraction meatmeal a fertiliser,
- Exploiting the "BSE free" status of Australian meatmeal,
- Dependence of the ultimate price for meatmeal on its overall constituents and their specification.
- The benefits of supplying the fullest possible details of meatmeal specifications to the "Directory of Australian Renderers",

- The possible development of other meals,
- Analyses of the protein content of meals by Kjeldahl digestion.
- New standards for 'fortified' blood and bone meals.

26) A five stage approach to marketing meatmeal to feedmillers in aquaculture countries is proposed to renderers.

27) Although meatmeal is hugely undervalued considering that:

- its protein sells at only half that of fishmeal protein;
- fishmeal supplies are under enormous and increasing pressure;
- aquaculture is expanding at a ferocious rate;
- worldwide the other consumers of fishmeal, the pig and poultry industries are expanding as well;
- meatmeal contains other substances besides protein that are valuable in aquaculture diets, such as up to A$112.5 of cholesterol per tonne; available phosphorous; around 50% of unsaturated fat; and gelatine;

renderers can still only expect to draw the next bid from prospective aquaculture customers at the beginning. Price increases beyond that will depend on upon increasing demand and client satisfaction. It needs to be recognised that renderers are selling into an international marketplace in competition with other meatmeal suppliers when they supply to aquaculture clients. At this stage of meatmeal protein being grossly undervalued in comparison with both fishmeal and soybean meal, detailed specification data will serve to arouse the interest of prospective buyers and provide an edge over competitors. As demand drives prices up towards real values then specifications that show quantitative benefits of one meatmeal against another, or against a competing protein will become more crucial. *It is recommended that renderers bear in mind the ultimate real value of meatmeal and its constituents for aquaculture while having to accept merely 'next highest bid' for their product as they develop associations with clients until the demand for it is fully developed.*

SUMMARY OF RECOMMENDATIONS TO THE RENDERING INDUSTRY

1. It is recommended that the rendering industry aim to produce meatmeals for aquaculture of 55% or more protein, less than 4% phosphorus with 10% or less fat.

2. It is recommended that renderers use the "BSE free" status of Australian meatmeals as a marketing feature and arrange appropriate "BSE free" as a routine procedure on all meatmeal exported for use in aquaculture.

3. It is recommended that renderers bear in mind the ultimate real value of meatmeal and its constituents for aquaculture while having to accept merely 'next highest bid' for their product as they develop associations with clients until the demand for it is fully developed.

4. It is recommended that renderers sell their meal on the actual protein contents of production runs or consignments.

5. That the Australian Renderers Association addresses the issues of standards for the addition of anti-oxidants and for the assessment of oxidative stability of meatmeal.

6. It is recommended that renderers and abattoirs consider the prospects for production of specialty substances in the context of their individual production systems. In particular the use of bile for cholesterol production seems encouraging.

7. It is recommended that renderers check with their laboratories that they are continuing their Kjeldahl digestions for 2 hours after the clearing stage when analysing for protein in meatmeal using that method of analysis.

8. It is recommended that the ARA develop and publicise new standards or codes for fortified "blood & bone" products as matters of urgency.

INTRODUCTION

The Meat Research Corporation has recently funded successful research work by the CSIRO Marine Laboratories on prawns, New South Wales Fisheries on Silver Perch and Queensland Department of Primary Industries on Barramundi aimed at replacing all or part of the fishmeal component of their diets with meatmeal. Prawn and fish diets comprise 30% to 70% fishmeal. The research has shown that meatmeal can form up to 40% of prawn diets, 30% of Silver Perch diets and can replace 100% of the fishmeal in Barramundi diets (Williams et al Appendix 1). Although meatmeal generally contains only around 80% of the protein of fishmeal, the price of its protein is generally only 50% that of fishmeal protein. Besides protein, meatmeal generally contains around 0.1 to 0.15% cholesterol (an ingredient in prawn diets up to 0.5% that costs around $75 per kg in pure form), 4% available phosphorus, gelatine and 10% fat.

Consequently the use of meatmeal to replace fishmeal in aquaculture diets offers a substantial saving in the cost of aquaculture feeds at present prices and as demand grows in that quarter, improved prices to renderers.

According to Williams and others (Appendix 1) world aquaculture has been growing at 10% per annum since 1984. The production in 1995 was worth US$42.3 billion. Compounded aquafeed production in 1994 was estimated at 4.25 million tonnes and by the year 2000 is estimated to be up to 7.5 million tonnes valued at US$1,000 per tonne for prawn feed and US$500 per tonne for fish feed. Carnivorous fish consume around 40% of the compounded aquafeeds and prawns 25%.

An appraisal of global aquaculture production and its unit values highlighted Japan, Indonesia, Malaysia, the Philippines, Taiwan and Thailand; followed by Bangladesh, India and China as the best likely countries in which to market Australian meatmeal for aquaculture. It is notable that the largest aquaculture producers, China and India did not produce high value products in 1993 (Table 1). It is presumed that this is because the aquaculture in these countries, as in Bangladesh was primarily conducted by numerous very small producers aiming at quantity of production rather than its quality. It is also presumed that much of the feeds in these countries would be prepared on very small scales rather than by feedmills.

Countries producing low value aquaculture products are unlikely prospective importers of meatmeal. On the other hand aquaculture industries can change rapidly and it is reported that Bangladesh for example is now a significant prawn producing country.

This is complemented by the data in Table 2 which displays the imports and production of fishmeal by country for 1993 (a long time ago in the rapidly expanding aquaculture industries).

Table 1 . Showing FAO data on 1993 aquaculture production and value in a selection of countries.

Country	Production (tonnes)	Value per kilogram (US$)
Bangladesh	267,816	1.58
China	19,185,135	1.47
India	1,438,915	1.28
Indonesia	592,081	3.29
Japan	838,032	4.56
Norway	172,271	4.44
Philippines	391,703	2.72
Taiwan	276,843	4.07
Thailand	414,259	3.57
United States of America	430,596	3.98
Vietnam	192,000	2.59

Japan, Thailand, Philippines, Norway among the large fishmeal producers are the ones with substantial aquaculture industries. The world's largest fishmeal producers in 1993, Peru and Chile, had no significant aquaculture production whatever. It is difficult to imagine that this state of affairs will persist given the quality of the marine environments in those two countries and the potential that aquaculture offers to add value to fishmeal. The development of large aquaculture industries in those two countries would place heavy supply pressures on the aquaculture industries of other countries and could be predicted to increase their interest and preparedness to substitute meatmeal.

It is also noteworthy that aquaculture used only around 1.1 million tonnes of global fishmeal production in 1995 or around 30% of the production available for export. The balance is used in stockfeed for animal industries that also expanded by 2.8% per annum in the period 1984 to 1995 (Williams et al Appendix 1).

The production and present export of meatmeal in Australia are characterised in Tables 3 to 5. The annual and monthly variations reflect the variations in the slaughter of livestock from month to month and from year to year.

Table 2 Showing 1993 fishmeal imports and their prices a well as production by main countries (but excluding Taiwan). Source FAO.

Country	Imports (tonnes)	Price (US$)	Production (tonnes)
China	639,547	547	
Japan	337,054	624	633,168
Germany	259,088	479	
UK	243,971	529	
Netherlands	113,154	536	
Italy	107,857	586	
France	88,298	589	
Iran	84,400	482	
Philippines	72,305	570	
USA	71,203	538	334,537
Thailand	66,911	734	280,000
Indonesia	62,448	625	
Norway	51,905	707	266,400
Belgium	46,121	312	
Denmark	44,801	628	359,613
Canada	34,764	546	54,400
Sweden	33,917	594	
Finland	33,052	579	
Korea	32,539	771	
Yugoslavia	31,270	547	
Hungary	31,078	582	
Australia	30,347	430	
Mexico	27,022	662	
South Africa			55,000
Russian Fedn.			266,444
Iceland			173,560
Peru			1,369,000
Chile			1,263,866

It can be seen from Table 5 that meatmeal exports from Australia have generally been around 30% of production and that they have been at low prices. This indicates that export has been the means to dispose of domestic surpluses. The generally poor domestic prices for meatmeal, considering its protein, phosphorus, trace mineral and

fat contents indicate that it has been poorly marketed, appreciated and/or oversupplied to the domestic market.

Table 3 Showing annual Australian meatmeal production (Tonnes) from 1980/81 to 1993/94 (From Australian Bureau of Statistics).

	Meatmeal* (tonnes)
1980/81	372,537
1981/82	344,722
1982/83	384,044
1983/84	322,198
1984/85	341,555
1985/86	372,098
1986/87	402,342
1987/88	417,744
1988/89	386,849
1989/90	466,871
1990/91	480,718
1991/92	479,973
1992/93	468,397
1993/94	453,536
1994/95	**

* Note: 1980/81 - 1988/89 Meatmeal production includes poultry offal and feather meal and excludes bloodmeal. 1989/90 - 1991/92 includes liver and fishmeal.
** Meatmeal production figures are not available after October 1994.
Source: Australian Bureau of Statistics Catalogue No 8359.

Indonesia was selected for the first country in which to study the potential for meatmeal in aquaculture to develop a "template" for further studies in other countries. This was on account of its close Australian business and scientific ties, the youthfulness and vigour of its developing aquaculture industries, their dispersed distribution throughout the archipelago, their potential for future development and the perceived quality and receptiveness of its aquaculture scientists. It was thought that the very complexity of Indonesian aquaculture made it the most suitable country in which to initiate the marketing of meatmeal. E G Green was selected as the industry partner on account of being a significant meatmeal producer and its substantial ongoing meat trade there that allows for frequent service visits by company staff in developing a long-term meatmeal trade with an aquafeed mill(s).

Table 4 Showing the production of Australian meatmeal by month (,000 tonnes) between 1990 and 1994 (From Australian Bureau of Statistics).

	1990	1991	1992	1993	1994
January	38	36	34	34	31
February	40	39	40	36	36
March	42	40	44	43	39
April	35	40	43	41	35
May	43	45	40	40	39
June	39	38	40	43	36
July	40	40	39	39	34
August	39	37	36	37	37
September	40	39	40	41	38
October	43	44	32	41	36
November	42	41	41	41	*
December	37	37	37	39	*

Table 5 Showing exports of meatmeal and fishmeal from Australia (,000 tonnes) from 1986/87 to 1994/95. (From Australian Bureau of Statistics)

	Meat Meal ,000 tonnes	Value/tonne A$	Fish Meal ,000 tonnes	Value/tonne A$
1986/87	115	na	-	-
1987/88	221	na	-	-
1988/89	74	na	-	-
1989/90	103	na	0.002	na
1990/91	119	na	0.32	na
1991/92	138	na	0.04	na
1992/93	155	426	0.23	630
1993/94	141	442	0.37	901
1994/95	138	379	1.48	1088

Following the development of the study "template" with Indonesia it is planned to undertake similar studies in the other promising countries working with a different and appropriate industry partner in each case. The other indicated countries are Thailand, Philippines, Taiwan, Japan and Malaysia with a prospect of China and/or Bangladesh.

Mr David Smith's report on the study is APPENDICES 3 of this report.

OBJECTIVES OF THE STUDY

The objectives of the study reported on here, that was conducted between March 10th and 19th 1998, were to:

i. Assess the scale and nature of the opportunity to market meatmeal to the Indonesian aquaculture industries, specifically the prawn industry since it is wholly export focussed and produces the highest value product. From that to propose a strategy to exploit the opportunities to market Australian meatmeal to Indonesian aquaculture in the perspective of the regional opportunities.

ii. Present the findings of the Australian research on using meatmeal as a fishmeal replacement in aquaculture diets to Indonesian aquaculturists.

iii. Explore the prospects of establishing a pilot alliance to supply suitable meatmeal to an Indonesian partner.

iv. Report to the Australian rendering industry on the prospects and recommend approaches for it to market meatmeal to aquaculture industries in Indonesia and elsewhere.

v. Establish from this study a template that can be followed to assess and exploit the corresponding opportunities in the aquaculture industries of other countries including Thailand, Malaysia, the Philippines, Taiwan, Japan and perhaps others such as Bangladesh or India.

THE STUDY GROUP

The study group comprised:

- Mr. David Smith of the CSIRO Marine Laboratories at Cleveland, Queensland.
- Mr Garry Minton, Chief Executive of E G Green & Sons Pty Ltd of Harvey, Western Australia.
- Mr Denis Roberts of Venturetech Pty Ltd of Perth, Western Australia who is the Technical Coordinator of the Meat Research Corporation's Co-products Key Program of which this study is a part.

David Smith of CSIRO Marine Laboratories was chosen because he had been responsible for the meatmeal work on prawns and could describe and discuss the results with first hand authority.

Garry Minton of Harvey By-products division of E G Green & Sons Pty Ltd, was one of the renderers who had responded to the earlier invitation to express interest in the work and was selected on the basis of his company's interest to market its meatmeal into the market, its expressed willingness to adapt and modify its meatmeal to do so and its ongoing trade in meat into Indonesia which gives it a frequent presence there. It was considered that the make up of any study required the direct participation of a significant renderer able to offer meatmeal for sale on the spot.

Denis Roberts participated on account of his position as Technical Coordinator of the Meat Research Corporation's Co-products Key Program and his knowledge of meatmeal and rendering.

STRUCTURE OF THE STUDY

Indonesia and its aquaculture industries are too large to be covered fully in the nine days of this study. The approach taken was to first undertake a thorough desk study of Indonesian aquaculture to glean as much information as possible on its scale and structure. That was not a simple task on account of various fax and telephone numbers evidently changing between being placed on lists and attempts to contact them. It was found few letters and faxes sent to Indonesia seeking information secured replies. A valuable exception was that sent to A M Djoko Sugiarto, Director of Planning, Direktorat Jenderal Perikan whose reply forms Appendix 3.

The Trade Attache at the Embassy of the Republic of Indonesia was helpful in terms of names and addresses of industry organisations and their officials, as was the Indonesian Trade Promotion Centre/Indonesian Commercial Office in Sydney that provided the valuable list of Indonesian millers of aquafeeds and other feeds that forms Appendix 4.

A particular difficulty once a list of aquaculture operators has been secured is to determine the significance of the individuals on it. In the first place the pace of development is so rapid that yesterday's figures are out of date, even if they can be obtained. Secondly some numbers refer to potential rather than actual scale of operation and so their scales are dependent on the stages of planning and implementation at the time. Thirdly while every organisation seems to have a head office in Jakarta, that is not necessarily where the action takes place nor where decisions relevant to the use of meatmeal in diets are made, in some instances at least.

Although not having a specialist engagement in aquaculture the Western Australian Government Trade Office in Surabaya proved to be especially helpful and effective in providing names for specific aquaculture contacts (Appendix 5) and subsequently for arranging meetings.

Once the desk study was completed an itinerary was planned so that the party met with major and smaller aquaculture and aquafeed manufacturers that covered a cross section of locally owned and foreign owned operations. It was considered that locally owned feedmills would have greater autonomy and independence in varying diets to use meatmeal, although dealing with foreign owned companies could have a greater long-term impact on account of their overall scale. In most cases the Western Australian Government Trade Office then arranged meetings, contacts and contact details, hire cars, interpreter as needed, and accommodation. Appendix 6 is a list of those persons met in the course of the study who provided business cards.

The study provided the opportunity to:

- understand and appreciate the structure of the Indonesian aquafeeds milling industry;
- ways in which prawns are produced and processed in Indonesia; and
- the circumstances in which feeds containing meatmeal would produced and used.

The study primarily focussed on prawn farming since its produce is wholly exported and it is the largest segment of Indonesian aquaculture by value, and so it is relatively unaffected by the present Indonesian currency crisis.

An immediate outcome of this was an appreciation of the specifications that meatmeal will need to meet for it to achieve its full potential in Indonesian aquaculture and its likely attributes, apart from protein, that will help it achieve that potential.

INDONESIAN AQUACULTURE INDUSTRY

Size

The Indonesian archipelago comprises more than 17,000 islands stretching more or less along the equator for 5,000 kilometres with 81,000 kilometres of coastline. Consequently there are multitudinous sites suitable for aquaculture and waters uncontaminated enough for both prawn and finfish aquaculture. Although there are several massive prawn farming projects, the largest comprising 16,000 ponds, the Indonesian prawn farming industry has scarcely begun to realise its opportunities for potential production

Some of the companies spoken to have firm plans for massive expansion of their farmed prawn production. These included companies that own suitable land in the tens of thousands of hectares in area. This is understandable given costs of production of less than US$5 per kilogram; buying prices to growers for fresh unprocessed prawns of US$8.50 to US$9.00 per kg at the factory door; and prices of processed prawns of around US$14.00 per kg.

From 1990 to 1994 fishmeal imports to Indonesia increased from 52,134 tonnes to 227,213 tonnes valued at US$92,490,000, an annual increase of 58.45% over the period. Not all of that would have been for aquaculture of course.

Current Indonesian aquaculture production of prawns is estimated at around 120,000 tonnes per annum. At a food conversion ratio of 2:1 that requires 240,000 tonnes of feed of which around 60% is presently fishmeal. The total annual use of aquaculture feeds in Indonesia is estimated at 400,000 to 500,000 tonnes. A 20% inclusion rate of meatmeal would thus require 48,000 tonnes for prawn feeds alone and 80,000 tonnes or 18% of the total Australian meatmeal production for Indonesian aquaculture overall.

Structure and Position of Feedmills

The major feed mills produce feed for their own prawn farms, or those of companies with whom they are corporately affiliated, in addition to contract and freelance growers. They also produce feeds for other species such as chickens. The mills inspected were state of the art in terms of machinery and computer controls. All had their own in-house laboratories. Some of them at least, have sophisticated distribution systems and procedures for ensuring that all of their feeds are sold and used while fresh.

All of the feedmills have experience in the use of meatmeal for non-aquaculture diets and some have used small quantities of meatmeal in finfish diets. None visited

indicated that they had used it in prawn diets. In every case where Australian meatmeal had been used it had been purchased through brokers.

The large feedmills or their associated companies generally have their own prawn processing operations as well. These processing operations are constructed and operated to the highest international standards of product quality, hygiene and quality assurance and are tightly geared to meet the requirements of their most fastidious clients, the Japanese. Wastage of edible material is nil and inedible material is processed into shrimp head meal for inclusion back into prawn diets. An abundance of cheap and talented labour together with the gift of Indonesians for working in teams facilitates this.

Use of Fishmeal and potential for meatmeal

Fishmeal generally comprises around 60% of prawn diets, so even assuming conservatively a feed conversion ratio of 2:1 over the entire 120,000 tonne annual Indonesian prawn production, amounting to 240,000 tonnes of feed, 144,000 tonnes of fishmeal is consumed per annum in prawn diets. Sometimes fresh fish is added to diets by mills in place of or in addition to fishmeal.

Considering that the CSIRO research has shown that meatmeal can form up to 40% of prawn diets today's potential use of meatmeal is up to 96,000 tonnes in prawn diets alone. A realistic medium-term potential on today's production figures might be half of that or 20% inclusion, that is 48,000 tonnes per annum.

For the future it seems likely that the Indonesian prawn industry will double within around 3 years. This is especially so given the progress that the industry appears to making in the control of white spot disease in prawns. The likely rate of expansion in other aquaculture industries is less clear and the only certainty is that they will expand, particularly so in the case of high value export products such as Barramundi (Sea Bass).

Indonesian fishmeal production

There is limited local seasonal production of fishmeal and no data wa obtained on its characteristics. The 1993 figures from the United Nations Food and Agriculture Organisation do not show any production of fishmeal by Indonesia although Indonesian statistics show 1,157 tonnes of fishmeal exports in 1996.

Ordinarily it seems that the local production is completed by mid February, although in 1998 production was still under way in mid-March 1998. This was reportedly selling very cheaply at less than US$400 per tonne and was depressing the price that the industry was prepared to pay for meatmeal at that time. The effect was acknowledged to be temporary and seasonal. It is probably a short term effect as well since no explanation was given as to why domestic Indonesian fishmeal prices were so far below world prices, it could simply reflect poor marketing on the part of fishmeal producers or it could have been a tool to depress import prices.

The quality of the local meals was not determined. However considering that prawns metabolise a high proportion of their feed proteins for energy rather than for growth, the biological value of protein in prawn diets is to that extent unimportant.

In some instances mills incorporate fresh fish directly into prawn diets when it is available. This technique offers prospects to wet back meatmeal to incorporate it in the same way to gain the benefit from the binding power of gelatine contained in meatmeal.

Packaging

All of the feed ingredients seen at mills were in bags. Some were 25 kilograms and some 50 kilograms. 50 kilogram bags were acceptable for meatmeal.

SCALE OF THE OPPORTUNITY

Characteristics and properties of meatmeal

Australian meatmeals typically contain:

protein	49% to 57%,
fat	10% to 12%,
ash	22% to 32%
phosphorus	2% to 5%

Generally 98+% of the particles pass through a 2mm screen and the pepsin digestibility of the protein is between 85% and 92%.

Generally around 50% of the fat is considered to be unsaturated, but little is known of fatty acid profiles or of the nature of lipid material apart from triglyceride.

It is considered likely that Australian meatmeal contains around 0.1% to 0.15%. But data is lacking on that too.

Meatmeal contains significant, but again unknown proportions of gelatine.

Table 6 Comparing the mineral composition of 50% meatmeal with anchovy, herring & menhaden fishmeals. (Extracted from "Nutrient Requirements of Swine" published by the National Research Council.)

	Meat & bone meal		Fishmeal		
	50% protein	55% protein	anchovy 65.5%protein	herring 72% protein	menhaden 61.2% protein
Protein (%)	*50.9*	*55.6*	*65.5*	*72*	*61.2*
Ether extract (%)	9.7	8.7	4.1	8.5	9.6
Calcium (%)	9.40	8.27	3.73	2.2	5.19
Phosphorus (%)	4.58	4.10	2.43	1.67	2.88
Sodium (%)	0.73	1.15	1.10	0.59	0.41
Chloride (%)	0.74	0.91	1.00	0.99	0.55
Magnesium (%)	1.13	0.27	0.24	0.14	0.15
Potassium (%)	1.44	0.55	0.90	1.08	0.70
Sulphur (%)	0.26	0.50	0.54	0.46	0.56
Copper (mg/kg)	1.5	9.7	9.0	5.6	10.3
Iron (mg/kg)	508	441	220	114	544
Manganese (mg/kg)	12.5	9.5	9.5	4.8	37
Selenium (mg/kg)	0.25	0.40	1.36	1.95	2.15
Zinc (mg/kg)	89	80	103	125	144

The phosphorus in meatmeal at 90% and better availability is more or less equivalent to di-calcic phosphate in its availability. It contains an excellent balance of minerals for animal nutrition which is indicated in Table 6.

Table 7 Illustrating comparisons of ring dried Australian (E G Green & Sons Pty Ltd) blood meal, freeze dried foetal calf red blood cell fraction, unscreened meatmeal, meatmeal screened through a 1.7mm screen and fishmeals (The latter extracted from "Nutrient Requirements of Swine" published by the National Research Council.)

Sample (g/100g)	Blood meal	Foetal red blood cells	Unscreened meatmeal	Screened meatmeal	Anchovy	Herring	Menhad -en
Protein	*83.8*	*92*	*48.4*	*57.2*	*65.5*	*72.0*	*61.2*
Cysteine	0.09	1.13	< detectn limit	0.37	0.60	0.74	0.58
Aspartic acid	7.55	8.31	2.82	2.84			
Methionine	< detectn limit	< detectn limit	< detectn limit	<detectn limit	1.99	2.08	1.75
Threonine	4.08	3.27	1.35	1.29	2.76	2.89	2.51
Serine	4.22	6.14	1.55	1.52			
Glutamic	7.39	7.81	4.75	4.90			
Proline	2.51	2.45	3.05	3.11			
Glycine	3.26	3.54	4.97	5.70			
Alanine	3.49	3.50	1.62	1.72			
Valine	6.09	5.90	1.35	1.47	3.50	4.36	3.19
Isoleucine	0.74	0.68	1.01	0.99	3.11	3.17	2.85
Leucine	9.15	10.68	2.13	2.10	4.99	5.23	4.48
Tyrosine	2.29	1.21	0.62	0.62	2.24		
Phenylalanine	5.53	6.03	1.16	1.29	2.70	2.73	2.46
Lysine	6.79	6.54	2.02	1.94	5.02	5.64	4.74
Histidine	5.27	5.32	0.79	0.89	1.6	1.66	1.44
Arginine	3.24	4.57	2.99	2.81	3.78	4.65	3.74

While Table 7 shows that meatmeal contains less of some essential amino acids than fishmeal, part of this lower content is a dilution effect of meatmeal containing around 50% protein compared with 62% to 72% protein in the fishmeals on account of its relatively higher fat and bone content.

Advantages of meatmeal for aquaculture

The outstanding advantage of meatmeal with respect to fishmeal is that its protein costs around 50% that of fishmeal based on 70% protein fishmeal at US$860 per tonne or US$1230 per tonne for protein; and 50% meatmeal @ US$300 per tonne or US$600 per tonne of protein.

Although the amino acid profile of meatmeal is inferior to fishmeal it can still replace part of the fishmeal in some aquaculture diets when used in conjunction with fishmeal (Smith Appendix 2) on account of the generous proportions of essential amino acids in fishmeal and, especially in the case of prawns, the high proportion of protein that is used for energy.

The estimated approximately 50% unsaturated component of the fat in meatmeal is useful to marine species and it is likely that lecithins and other growth factor lipids may be present in significant amounts.

The likely 1.0% to 1.5% cholesterol content of meatmeal, reported on a very narrow survey, is a valuable growth factor in prawn diets. In fact pure cholesterol is priced at around A$75 per kilogram and is generally added to diets to 0.5%. Thus meal with 0.1% cholesterol should have an additional value in practice of A$75 per tonne.

The available phosphorus content of meatmeal is such that a diet containing 40% of a 4% phosphorus meatmeal would contain 1.6% phosphorus and would need little or no addition of di-calcic phosphate. Based on a 22% phosphorus di-calcic phosphate value of A$550 per tonne 4% phosphorus meatmeal should have an additional value of A$100 per tonne.

Meatmeal has excellent binding properties and can assist the water stability of aquaculture feeds. Binders added to aquaculture diets are either bulky as in the case of starches or expensive as in the case of synthetics. The high gelatine content of meatmeal can contribute significantly as a fully digestible low bulk binder if the feed mixing milling procedures are appropriate.

So the total notional value for aquaculture of 1 tonne of meatmeal is:

500 kg of protein @ A$900 per tonne (based on A$450 per tonne for 50% protein meatmeal)	A$450
40 kg of phosphorus A$2,500 per tonne (based on A$550 for di-calcic phosphate of 22% phosphorus)	A$100
1 to 1.5 kg of @ A$75 per kg for pure cholesterol	A$75 to A$112.5
Unsaturated fat and lipids	Value as yet undetermined
Gelatine value for binding	value as yet undetermined
Total notional value of 1 tonne of 50% protein meatmeal for aquaculture	A$625+ to A$662.5+

Table 6 shows that the mineral composition of meatmeal compares favourably with fishmeal. In particular it is superior with respect to phosphorus.

This it can be seen that "BSE free" Australian meatmeal at a price of A$450 but a value greater than A$1,300 to A$1,675 is bargain priced for aquaculture with respect to fishmeal at present prices and that from the renderer's point of view there are generous prospects for its value to increase.

Disadvantages of meatmeal for aquaculture

The price advantage of meatmeal protein being half the cost of fishmeal protein is partially offset by its lower biological value.

There are instances where protein levels below 55% in meatmeal would add too much bulk to a diet. In view of this and the fact that for the foreseeable future meatmeal is likely to be traded almost solely on its protein content, and that will include freight costs, it is logical that renderers supplying to aquaculture feed manufacturers produce a minimum 55% protein meal. This can be done either by segregation of raw materials prior to rendering or by classification of meatmeal after cooking.

The relatively high (around 10%) fat content of meatmeal with around 50% of it saturated fat is likely to set limitations to its use in some diets. This is especially the case with prawns at higher levels of inclusion - say greater than 30% or 40%.

Most users of meatmeal wrongly consider it to be a highly variable product. Meatmeal produced within an individual plant is extraordinarily consistent. However there is a wide variation in composition between plants.

- Presumably the principal reason for variations experienced in meatmeals is that users have been in the habit of procuring supplies through third parties from different renderers rather than consistently from individual renderers.
- Secondly, many renderers have registered their meals with government authorities as meeting minimum and maximum specifications - leaving safety margins against possible prosecution.
- They then sell to these same conservative specifications, with their inbuilt safety margins, rather than on analyses of composite samples taken in the course of producing the actual consignment for sale.
- Where the client then relies on the sale specification for their feed formulation there is absolutely no advantage to him from a product that is better than its specification. Neither party wins.

The solution to securing consistent meatmeal is for end users need to connect, through third parties if necessary, to individual renderers who in turn should sell on the basis of actual analyses of composite samples taking at either load-out or during production.

Although di-calcic phosphate is generally added to prawn feeds to provide 1% to 2% phosphorus, this could be exceeded by some meatmeals if used at high levels. Excess phosphorus is not merely wasted but actually contributes to pond pollution.

The pellets for prawn diets can be as small as 1.8mm diameter, and some diets may be crumbled even finer. Although aquafeed millers do mill ingredients before mixing it is like to be advantageous for renderers to mill their meals more finely than at present for aquaculture diets. Smith (Appendix 2) suggests 1.2mm if it can be achieved without undue heating. This would assist as well in making the phosphorus of bone fully available to aquaculture species over the relatively short length of their intestines.

Wool and hair are likely to interfere with pelleting as well and are of suspect digestibility. They should either be digested during the rendering process or screened out.

Porcine material

Renderers should not provide meatmeal that contains pork material to Moslem countries and might even consider a declaration that the supplied meal is free of pig material.

Desirable specifications of meatmeal

Below are specifications suggested as desirable to be met or provided to buyers of meat meal for use in aquaculture diets. None of them are mandatory. However meeting them is likely to make the meal the most attractive. For example one might still sell meal with 15% of fat, however such a high fat level would seriously limit the amount of the it that could be used.

Some of the data would be expensive to acquire and it would perhaps be most cost effective to first have discussions with prospective buyers to arrive at approximate acceptable specifications before having them done, so that they are done on truly representative meal. For example many of the specifications would change considerably if it was decided to modify a meal from 50% protein to 55% or again to 60% protein.

Protein	55% or higher
Fat	low as possible <11%
Oxidative stability	add adequate specified anti-oxidant and specify stability
Ash	<22%
Moisture	Specify, keep low to increase the protein but not low enough to scorch the tallow and protein
Microbiological status	Quote results of Standard Plate Counts and Salmonellae testing
Phosphorus	Specify
Calcium	Specify
Cholesterol	Specify
Pepsin digestibility	Specify
Particle size	<1.7mm and specify
Whole hair and wool	nil
Amino acid profile	Specify on composite sample
Gelatine content	Specify if possible (can use hydroxyproline content - 14% of gelatine)
Lipid profile	Specify if possible

BSE

Although aquaculture producers are generally relaxed about using meatmeal from the BSE point of view, many of their clients are not. Renderers should be prepared to arrange an AQIS certificate or declaration that the meal is free from BSE. The "BSE free" status of Australian meatmeals should be emphasised and used as a marketing feature.

Microbiological status

Although the microbiological status of meatmeal was not raised as an issue in Indonesia it is a matter that should be kept under consideration considering the extremely high hygiene standards maintained in Indonesian prawn processing. It is suggested that where renderers have microbiological data on their meals that they should quote it in their marketing documentation. Information both on total viable counts of microorganisms per gram and the outcomes salmonellae tests would be worth quoting.

MARKETING MEATMEAL FOR AQUACULTURE

Currency situation

The Indonesian prawn industry and much of its finfish industry is 100% export oriented with its greatest market being Japan.. Consequently in theory it is unaffected and perhaps even assisted by the depressed value of the rupiah.

There are four aspects to the present drastically depreciated state of the Indonesian rupiah:

- The first is its very low value that renders the costs of all imported goods very high.
- The second is that it continues to fluctuate widely.
- Thirdly, banks require deposits in excess of the value of the letter credit before they will issue one.
- Fourthly, Indonesian interest rates have been quoted as high as 45%
- The poor credit rating of some Indonesian banks.

So, rule one is where letters of credit are used, the exporter needs to first assure himself that the Indonesian bank proposed is in good standing with his Australian bank. Under the prevailing conditions of wild variations in the value of the Rupiah exporters might consider telegraphic transfers of funds against bills of lading. However the latter would require the importer to pay very high interest rates during the shipping period. It is a complicated scene and one on which the exporter should confer in detail with his bank, keeping in view the prospect of adding value on behalf of his client. For example with the very high Indonesian interest rates it would be realistic for the Australian exporter to bear the interest at Australian rates and simply add it to the price rather than have the client pay Indonesian rates of interest.

Protein based price with nominated components

For the present meatmeal will be valued and traded solely on its protein content and so it is realistic to adjust its price in direct proportion to its protein content. For example 50% protein meal at A$450 per tonne would have its price adjusted to A$495 if it was classified to raise its protein to 55%. It is worth bearing in mind too that the higher the protein content the less the freight cost of shipping it. Hence higher protein meal has a freight advantage. For example the protein in 55% protein meal is 10% cheaper to freight than that in 50% protein meal.

An important aspect of this is that where a high ash meal is produced as a co-product of a low ash meal, that its non-protein component is effectively free and contributes to the favourable economics of utilising it in fertiliser. For example a 35% protein high ash

meal would have a nominal value of only $315 per tonne based on protein at $900 per tonne from a price of $450 per tonne for 50% protein meal. Yet it is likely to contain 60 kg or more per tonne of fertiliser phosphorus (@ $2,000 per tonne) worth around $120 or more and so has a notional value of $435+. This product would be equivalent to very high grade blood and bone. Typical wholesale prices for 'ordinary' blood and bone are around $400 per tonne.

Consistency

While a glance through the Directory of Australian Renderers will testify to the high degree of variability between the meals produced from different rendering plants it is not often realised that *the meals produced from individual rendering plants are extremely consistent.*

It is for this reason that there is much to be gained by both renderers and their end users by developing direct links between the two. Once direct links are established it becomes valuable for the renderer to provide the client with detailed analyses of his product and for the client to have them. However where the end-user of meatmeal is sourcing product from various suppliers the natural tendency is for them to assume "fair average quality" numbers in which case the end-user will over value poorer meals and under value better ones.

Again where direct connections are established between renderer and end-user it becomes worthwhile and profitable for the renderer to adapt his meal to better suit his client. Such adaptation could include modifications to protein, ash or fat contents or fineness of grind and so on.

Many renderers register their product as stockfeed on the basis of minimum or maximum levels of constituents such as protein, fat, ash, phosphorus and so on. Consequently:

- In doing so they tend to choose safe figures that they can be sure of meeting in all circumstances.
- It would be wasteful for them to sell meatmeal for aquaculture use on that basis for two reasons:
- Firstly, they are likely to be undervaluing and under pricing their product and
- Secondly, if the end-user uses it on the "registration figures" then he will not be benefiting from the extra protein and so on either.

Ideally meatmeal would be sold for aquaculture use on an indicative protein content based on regular weekly analyses provided by the renderer with provision for the actual price to rise or fall by deviations above or below the indicated figure on analysis of a representative composite sample taken in the course of either production or loading of the consignment.

55% Protein - bulk limitation

It is desirable to produce meatmeals with high protein for aquaculture uses in the first place because:

- that is preferred by the end-users.
- Secondly, at this stage meatmeal will be bought solely on its protein content and the renderer will receive no price consideration for the non-protein portion of the meal.
- Thirdly, the higher the protein content the less the freight cost per kilogram of protein.
- Fourthly, since the buyer only pays on the basis of protein the renderer can acquire the non-protein component of meal being used for fertiliser for nothing.

Broadly there are two routes to produce high protein meatmeal. The first is to render low bone material separately. Where a continuous renderer is used the route would be to render the low bone material early in the day and the high bone material late in the day. The second route is to produce the meal normally and then to fractionate it into high and low protein fractions using a commercial classifier.

High ash meatmeal fraction

On the assumption that a 51% protein meatmeal is fractionated, for example into 57.5% high protein fraction and a 30% protein high ash fraction, a renderer proposing to market a high protein meal should have a strategy developed in advance to market *at least 25% of the original amount as a high ash fraction.*

Where the fractionation was less effective than this the quantities of high ash fraction would be correspondingly greater.

In some instances it may be possible to deal with this by blending the high ash fraction back with normal meal. In others it will be necessary to develop a new market for it. Fertiliser is the indicated outlet.

On the other hand high bone material sold as blood and bone has a wholesale value of around A$400 per tonne.

Reduced ash

Generally higher protein meals are automatically lower in ash. Prawn diets tend to contain 1 to 2% of phosphorus and 2 to 3% calcium. Amounts greater than that merely serve to take up bulk in the diet and on passing through the prawns create a pollution hazard in the pond system. Consequently a high ash content in meatmeal sold for aquaculture feed earns the renderer no price return and can actually be a nuisance to the prawn or other aquaculture farmer.

Reduced fat

Around 50% of the fat in meatmeal is saturated and saturated fat is indigestible to prawns and to some fish. In addition it has been suggested that high levels of unsaturated fat may actually be deleterious in prawn diets although the level at which that might occur is undefined.

It seems that fat at around 10% in a 55% protein meatmeal should not significantly limit its inclusion in prawn diets but that it could prove limiting at higher levels or at lower protein contents. That is not to say that meatmeal at higher fat levels could not be used at all - rather that relatively smaller proportions might be feasible (Smith Appendix 2).

It is worthwhile to remember than in a 55% protein meatmeal a 1% reduction in fat will produce a 0.55% increase in its protein level. Obviously the same applies to other non-protein constituents such as bone and moisture as well.

Anti-oxidant

Aquaculture species perform poorly on rancid diets (Smith Appendix 2) and renderers should routinely add appropriate anti-oxidants at appropriate levels with citric acid synergist where desirable to all meatmeals destined for aquaculture diets.

This is particularly important on account of the crucial role unsaturated fats play in aquaculture diets, their high concentration in such diets and the humid, moist and sunny conditions commonly surrounding aquaculture farms. Most feedmills are acutely aware of the importance of fresh prawn diets and take considerable precautions to ensure that growers only use their feed when it is fresh.

Anti oxidants are routinely added to fishmeal and since meatmeal is proposed as a partial replacement for fishmeal anti-oxidants should be routinely added to ensure its equivalence.

Milling

At least some feedmills put their ingredients through mills with 0.25mm screens. Renderers could consider putting their meal through the finest screens feasible for them as a service to clients, provided that they can do so without heat degradation. Smith (Appendix 2) suggests 1.2mm provided that it can be done without overheating.

Nonetheless, none of the feedmills visited in Indonesia raised the issue of particle size.

Desirable descriptions of meatmeal

One meatmeal is valued with respect to another for aquaculture at present solely on its protein content. However when valued in comparison with other protein sources such as fishmeal and soybean meal the value of other constituents may also be taken into consideration. Some of the incidental components of meatmeal are valuable in aquaculture diets.

For example it seems that:

- meatmeal may generally contain 0.1 to 0.15% cholesterol. This product that in Australia costs the CSIRO Marine Science Laboratories around A$75 per kilogram is added to prawn diets at up to 0.5%.
- Dicalcic phosphate costing A$550 per tonne and containing 22% phosphorus is also added to bring the phosphorus up to 1 to 2% and the phosphorus in meatmeal is approximately as available as that in dicalcic phosphate.
- Slightly less than 50% of the fat in meatmeal is unsaturated and constitutes a valuable nutrient.
- Lecithin is another valuable constituent that may be present in useful quantities.
- Finally meatmeal has a high gelatine content that can make it a useful binder in some feed production systems.

A detailed specification of as many of the characteristics of meatmeal as possible is a valuable aid to the marketing of meatmeal. In the first place it explains to the client the benefits and side benefits of using a particular renderer's product in a way that is useful to the client because he can take account of the characters specified into his overall

ration formulation and costs. That is, it is a client service. Secondly it specifies the advantages of using the meal in comparison with an alternate type of meal or the meal of a competing renderer.

Technical basis for selling

Indonesian aquaculture and its feedmilling industry operate at world's best practice levels. It is informed and efficient. Its feeds are based ruthlessly on lowest costs to achieve specified standards. Only facts and service to the client will count in its marketing.

Renderer experience in country and commitment

Although the outcomes of the Australian research showed that meatmeal can be included at up to 40% of prawn diets, it must be remembered that that was under experimental conditions and there is still a large leap in faith and a degree of courage required for Indonesian prawn farmers to use meatmeal commercially. For example a 0.5 hectare pond that contains 60 prawns per square metre weighing 32 grams at harvest will yield 9,600 kg of prawns valued at US$9 per kilogram at the factory door, amounting to $86,400. The stakes are very high.

Although the world situation with respect to protein for prawn and aquaculture feeds will ultimately demand that meatmeal be routinely used in diets, that situation is still a little way off and in the meantime the aquaculture industries will need to be induced to use meatmeal. The fact that meatmeal protein costs only half that of fishmeal will prove a powerful force. But client service will play an important role in this as well.

Client service will be greatest where the renderer takes the trouble to understand his client, his needs and concerns and his culture. This is likely to be best achieved where the renderer already has dealings in the country concerned in connection with other products such as meat and is in a position to make regular visits at reasonably short intervals.

Payment arrangements

In Indonesia in March of 1998 letters of credit can be expensive for Indonesians to arrange because Indonesian banks require deposits in excess of the amounts of letters of credit before issue. This of course ties up expensive capital that is the more expensive when interest rates of up to 45% are taken into consideration.

Then there is the issue of creditworthiness of some Indonesian banks. An exporter must verify that letters of credit from the proposed Indonesian bank will be accepted by his Australian bank. An exporter would be foolhardy not to conduct detailed discussions with his bank before agreeing to payment arrangements.

Besides the costs of letters of credit and the depreciated value of the rupiah there is the issue of fluctuations in the rate of exchange of the rupiah, particularly with respect to the US dollar. Telegraphic transfer is one solution to overcoming this difficulty, but it can leave the importer with a hefty interest bill.

While these are matters for the consideration of exporters and their banks it has been pointed out that the use of telegraphic transfers of money against bills of lading is an approach with merit.

Clearly with extraordinarily high Indonesian interest rates there may be prospects for the exporter to enter into arrangements in which the interest is paid at Australian rates and the exporter is compensated by a modest *pro rata* price increase to their mutual benefit.

In these catastrophic times for the Indonesian economy it is imperative for sellers to verify that the financial and/or credit status of prospective clients is satisfactory in the context of the payment arrangements. Money matters are primarily issues for banks to solve.

Other countries

The extreme currency crisis presently prevailing in Indonesia renders it a most difficult market in which to work for the present. That should be a short term situation. However there are other reasons to look elsewhere as well to market meatmeal for aquaculture. For example Thailand and the Philippines both have huge aquaculture industries, longer traditions of 'industrial' aquaculture than does Indonesia and both have opportunities for great expansion. Japan has a very large aquaculture industry with high value product, as does Taiwan. Bangladesh and India both have large aquaculture industries. Table 3 shows the FAO figures on aquaculture production and values for a number of these countries. Working in additional countries will develop wider marketing horizons and in the case of Thailand for example there are strong scientific ties in aquaculture. Some Australian companies have well established contacts in Japan, Taiwan and Malaysia for example from other trading activities. English is spoken throughout the Philippines. Several other countries share

Indonesia's advantages of cheap labour, suitable topography and access to suitable water, though not generally to the same degree for longer term development.

Another reason for diversifying meatmeal marketing activities among a number of countries is to avoid the spectacle of Australian companies 'getting under each other's feet' in the early stages of market development.

HIGH ASH FRACTION

Since meatmeal would be sold, at least initially, to aquaculture solely on its protein content, the value of a 40% protein high ash residual meatmeal on the basis of a 50% protein meatmeal at $450 per tonne would be $360. This would be marketable as "blood & bone" for which the wholesale price, admittedly on limited sales, is around $400 per tonne. The difference could pay the cost of the fractionation.

Blood and bone is an excellent fertiliser of high repute and recognised as such among many gardeners and horticulturists. However it contains low amounts of potassium, with which it would be logical to fortify it. For some applications it could be beneficially fortified as well with additional magnesium, calcium and trace elements. It contains practically no humus. Fortunately almost all of these constituents can be procured at less than the cost of the meal, in several cases vastly less, and yet if added to "blood & bone" they would improve its value. Furthermore all of them can be added in a way that complies with the requirements for registration of fortified blood and bone as a certified or registered organic fertiliser.

So the prospects for the production of fortified blood and bone products are excellent. Its marketing will be more difficult because "blood & bone" has not been promoted as a fertiliser and because in recent times it has been adulterated with rock phosphate in which the phosphorus content is very much less available than it is in natural "blood & bone" or in meatmeal.

RECOMMENDATIONS TO RENDERING INDUSTRY

55+% protein, low ash and low fat meatmeal

Mention has been made of the desirability of producing meatmeals of 55% or higher protein for aquaculture (Smith Appendix 3). This is in the interests of reducing the bulk of high protein aquaculture, particularly prawn diets and of competing more strongly with fishmeal which is of higher protein.

Besides, in the case of prawn diets di-calcic phosphate is normally added, but only to raise the phosphorus level to 1 to 2%. So, many meatmeals would supply an excess of phosphorus when included at high levels in prawn diets. The excess would be wasted in the first place, and in the second would be passed through the prawns and become a pollutant on the bottom of the prawn pond. This suggests that a maximum phosphorus level of around 4% would be acceptable if meatmeal was to form 30% of a prawn diet and 3.75 if it was to comprise 40% of the diet.

Fat can also be limiting because the approximately 50% of it that is saturated is not only useless to prawns and some other aquaculture species but can have deleterious effects on the creatures as well. While the level at which fat becomes a problem is uncertain it appears that even 10% may limit its inclusion in prawn diets to some extent.

It is recommended that the rendering industry aim to produce meatmeals for aquaculture of 55% or more protein, less than 4% phosphorus with 10% or less fat.

High ash fraction "blood & bone" fertilisers

Depending upon the efficiency of the fractionation or separation systems that the rendering industry might use in producing high protein meatmeals there will be a greater or lesser collateral production of high ash "blood & bone" meal. Indicatively this is likely to be around half of the high protein meal.

So, the production of 100,000 tonnes of high protein meatmeal is likely to be accompanied by the production of 50,000 tonnes of high ash "blood & bone". Assuming that this was fortified by the addition of 20% of its weight of minerals, it would amount to 60,000 tonnes or around 50% of the present use of organic fertilisers throughout Australia.

Marketing this is a major task in which there is a role for all industry players, including the Australian Renderers Association and the MRC. One of the most important tasks for the ARA is to develop standards or codes of practice for the production and

composition of high performance "blood & bone" fertilisers. It is an invaluable service that the ARA could perform for its industry and the matter is pressing.

The development of high performance "blood & bone" products is most important, but relatively straightforward. The second major and more difficult task for the ARA is in publicising and promoting its "code of practice" "blood and bones".

The third task is to play a role in coordinating that publicity with other bodies such as its own members and MRC.

It is recommended that the ARA develop and publicise new standards or codes for fortified "blood & bone" products as matters of urgency.

BSE Free Status

On several occasions during the study it was emphasised that it would be advantageous to sales of meatmeal into Indonesian aquaculture to have certification from AQIS as the relevant Australian government body that meatmeal is free of BSE. It was explained by the operator that this to satisfy customer concerns rather than their own.

It is recommended that renderers exploit the "BE free" status of Australian meatmeal in the marketing and arrange appropriate certification on the BSE free status of its meatmeals as a routine procedure on all meatmeal exported for use in aquaculture.

"Next bid" effect & specifications

Although meatmeal is hugely undervalued considering that:

- its protein sells at only half that of fishmeal protein;
- fishmeal supplies are under enormous and increasing pressure;
- aquaculture is expanding at a ferocious rate;
- worldwide the other consumers of fishmeal, the pig and poultry industries are expanding as well;
- meatmeal contains other valuable substances in aquaculture diets besides protein, such as up to A$112.5 of cholesterol per tonne, available phosphorous and 50% of unsaturated fat;

renderers can still only expect to draw the "next bid" from prospective aquaculture customers who will purchase at prevailing market prices. Price increases beyond that

will depend on upon increasing demand and client satisfaction. Finally it needs to be recognised that renderers are selling into an international marketplace in competition with other meatmeal suppliers when they supply to aquaculture clients.

At this stage of meatmeal protein being grossly undervalued in comparison with both fishmeal and soybean meal, detailed specification data will serve to arouse the interest of prospective buyers and provide an edge over competitors. However as demand drives prices up towards real values then specifications that show quantitative benefits of one meatmeal against another, or against a competing protein will become more crucial.

It is recommended that renderers bear in mind the ultimate real value of meatmeal and its constituents for aquaculture while having to accept merely 'next highest bid' for their product as they develop associations with clients until the demand for it is fully developed.

Directory of Renderers - maximum specifications

The copies of the "Directory of Australian Renderers" that were given to the contacts made in Indonesia were extremely well received. There can be no reservations about the value of the publication in assisting meatmeal buyers to overcome quality and specification variability in the meatmeal they purchase and its potential to be a beginning to ongoing associations between individual renderers and particular aquaculture feedmillers.

The "Directory of Australian Renderers" is about to be updated. In the course of this it will be valuable for renderers to submit as much information as they have on the specifications of their meal. They have nothing to lose and everything to gain from doing so. Information on the capacity of their plants (which is different from actual production) is useful to prospective meatmeal buyers as well since it provides them with an indication of the renderer's capacity to supply and can save both parties time in negotiating sales volumes beyond the capacity of some plants to supply.

An important issue arises from some of the information provided in the "Directory of Australian Renderers" evidently being the same as that provided for purposes of registration of individual meatmeals as stockfeeds and so are minimal or maximum levels of some specifications. Selling meatmeal on this basis is likely to lead to lower prices than would be earned if actual specifications are used. Meatmeal at this stage is bought and paid for solely on its protein content. It is suggested to exporters who may be short of analytical data on their meal that they quote their meal on the basis of

indicated protein and the price be adjusted for actual protein analyses on a composite sample collected during production or loading of the consignment.

It is recommended that renderers sell their meal on the actual protein contents of production runs or consignments.

Rancidity

The feeding of a rancid diet in an aquaculture is disastrous. Anti-oxidants are routinely added to fishmeals to prevent rancidity. If meatmeal is to compete with fishmeal it is essential that anti-oxidants be added to them as well.

Along with this renderers should be able to provide data to clients on the oxidative stability of their meatmeals.

That the Australian Renderers Association addresses the issues of standards for the addition of anti-oxidants and for the assessment of oxidative stability of meatmeal sold for use in aquaculture.

Other meals

Considering that pure cholesterol costs around $75 per kilogram and that boiled lamb brain contains 2.2% cholesterol, boiled lamb brains should have a value of A$1.65 per kilogram for aquaculture. Nervous tissue in general may have a similar value, although levels in beef brains and in spinal cords is unknown. Renderers and abattoirs could do well to consider means of utilising nervous tissue in aquaculture diets.

It is reported that one New Zealand company is producing cholesterol for aquaculture from gall.

There are other prospective valuable substances in nervous tissue as well such a lecithins.

It is possible that other tissues and offals may have useful levels of growth factors and it is suggested that renderers give consideration to assessing them for the production of specialty meals.

It is recommended that renderers and abattoirs consider the prospects for production of specialty substances in the context of their individual

production systems. In particular the use of bile for cholesterol production seems encouraging.

Kjeldahl digestion

Since meatmeal is bought on its protein content it is important that it be analysed accurately. If protein is to be accurately measured by Kjeldahl digestion it is essential that the digestion be continued for 2 hours after the digest clears rather than for the 45 minutes for which it is normally continued when protein is measured in non-meat sources. If the procedure is not followed it is likely that the analysis will underestimate protein by around 3%.

On the basis of 50% protein meatmeal selling at $450 per tonne that would amount to forfeiting $27 per tonne.

It is recommended that renderers check with their laboratories that they are continuing their Kjeldahl digestions for 2 hours after the clearing stage when analysing for protein in meatmeal.

SUGGESTED APPROACH TO MARKETING MEATMEAL FOR USE IN AQUACULTURE DIETS

Stage 1. Select the prospective partner(s)

The first step is for the renderer to produce large sample size of a meatmeal whose production he can sustain with a protein level comfortably higher than 50%, fat around 10% or less and 4% or less of phosphorus. In doing this he should take account of the quantity of collateral production of high ash fraction meal that will result.

The next is to obtain laboratory data on it that specify as far as possible its:

Protein content
Pepsin digestibility
Amino acid profile
Moisture content
Fat content
Lipid profile
Ash content
Phosphorus content
Calcium content
Cholesterol content
Particle size
Gelatine or hydroxyproline content
Standard plate counts
Salmonella status

Note that this testing will be expensive and should not be undertaken until the renderer has assured himself that the meal being tested is very close to what it is intended to sell.

The target should be selected. The logical place to begin is with the list of feedmillers in Appendix 4. It can be seen that the list includes mills producing animal, fish, shrimp and bird feeds. The number of categories in which feedmills are listed can be regarded as an indication of their degree of specialisation and perhaps of their size. The size of feedmill is an important issue with respect to the size of the renderer. For example it is doubtful if a large feedmill would be interested in developing a relationship with a very small renderer. On the other hand a larger renderer would need to decide if it was better to be the major meatmeal supplier to a single mill or a minor supplier to several mills.

So, indicating the quantities of meal that are likely to be available each month and quoting the successful outcomes of the Australian research indicating that meatmeal can

replace substantial proportions of fishmeals in aquaculture diets, the next step is to make fax contact with all of the targeted prospective aquafeed millers and invite them to express interest in meeting on their home turf during the period when it is proposed to visit Indonesia. *It is recommended that such visits not be made during the Moslem fasting month of Ramadan that begins on 20 December in 1998, or the week following.*

A valuable addition to the above data will be data indicating the consistency of specifications of the plant's meatmeal. Even though it may not be of the same specific grade as the higher protein meal that it may be planned to trade, the regular analytical and microbiological reports on past production can be quoted as indicators of consistent specifications. *Consistent product will be of great value to most feedmillers.*

Apart from Appendix 4 contact details can be got from other reports similar to this, from the Australian or state trade offices, from the feedmillers association, or the aquaculture associations in Indonesia.

In the event that renderers choose to exploit the opportunities in other countries, they should find the same approach valid. Most foreign embassies have trade attaches and many of them, such as Thailand operate Australian trade offices as well.

Stage 2 Selection of the client(s)

This primarily involves a personal visit that should be conducted by the person in the organisation who would authorise any modifications to the meatmeal or its production that may become desirable in the light of discussions with the prospective clients. He should be accompanied by a technically up to date production manager/supervisor who should be the person directly responsible for making them. This is because:

- In the first place the head of the prospective importer will expect to a suitably senior representative of his prospective supplier and important decisions may need to be taken on the spot.
- Secondly, the technically up to date production person will be aware of the practicality of changes that may be considered and be better able to identify profitable or desirable changes that could be made.
- Finally, two heads are always better than one in negotiations, particularly when negotiating with more than one opposite number.

Above all the senior person must be in a position to quote CIF prices, quantities and deliveries and to specify terms of payment on the spot.

A full file of technical data, including analytical reports on the renderer's meatmeal should be taken on this visit. In addition it will be helpful to take Dr Kevin Williams' paper on "Fishmeal Replacement in Aquaculture Diets using Rendered Protein Meals" (Appendix 1) to the 1997 Melbourne Renderers' Symposium and other data from Appendices 2, 3, 4, 5 and 6.

An important objective of this process is to identify companies that the Australian renderer will feel comfortable and confident in developing an ongoing trading relationship with as well as those with whom it would be good business to deal with. Mutual confidence and trust or at least understanding are essential if a long term association is to be developed.

A further important objective is to develop the fullest possible understanding of the needs and position of the prospective clients, because it is in these details that the renderer is most likely to identify the alterations that he can most readily make so as to his product more valuable to the prospective client or other opportunities to improve business between them. It is in this regard that the renderer might even consider having a third technical person present.

The ideal client will be one with at least an interest in understanding and appreciating the renderer's situation as well.

A trap that needs to be avoided in this phase is that of limiting the study of prospective clients to names provided by third parties because these can be restrictive on account of the third party's circle of contacts or restrictive by design. The objective is to select the best possible trading partner and that will require meeting all or nearly all the respondents to the initial round of faxes.

In all of this it needs to be clearly understood by both parties that commercial realities will always prevail. The prospective client cannot expect the supplier to sell against the market and the renderer cannot expect the feedmiller to buy against the market since the first essential is that they both stay in business.

Finally, verify the prospective client's financial standing for creditworthiness.

Stage 3 High ash meatmeal outlet

The renderer should identify a profitable outlet for the high ash meatmeal fraction. If his operation is a large one he may be able to deal with it by blending it back into his

normal production. Failing that, the best prospects are likely to be found in fertilisers as discussed earlier.

Stage 4 First consignment

The renderer may be fortunate enough to make the first sale on the basis of the samples provided on the first visit to the target country. It is more likely that he will have homework to do before the first sale is made.

The sale should not be made until the product conforms precisely with was agreed to during the visit or subsequently. This is because the importer will anticipate that the renderer will be putting his best foot forward on an initial consignment and because the importer will be unfamiliar with the renderer's situation and be unable to conceptualise on what might have been or what could be done.

At least one member of the party making the first visit, preferably the most senior should follow up on the arrival and out turn of the first consignment in person to verify that it has turned out as planned, as a sign of goodwill, to observe the importer's reaction to the product and to identify things that could be done better.

Finally there should be a wash-up conference with the importer and again with production in Australia on the out turn of the consignment.

Stage 5 Ongoing Business

Even with things going smoothly provision should be made for up to two follow-up visits to the client within twelve months of the first successful consignment and thereafter at least annually. Ideally these should not all be made by the one individual since that may prevent fresh opportunities, or even problems being identified. Besides it can make the association too dependent on just two or so individuals and a long standing association requires more depth than that.

It is important to remember that aquaculture and aquafeed milling are highly technical industries and while a visit by a non-technical sales person may assist goodwill, it can do little else to improve business in those industries. The Australian renderer will need to keep abreast with developments and trends in aquaculture in the target country for example. The renderer should expect cooperation from the client in doing this and conversely the client should be entitled to expect the renderer to keep him up with developments visible from the Australian end as well.

An essential aspect of mutual visits is to maintain a situation in which chief executives are available to each other so that every problem can be corrected on the spot as it arises.

Ideally a visit to the Australian rendering plant should be arranged within a reasonable period of the trade first developing.

From this point the ongoing trade is a matter of servicing the client and keeping one's eyes open.