AQUACULTURE SECTION

Australasian Aquaculture Conference, Sydney 2004: Indigenous Aquaculture Session – The Pacific Experience

Background

The workshop *Indigenous Participation in Aquaculture – the Pacific Experience* was held as a day-and-a-half session in the Australasian Aquaculture 2004 conference at the Sydney Convention and Exhibition Centre, Darling Harbour, on 27–28 September 2004. The conference was the first in a biennial series of conferences to be held in different states of Australia to assist in promoting the development of sustainable aquaculture technologies in Australia and the wider Asia-Pacific region. The conference itself was a great success, with over 1300 participants, including a substantial international attendance, and a strong trade show.

A major aspect of the workshop *Indigenous Participation in Aquaculture – the Pacific Experience* was to promote exchange of information and experiences between researchers, government representatives and industry involved in aquaculture development in the Pacific. The SPC Aquaculture Section has formed an informal working group (the Pacific Aquaculture Working Group) in support of this objective, and this workshop was an activity of the Pacific Aquaculture Working Group.

The workshop also recognised the increasing interest in aquaculture as an industry that can provide benefits for rural Indigenous communities in Australia as well as in the Pacific Islands region. The Pacific has a diverse and vibrant tropical aquaculture industry, and has many commodities common to Australia (pearls, shrimp, sea cucumber, etc.). An additional aim of the workshop was to capture the experience of Pacific Islands aquaculture to develop linkages to support Indigenous aquaculture development in Australia.

Objectives

Prior to the workshop, the main objectives were identified as:

1. Promote the exchange of information and experiences between Pacific Island countries and Australia in support of Indigenous involvement in aquaculture.

2. Promote and support the involvement of Indigenous people in the aquaculture industry in Australia and the Pacific.

3. Assess the potential for adoption of Pacific Island cultured commodities and technologies to assist the development of Indigenous aquaculture in Australia.

4. Support the objectives of the Australian Aquaculture Action Agenda for Indigenous people.

Outcomes

The workshop was very successful and 23 presenters from eleven countries (Australia, Cook Islands, Federated States of Micronesia, Fiji Islands, Kiribati, New Caledonia, New Zealand, Papua New Guinea, Samoa, Solomon Islands, Vanuatu) were well received. The presentations featured many successful aquaculture ventures and highlighted economic, technical and cultural issues faced by communities in the region.

During the workshop, key issues were noted, then raised for discussion in the final facilitated session. These issues are summarised below, listed in dot point under the relevant desired workshop outcomes (identified prior to the workshop).

Outcome 1: Identify key issues to assist Indigenous aquaculture development in Australia and the Pacific.

The issues discussed were:

- "Western"-style work practices and business frameworks are not always compatible with Indigenous operations. Cultural issues and the history of developments in Indigenous communities (conflicting cultural demands, availability of "sit-down" money) must be considered.
- There is a strong need to consider cultural issues when planning and implementing technical training for Indigenous groups (e.g. consider limited literacy, focus on group-based rather than individual problem solving, "hands-on" training, imaginative solutions to facilitate training and maintain interest).
- There is a need for business (e.g. budgeting) as well as technical training.
- More direct Indigenous involvement in management was recommended. Success and ownership are positive forces and perpetuate success.
- It was noted that small-scale, extensive systems give direct benefits to communities and families (food security, cash income). Larger operations may have to contribute in different ways (employment, scholarships). It must also be

recognised that indirect benefits in the form of employment pride, improved self-esteem, production of species of "cultural" value, etc., are very important.
- There is a need to recognise that cultures are different but that common elements exist and there is potential for collaboration in many areas.
- Consultations, negotiations and business operations must be appropriate to the cultural obligations and sensitivities within communities.
- Complicated ownership systems (both land and sea tenure) must be taken into account in the establishment of aquaculture operations.
- Enhanced income by groups may cause conflict within the community.
- Environmental Scanning needs to take cultural factors/issues into account.
- There is a need to manage expectations within communities and to deliver on promises. Long production timeframes may cause communities to lose interest.
- There is a need to identify social issues regarding Indigenous aquaculture development.
- Full-time employment in an aquaculture industry may not be appropriate or necessary. For example, paid "blocks" of time may be more effective and acceptable.
- There can be delays associated with resolving intellectual property (IP) issues, particularly those associated with traditional knowledge. Many communities and/or individuals don't want traditional knowledge recorded in writing or given to other groups.
- Capacity-building amongst communities should focus on younger people. Consider mentoring from elders; utilise experience from other aquaculture businesses.
- Collaboration in sponge marketing: develop critical mass to fulfil market demand.
- Focus on interested groups and issues to assist those groups, and not the big picture.
- Environmental issues: understanding of why it is so important to people.

Outcome 2: Develop a collaborative framework to advance Indigenous involvement in aquaculture in Australia and the Pacific.

- There is a need to develop regional centres of research and development (training, extension, advice, support, expertise) and provide institutional support.
- The Pacific/Indigenous Aquaculture session is to be included in Australasian Aquaculture 2006 in Adelaide and in subsequent conferences to maintain interest and focus, report on progress made and promote new ideas.
  Output: *Commitment to include similar workshop every year.*
- Development of a "one-stop" internet shop for Indigenous groups seeking information on how to develop an aquaculture project would be a very useful first step in supporting Indigenous aquaculture. Consider Australian Indigenous and Pacific Islands network. Form links with established websites, e.g. SPC and NACA. One of NAC's objectives is to support the development of a website for information and contacts, enhance communications.
  Output: *Website to be hosted by NAC.*

Outcome 3: Prepare a report on issues identified in a facilitated workshop, reviewing the day's proceedings.

- Write up the outcomes of the meeting and distribute to interested parties (participants, sponsors, government agencies).
  Output: *This document.*
- Develop a basic booklet to outline the strategic requirements, issues and working relationships for establishing Indigenous Aquaculture Ventures. This can be distributed widely to Indigenous communities.
  Output: *Published booklet.*
- "Good news" examples of successful aquaculture ventures that can provide positive stimuli to other ventures.
  Output: *Publication on successful case studies.*

Outcome 4: Utilise these outcomes to assist implementation of aquaculture development in the Pacific Islands region.

- A major outcome from the workshop with regard to implementation of aquaculture development in the Pacific Islands region was the opportunity for workshop participants from PNG, Solomon Islands, Samoa, Fiji Islands, Kiribati, Cook Islands and Vanuatu to interact with each other and with Australian workshop participants, and to participate in a large international technical conference.
- Through providing a forum for Pacific participants to interact, the workshop contributed directly to the aquaculture outputs of the SPC Coastal Fisheries Programme Strategic Plan 2003–2005, particularly Output 1.1: *Establishment and maintenance of a regional network of contacts as a means of exchanging ideas, knowledge and experience on*

Pacific aquaculture issues. This network will be maintained and expanded through the mechanisms identified in this report.

- The workshop also contributed to Output 1.3: *Development of the Pacific Island human resource base for aquaculture*. Participation in an international workshop/conference assisted in building capacity in regard to presentation techniques and networking with other practitioners within and outside the Pacific Islands region, as well as providing exposure to the wider Australasian aquaculture scene.
- The workshop provided opportunity for identification and finalisation of collaborative "miniproject" proposals to be funded under the ACIAR project Sustainable aquaculture development in the Pacific Islands region and northern Australia (FIS/2001/075). These include:
  - Development of commercial and farm-made feeds for tilapia and freshwater prawn in PNG and Fiji.
  - Monoculture of the freshwater prawn *Macrobrachium lar* in Vanuatu and integrated prawn–taro farming in Wallis and Futuna.
  - Training in microalgal culture technology for Samoa.

Output: Two mini-project proposals submitted for funding.

- There was general agreement amongst participants that many of the cultural issues raised by Australian Indigenous participants were also applicable to Pacific Island countries.

Outcome 5: Utilise these outcomes to assist implementation of the National Aquaculture Development Strategy for Indigenous Communities in Australia.

- Continuity of funding or support is very important (CDEP top-up?).
- Recognise the importance of risk analysis. It is important to thoroughly research the proposed operation/species/system before proceeding. Should be appropriate to the cultural group and have high probability of success. Need to recognise that promises must be realistic.
- Maintain the networks established from this conference.
- Strategic planning directions: need to plan "What, How, When"; we know why.
- Develop partnerships with existing industry: Skretting example (Bathurst Island, NT, Tiwi people). May have both positive and negative impacts (e.g. sit-down money from mining companies).

Organisation and sponsorship

The organising committee comprised the following persons:

Dr Mike Rimmer, Department of Primary Industries and Fisheries, Queensland, Australia; Dr Yves Harache, IFREMER, New Caledonia; Mr Ben Ponia, Secretariat of the Pacific Community, New Caledonia; Dr Warwick Nash, WorldFish Center, New Caledonia; Mr Dennis Ah-Kee, National Indigenous Aquaculture Unit, Department of Agriculture, Fisheries and Forestry, Australia; Mr Ian Lyall, Department of Primary Industries, New South Wales, Australia; Ms Cathy Hair, Department of Primary Industries and Fisheries, Queensland, Australia

The workshop was facilitated and chaired by Grant Sarra (Grant Sarra Consultancy Services), assisted by Dennis Ah-Kee as the co-chair.

The workshop was sponsored by the Australian Agency for International Development (AusAID) under the International Seminar Support Scheme (ISSS), the Australian Centre for International Agricultural Research (ACIAR) and the Australian Department of Agriculture, Fisheries and Forestry (DAFF).

SPC seaweed quarantine protocol development undertaken by the Institute of Marine Resources, University of the South Pacific

In 2003 the Secretariat of the Pacific Community (SPC) commissioned the Institute of Marine Resources (IMR) of the University of the South Pacific to: 1) conduct a literature review of the introductions of the seaweed *Kappaphycus alvarezii* to Pacific Islands countries and the current state of seaweed farming in these countries and 2) to field-test their proposed quarantine protocol for introducing kappaphycus seaweed to new locations. The following is a synopsis of the quarantine protocol report which is now available online on the SPC Aquaculture Portal (http://www.spc.int/aquaculture/site/publications/documents/Seaweed%20quarantine%20project.pdf)

Kappaphycus seaweed is farmed for its carageenan content commonly used in the food processing and pharmaceutical industry. It has been introduced to Pacific Island countries since 1977. The industry has met with

varied success. In Kiribati it has become an important cash crop for both the rural and national economies. In Fiji Islands the progress has been erratic, although the commodity is still recognised as having a potential to be an important income earner in rural areas. In Solomon Islands there has been recently rejuvenated effort leading to rapid increase in farming and export volume. Growth trials have been conducted in other Pacific Island countries although few have led to commercialisation.

These developments have required that whole plants or cuttings of kappaphycus be transplanted from island to island, with most of the material originating in the Philippines, Kiribati or Fiji.

On only one occasion, a shipment from Fiji to the Solomons in 1988, has there been any documented attempt to quarantine the plants in order to minimise the risk of importing associated species or any diseased plants. Quarantining is important to minimise the risk of accidental introductions, and also to establish if the species being introduced is likely to become a pest itself. The main quarantine problem, however, is that of preventing accidental introductions of associated species; and when volumes exceeding half a tonne are sometimes transplanted this is a real risk.

SPC has therefore developed a protocol for translocating kappaphycus, and commissioned the University of the South Pacific's Institute of Marine Resources (IMR) to field-test their protocols. The protocol is fairly simple and involves washing and cleaning the specimens before they are dispatched and upon arrival, and keeping the plants in quarantine for two weeks during which period there is further cleaning and washing. This protocol is intended to remove most if not all macrobiota, but obviously will not remove the microflora such as diatoms, dinoflagellates and protozoa living on the surface of the seaweed. Nor will it isolate internal parasites such as viruses, fungi or protozoa, although plants that are obviously diseased would be removed.

Accordingly, the IMR obtained shipments of kappaphycus from three Fijian farms to test this protocol. The morphology of kappaphycus is much influenced by environment, especially wave action, and the plants that we received exhibited very different morphologies. We discovered that, compared with many other seaweeds, kappaphycus supports a relatively sparse macrobiota. This is particularly so for laxly branched, long slender plants from Macuata and Savusavu. Compressed, ball-like specimens from sites with relatively high wave action, such as Bua, provided more nooks and crannies for phytal flora and fauna. Hosing and gently scrubbing

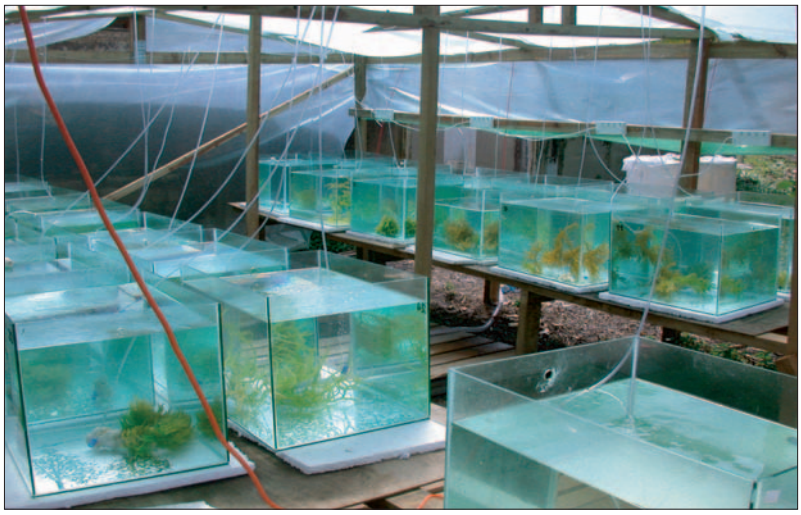


Figure 1 (top): Experimental set-up of seaweed quarantine trials
Figure 2 : Seaweed within Fiji displaying different morphology
Left to right: Bua, Savusavu and Macuata seaweed

Figure 3: Parasites and other organisms associated with the seaweed host
Top left to right: microfauna, eggs, zooanthids. Middle row: algal fragments
Bottom row epiphytic algae embedded into thallus

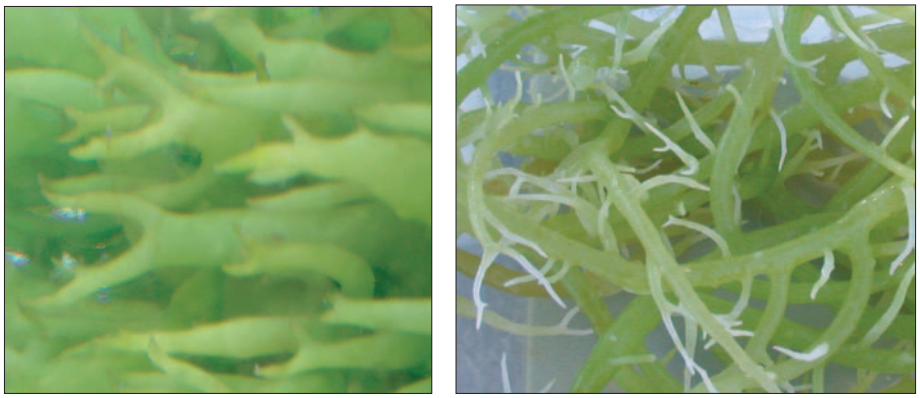


Figure 4: Kappaphycus algae under stress. Left to right, filamentous algae, necrotic tips.

the plants with filtered seawater proved to be an effective means of dramatically reducing the epibiota on the specimens.

After two weeks, untreated plants had a much greater diversity and abundance of macrobiota than did the washed plants. Some species were, however, persistent, especially several types of filamentous epiphytic algae, whose bases are embedded in the kappaphycus tissue. Though these epiphytes can be picked or scrubbed off, they quickly regrow. In the absence of any strong water movement in our culture tanks they looked likely to overgrow the specimens unless the cleaning process was maintained. Although washing removed most macrobiota, handling the plants evidently caused stress, which resulted in the treated plants growing more slowly than those untreated. However, all specimens exhibited significant growth over two weeks. Another problem was that after a week, many plants lost colour and became necrotic at their tips. This indicates the problems of a closed tank system where seaweeds are likely to become nutrient limited.

We concluded that the washing and quarantine procedure was effective at removing most large epifauna, but it would not prevent the introduction of some small epiphytes embedded in the host's tissue. Microscopic examination of periodic washings also showed that washing did not significantly reduce the surface microbiota.

Several simple improvements to this procedure could be made. Perhaps the simplest is to wash the plants in fresh water, which would be more effective at removing the animals, and which is possible because kappaphycus tolerates low salinities for short periods. Second, we would recommend experimenting with surface disinfectants to try to kill epiphytes and epifauna. Brief immersion in copper sulphate may kill epiphytic algae including phytoplankton and even fungi, while Betadine (an iodine based antiseptic) or chlorine would eliminate a wide range of microorganisms. Experiments are needed to test dosage and exposure periods. If successful, then surface disinfection could reduce the quarantine period.

Another stratagem is to minimise the volumes of the seaweed that are transplanted. One method is to minimise the mortality of the transplants at their new location so that there is an opportunity to "bulk up" the specimens to provide the desired biomass needed to supply cuttings; that is, to establish a nursery for the plant. Otherwise, anticipating high mortality, countries will continue to import very large volumes, and the risk of introducing unwanted species increases with the volume, possibly exponentially. Another method, best adopted, is to transplant only the apical parts of plants, because these are relatively free of epiphytes and animals. Where countries want axenic cultures of kappaphycus, then tissue culture is really the only option. This requires considerable expertise and equipment at source and also at the destination, where the cultures may have to be maintained for as long as four years before there is sufficient material to provide cuttings for an experimental farm.

Reference

Sulu, R., Kumar, L., Hay, C. and Pickering, T. 2004. Kappaphycus seaweed in the Pacific: review of introductions and field testing proposed quarantine protocols. Noumea: Secretariat of the Pacific Community.

For further information on the seaweed quarantine protocol please contact Ben Ponia, SPC Aquaculture Adviser (benp@spc.int).

Fiji Freshwater Aquaculture Census Survey

Introduction

Following a aquaculture study tour in June 2004 (see *Fisheries Newsletter* #109) and meetings with Department of Fisheries officials in Fiji, a request was made by Chief Executive Officer of The Ministry of Fisheries and Forests to SPC and ACIAR to carry out a freshwater aquaculture pond census and to assist in development of a strategic plan for freshwater culture in Fiji.

Thus a survey of fish farmers with ponds was organised by the SPC Aquaculture Section, with funding support from ACIAR.

The objective of the survey were to:

1. quantify the present status of the industry;
2. identify advantages, constraints and trends within sector; and
3. formulate recommendations of strategic requirements to support freshwater aquaculture development in Fiji.

Survey methodology

A survey questionnaire was developed by SPC to solicit information describing the

farmers' situation. The questionnaire was tested briefly at Naduruloulou aquaculture station on 21 June 2004. The survey was executed in three visits during June–July 2004.

An inventory of fish farmers to update records was conducted by the Department of Fisheries prior to the survey. From the records available the number of fish farmers in the two main islands of Viti Levu and Vanua Levu was estimated to be around 300. It was agreed to attempt to interview all farmers to obtain statistically reliable information as well as update the current records.

Results

The pond census indicates the typical profile of a farmer is of Fijian ethnicity, middle aged and male. The majority of farms are operated by men (92%). A very small percentage of the fish pond operators are women but they share fish farming responsibilities with men. The majority of farmers belong to Methodist denomination.

Most of the farmers had considerable fish farming experience, ranging from 5 to 10 years, and the main economic activity is crop production. There are a total of 110 existing farmers including those with farms under construction. The census reported a further 57 ex-farmers who had become disillusioned with their prospects or cited a lack of government support. There were also a lot of farmers who were intending to start fish farming.

Nile tilapia (*Oreochromis niloticus*) and giant freshwater shrimp (*Macrobrachium rosenbergii*) are the two main commodities. Chinese carps are also cultured but by a small number of farmers only. Thirty tonnes of tilapia valued at FJD 125,000 and 1.7 mt of shrimp worth FJD 30,000 were produced in 2003. Two thirds of the ponds were farming tilapia and 10 per cent shrimp, although one third of the farmers wished to cultivate shrimp if possible. Up to 20 per cent of the farms were integrated with crops or other livestock.

The total area of pond size is slightly over 25 hectares with an average size of 715 square metres. The main source of water for the ponds is mainly streams, followed by springs and rain. Some ponds received water from wells, dams or from irrigation canals. Water is present in ponds throughout the year. However, some ponds did not meet the recommended water depth to culture fish and prawns, namely 0.8 m at the inlet and 1.2 m at outlet side.

Forty per cent of the ponds are located in Naitasiri Province. Half of the farms are on *mataqali* owned land with the remaining quarters equally divided between freehold and leased arrangements.

Half of the farmers surveyed indicated that a lack of fingerling and feed supply is the greatest impediment to farming. The majority were unable to get financing, although almost half of the farmers were recipients of government subsidies. Almost all of the farmers would like training in every aspect of aquaculture.

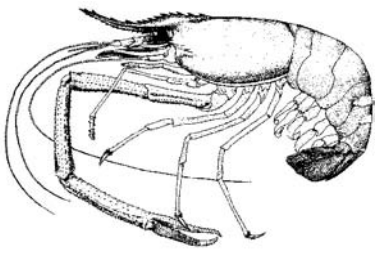
Problems encountered

During the interview, the fish farmer (the respondent) was questioned based on the survey form, which included a set of questions. Attempts were made to obtain all the relevant information from the farmers. However, the farmers were not able to provide all the information and in some cases hardly any information was obtained as they did not keep records. In a few cases the farmers were not present at the time of the interview and their immediate family members were not able to give the information.

Use of the results

The survey established the current situation of freshwater aquaculture, providing the basis for evidence-based advice to the Ministry of Fisheries and Forests and other stakeholders. It is anticipated that the survey results will help policy-makers review and formulate freshwater aquaculture policies and plan aquaculture intervention programmes and projects. Indirectly, the survey results show us how effective are the freshwater aquaculture programmes in Fiji. The results may also assist in determining priorities and channelling resources for intervention programs for better aquaculture extension services for the people.

A final report has been compiled and will be disseminated to Ministry of Fisheries and other stakeholders in Fiji.



Fiji Freshwater Aquaculture Strategic Planning Workshop
4–6 August 2004, Nadi Tanoa Hotel, Nadi

Introduction

Following the Fiji National Aquaculture Census Survey, a planning workshop was held at Nadi Tanoa Hotel on 4–6 August 2004, organised by SPC Aquaculture Section and Fiji's Ministry of Fisheries and Forests (MFF). Funding was provided by ACIAR. The workshop was held at the request of Chief Executive Officer of the MFF.

The objective of the workshop was to formulate a five-year framework to develop the freshwater aquaculture sector in Fiji.

The Fiji government recognises freshwater aquaculture as having a major potential for the rural areas but in the recent past support provided through extension programmes has not been well targeted. Thus, there was a need to consolidate progress and establish clear and valid objectives. The Government of Fiji is the main stakeholder and driver of the aquaculture sector. A strategic plan was therefore required to "sell" the sector in order to raise investor confidence, support government budgetary appropriations and encourage more positive interventions by donor agencies.

Methods used to develop the plan

In order to develop a plan, a national census of the freshwater aquaculture industry was conducted in June-July 2004 to determine the actual status of the sector, its emerging issues and trends (see report in this issue). The objectives and indicators for the plan were developed through a facilitative process with moderation provided by Amber Davidson (SPC Planning Adviser) and Christine Chung (Moderation Specialist).

SPC Aquaculture Adviser (Ben Ponia) and Filimone Mate of MFF provided an overview of aquaculture in Fiji followed by SPC Aquaculture Officer (Satya Nandlal) presenting the results of the census survey. These presentations on the present status of the aquaculture industry in Fiji provided a basis of information (evidence-based) for the discussions. Participants first focused on identifying challenges for the sector, developing objectives, strategies and performance indicators. The plan was refined after further consultations with MFF staff with the assistance of SPC.

The Minister of Fisheries and Forests and senior officials (Chief Executive Officer, Director of Fisheries), other ministry senior staff and most of the aquaculture staff including three staff from USP attended the workshop. Mr Barney Smith of ACIAR and Dr Peter Mather of Queensland University of Technology, Brisbane, also attended the workshop. There were a total of 25 participants.

The plan

The plan for the development of freshwater aquaculture industry for the period 2005–2010 consists of 7 major objectives or challenges: policy and legislation, research and development, infrastructure development, market research and development, extension support services, human resources development and industry support. Under each of these major objectives, specific objectives and strategies to achieve the objectives with performances indicators are identified, with a list of resources required to achieve the objectives. These include budget estimates for the period 2005–2010, expertise to be developed and acquired, and information on the land resources base (land classification, land use capability and potential sites for aquaculture).

The plan projects a production of about 6500 tonnes of fish and shrimps in a pond surface area of 450 hectares with a value of FJD 60 million. The forecasts could be exceeded provided preconditions to increase the productivity of the farms are adhered to: for example, stock improvement and maintenance of quality stocks, incentive packages and land owner support and participation in the sector. It is anticipated that production could further be increased if research on improving fish growth and productivity is maintained and farm productivity monitored and evaluated on a regular basis.