

# FISHERIES RESEARCH AND DEVELOPMENT CORPORATION

## FINAL REPORT

TITLE OF PROJECT	Feeds for warmwater aquaculture: what are the lessons from other aquaculture and agriculture industries
NUMBER OF PROJECT	90/101
RESEARCH ORGANISATION	NSW Fisheries Brackish Water Fish Culture Research Station Salamander Bay NSW 2301
PRINCIPAL INVESTIGATOR	Dr Geoff Allan BSc (hons) PhD Research Scientist Brackish Water Fish Culture Research Station Salamander Bay NSW 2301 Telephone (049) 821232 Facsimile (049) 821107
FUNDING AGENCY	Fisheries Research & Development Corporation

### SUMMARY

An Aquaculture Nutrition Workshop was organised to review the current status of aquaculture nutrition research in an effort to help stimulate the rapid development of cost-effective diets and feeding strategies for aquaculture species in Australia. The Workshop was held at the Ambassador Resort, Salamander Bay, New South Wales from 15–17 April 1991. Altogether 43 papers and three posters were presented. These included reviews of digestive physiology, animal nutrition and diet development for fish, crustaceans and molluscs, results from nutrition research and overviews of issues relating to the environment and the manufacture and storage of feeds. One of the features of the workshop was the participation of pig and poultry nutritionists. The development of cost-effective pig and poultry diets has played a pivotal role in the success of these industries in Australia.

Following the Workshop two industry-orientated seminars were organised one at Salamander Bay and one at Hobart, to give feed manufacturers and fish farmers the opportunity to hear about the development of feeds for successful aquaculture industries overseas and to discuss other issues relating to feeds and feeding.

### BACKGROUND

As feed costs are as much as 60% of the operating cost of rearing fish and prawns (Manzi, 1989) the development of successful semi-intensive or intensive aquaculture industries around the world has been dependant upon the formulation of nutritionally adequate, appropriately priced artificial diets. The channel catfish

industry in the United States of America (Robinson, 1989) is a prime example of an industry which struggled until appropriate, cheap feeds were developed. For some intensively farmed species fishmeal and fish oil can constitute more than half the diet and although predictions are that requirements for fishmeal for aquaculture will double in the next ten years there is no expectation that catches of fish used for fishmeal and oil will increase on a global basis (Barlow, 1989). Although world supplies of fishmeal and oil may be adequate to meet demand from aquaculture (Barlow, 1989), price is increasing as 'higher profit margin' products using fishmeal are developed (Manzi, 1989). In addition, there is very little Australian product available.

Unless feeds much cheaper than most of those presently available can be developed, based at least predominantly on cheaper, Australian components, the future for aquaculture in Australia is not promising.

With the exception of oyster and trout farming, aquaculture in Australia is a relatively new industry and appropriate diets for local species have either not been developed (eg freshwater and marine fin fish) or must be imported at high cost (eg penaeid prawns). Some nutritional research with Australian species has been done (eg for some penaeids: Maguire and Hume, 1982; Maguire and Allan, 1987), however, for many local warm-water fish species with aquaculture potential, eg silver perch *Bidyanus bidyanus* and snapper *Pagrus auratus*, very little information on nutritional requirements exists. However, nutritional information and experience with the formulation of diets for other species which are cultured elsewhere, eg penaeids (for reviews see New, 1976, 1980; Kanazawa, 1985) and channel catfish, *Ictalurus punctatus*, (for review see Robinson, 1989) will have many useful lessons for the development of diets for Australian species. In addition the successful development of some Australian terrestrial agriculture industries, eg poultry and pigs, has also only been possible with the successful development of nutritionally adequate, suitably priced, artificial diets. Development of these diets, in particular the substitution, or partial substitution, of expensive protein sources, has many parallels with what is required for the development of cost effective diets for Australian aquaculture.

This project was conceived to obtain funds to canvass the experience and opinions from the many agricultural researchers in NSW and Queensland who have expertise in the development of animal feeds which should facilitate the development of cost-effective feeds for aquaculture. After identification of key personal and preliminary data gathering the project leader convened a workshop to review results from Australian and overseas aquaculture nutrition research, as well as from other relevant Australian agriculture industries. The major objectives of this workshop was to identify problems, and solutions, experienced during the development of diets elsewhere and to formulate a systematic research approach towards the development of cost-effective diets for Australian aquaculture industries.

## OBJECTIVES

- 1 To formulate a systematic research approach to develop cost-effective diets for Australian aquaculture industries.
- 2 As part of the first objective, to convene a workshop to examine the successful development of formulated diets in other aquaculture and relevant non-ruminant agriculture (eg poultry and pig) industries to facilitate the development of cost-effective aquaculture feeds in Australia.

## REPORT

Discussions were held with scientists from state and federal government research institutions and relevant private companies with research experience with both terrestrial animal nutrition (especially monogastric animals such as pigs and poultry) and with aquaculture nutrition. Correspondence with international fish and crustacean nutrition experts was also initiated. Following these discussions a draft agenda for a workshop was prepared and a first notice was sent out to as many people as possible, both within Australia and overseas, who were likely to be interested in an aquaculture nutrition workshop. The response to this notice was very positive and it was apparent that the two-day workshop envisaged when the FRDC application was submitted would not be sufficient. A third day was added, an agenda finalised and three international experts who were to be funded to attend the workshop, were selected. The topics for the international experts were chosen to cover areas of deficiency in Australia expertise which were likely to present major restraints to the rapid development of cost-effective aquaculture diets. In addition, a number of Australian aquaculture and agriculture nutrition experts were selected and appropriate topics chosen. (see Attachment 1: second workshop notice and list of invited speakers and topics).

A second notice was sent out which included a call for abstracts. When these were received they were sorted into appropriate headings and the workshop program was finalised. A Program and Abstract Booklet was printed and sent out to all delegates (see Attachment 2).

To ensure that industry representatives, including existing and potential fish and crustacean farmers, feed manufacturers and equipment suppliers, were not excluded from what was basically a research orientated workshop, two industry - orientated seminars were also organised. One of these was held at the Brackish Water Fish Culture Research Station at Salamander Bay and the other at the fisheries research laboratory at Crayfish Point, Hobart, Tasmania. The aim was to give industry representatives the opportunity to hear about the development of feeds for successful aquaculture industries overseas and to discuss other issues related to feeds and feeding (see Attachment 3: Notice for industry-orientated seminars, agendas and list of participants).

The three-day Aquaculture Nutrition Workshop and the two one-day Industry Seminars were very successful with over 150 participants from around the world including New Zealand, Canada, USA, Japan and Tahiti as well from all states in Australia. All presentations were recorded on cassette tapes and are available for

a nominal charge. To rapidly disseminate information from the workshop a summary of some of the major papers was prepared by Mr D O'Sullivan and Ms D Watson (with assistance from Dr G Allan and other speakers) and published in *Austasia Aquaculture* (see Attachment 4).

The papers arising from the workshop, 43 in all, were each sent to two referees, edited and revised by the authors. It was a measure of the high quality of the material that only three papers were rejected by referees and editors.

All papers were then sent to a copy editor to further improve the quality of the volume, typeset and printed. Galley proofs were sent out to all authors prior to final layout.

The Proceedings were published in a 248 pager (A4 size) soft cover book (see Attachment 5). As the number of delegates, and the length (and quality) of papers presented, was much greater than anticipated printing and publication costs associated with the Proceedings was much higher than anticipated. In addition, when the workshop was run NSW Fisheries and NSW Agriculture were one department and staff at the Communications Unit at NSW Agriculture had agreed to typeset the Proceedings, design the cover and arrange printing tenders free-of-charge. Unfortunately, the then NSW Agriculture & Fisheries was reorganised and became two separate departments. NSW Agriculture could no longer provide the service free-of-charge. Consequently, additional funds were sought from FRDC to cover the full printing and publication costs.

One thousand copies were printed. All delegates received a free copy and additional copies have been made available for AUD\$75 plus AUD\$10 postage within Australia AUD\$30 postage outside Australia. To help promote the sale of the Proceedings a brochure was printed (Attachment 6) and has been widely disseminated throughout Australia and the world. Abstracts have been sent for inclusion in international abstracting services and a number of popular aquaculture and fish farming journals and magazines have been sent copies of the Proceedings and/or the advertising brochure.

Following the workshop and the lengthy discussions held with other aquaculture and agriculture nutritionists, research strategies for aquaculture feed development were formulated. The Workshop was extremely beneficial to NSW Fisheries in the formulation of their successful applications to Grains Research and Development Corporation for funds to investigate the potential use of Australian oilseeds and grain legumes in diets for silver perch. Additional successful research applications were submitted from other organisations for research on barramundi, penaeid prawns, abalone and salmon. More recently, information gained for the workshop and contacts made with other scientists have culminated in the coordination and submission of a large collaborative research proposal to replace fishmeal in aquaculture diets. This was one of the key research priorities identified during the workshop. The collaborative proposal has been coordinated by NSW Fisheries and includes nine individual, linked sub-projects involving approximately 16 research institutions and private companies.

## REFERENCES CITED

- Barlow, S., 1989. Fishmeal - world outlook to the year 2,000. *Fish Farmer*, September/October 1989, pp. 40-43.
- Kanazawa, A., 1985. Nutrition of penaeid prawns and shrimp. In: Taki, Y., Primavera, J. H. and Llobrera, J. A. (Editors), *Proceedings of the First International Conference on the Culture of Penaeid Prawns/Shrimps*. Iloilo City, Philippines, 4-7 December, 1984, pp. 123-130.
- Maguire, G. B. and Hume, I. D., 1982. A study of the nutritional requirements of school prawns *Metapenaeus macleayi* (Haswell) in some Australian brackish water farming ponds. *Aquaculture*, 29: 261-278.
- Maguire, G. B. and Allan, G., 1987. Nutritional studies on school prawns *Metapenaeus macleayi* and leader prawns *Penaeus monodon*. In: E. Chauvez (Editor), *Proceedings of the Australia - Mexico Workshop on Marine Sciences*, Merida, July 1987, (in press).
- Manzi, J. J., 1989. Aquaculture research priorities for the 1990's. *World Aquaculture*, 20(2): 29-32.
- New, M. B., 1976. A review of dietary studies with shrimp and prawns. *Aquaculture*, 9: 101-144.
- New, B. B. A bibliography of shrimp and prawn nutrition. *Aquaculture*, 21: 101-128.
- Robinson, E. H., 1989. Channel catfish nutrition. *Reviews in Aquatic Sciences*, 1(3): 365-391.