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**Australian Centre for  
International Agricultural Research**

# Final report

Small research and development activity

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*project*

## **Barramundi feed development trial in Western Province, Papua New Guinea**

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## 1 Acknowledgments

Steering Committee members wish to thank Ian Middleton and staff at Ok Tedi Development Foundation who organised and facilitated arrangements in PNG for the Steering Committee's visit. Mrs Helena Heasman organised all the teleconferences, international flights for the Steering Committee's visit to PNG and prepared the draft final report. Her assistance to this project was invaluable and gratefully acknowledged. Barney Smith and Chris Barlow, ACIAR Fisheries Research Program Managers supported the Steering Committee and remain committed to farmer based livelihoods in PNG.

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## 2 Executive summary

The development of a non-mine related economic base for the mine impacted communities of the Western Province remains a major challenge in the Western Province and PNG. Ok Tedi Mining Limited (OTML), through its Ok Tedi Development Foundation (OTDF) Rural Development team, is working in partnership with Western Province Division of Agriculture and Livestock (WPDAL) and PNG Sustainable Development Program Limited (PNGSDP) to facilitate the development of core primary industry sectors, including; agriculture, livestock, fisheries (aquaculture), and forestry in the province.

In 2005 and 2006 the OTDF fisheries program deployed two barramundi cages in the Middle Fly region to trial the feasibility of farming barramundi within the off-river water bodies in the Fly River system. The project proved to be feasible, and with the financial support of Western Province Sustainable Aquaculture (WPSA), the project principle was expanded into full commercial trials in 2009 in Lake Murray and two other ox-bow lakes in the Middle Fly.

The PNGSDP Company, through the WPSA Program, commenced the development and subsequent construction of a barramundi hatchery on Daru. The Site for the Hatchery Land on Daru was secured in December 2007 and contracts for construction were issued. The Hatchery provided fingerlings for commercial cage farming trials in the Fly River as well as fingerlings for stock enhancement. The hatchery complex also serves as a training centre and includes administration and accommodation buildings on site.

Mr Ian Middleton (initially Manager of WPSA and later CEO of Ok Tedi and Fly River Development Program, still referred to as OTDF) managed the development of the hatchery. While he had experience with establishing a barramundi hatchery and sea cage farm at Madang, he requested specialist advice from ACIAR to assist PNGSDP meet their overall objectives. A Steering Committee was accordingly formed comprising Dr Geoff Allan, Dr Mike Rimmer and Dr Craig Foster who collectively provided the expertise required to advise Mr Middleton on experimental design and production protocols.

The Steering Committee reviewed all documentation about the construction and proposed operation of the hatchery in Daru, as well as plans for evaluation of cages throughout the Fly River, Strickland River and Lake Murray. The Steering Committee held five teleconferences to discuss these plans and to review experimental design. In addition, the Steering Committee undertook one comprehensive visit to Western Province, PNG, inspected the hatchery (at that time nearing completion), and all the cage sites. A series of recommendations were provided to OTDF on hatchery and larval rearing, restocking and growout trials.

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## 3 Objectives

The aims of this Steering Committee were to assist PNG SDP to:

1. Commission the hatchery at Daru by providing advice on culture methods and operation of hatchery facilities.
2. Provide advice on extensive larval rearing methods for production of juveniles
3. Provide advice on establishing community based inland lake and river cage and estuary and sea cage operations, including feed & feed management options
4. Provide advice on stock enhancement of barramundi
5. Identify other operational priorities and help plan R&D activities for barramundi and other indigenous species
6. Identify technical expertise as required to perform short term tasks on site in Daru to assist hatchery operations on terms to be agreed by both parties

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## 4. Methodology

1. The Steering Committee was intended to initially operate two years.
2. The Steering Committee met in PNG to inspect the hatchery and all associated facilities, and travel to the proposed cage and stock enhancement sites in the Fly River.
3. The Steering Committee usually met via teleconference.
4. The Steering Committee addressed issues identified by Ian Middleton as priorities and prepare verbal and written advice to PNGSDP, through Ian Middleton.
5. Prior to the first meeting, details of the hatchery building plans and the scope of the project were provided to the Steering Committee by Ian Middleton.
6. Full agendas were prepared and circulated prior to each meeting (including teleconferences). Agendas will be prepared by Ian Middleton, in consultation with the Committee.

### **Members of steering committee (with expertise):**

- Dr Mike Rimmer (barramundi hatchery, extensive larval rearing, cage culture, stock enhancement)
- Dr Geoff Allan (feed preparation in PNG, Fly River herring, R&D management)
- Dr Craig Foster (barramundi sea cage culture, commercial feed, barramundi in indigenous communities)

Budget (principle of approximately equal funding from ACIAR and PNG SDP) – refer to attached spreadsheets showing counterpart funding. Budget attached as Appendix 2.

ACIAR funded: 1) travel costs to PNG, 2) per diem in Port Moresby, 3) secretariat support for teleconferences.

PNG SDP funded all costs for the steering committee ex-Port Moresby including: 1) domestic air fares, 2) accommodation in Daru and or other regional sites, 3) meals and 4) other expenses.

A powerpoint presentation was delivered by Mr Ian Middleton at the ACIAR Fisheries and Aquaculture Research Meeting, National Fisheries Authority, Port Moresby on 8<sup>th</sup> May 2008 (attached at Appendix 3).

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## 5. Progress

1. Hatchery plans were sent to Steering Committee members (attached at Appendix 4).
2. A series of teleconferences were conducted over a period of approximately 18 months so that the Project Manager could update the Steering Committee on progress and receive comments and advice in return. Agendas and notes of these teleconferences are as follows:

### Informal AGENDA for the First Teleconference of the ACIAR/PNGSDP Steering Committee; 1600 (PNG Time, Friday 19<sup>th</sup> December 2008)

Ian Middleton was unable to join the 1<sup>st</sup> teleconference and the Steering Committee had an informal discussion as follows (email sent by Geoff):

Sorry you were unable to join the teleconference. We discussed the project briefly and I summarised for Mike and Craig the aims and objectives as best I could.

We agreed that it would be very helpful if you could send us all an outline of the business plan for the entire project, including the objectives, proposed time frame for key activities, and any plans to evaluate success. It is also important that you let us know what information (advice) you are after so we can respond or suggest more appropriate contacts.

We will need to plan the site visit so please also let us know your thoughts about the most suitable time for this to occur and how we can best prepare (i.e. what do we need to do beforehand).

I look forward to hearing from you.

### AGENDA for the Second Teleconference of the ACIAR/PNGSDP Steering Committee; 1300 (Cairns Time, Thursday 12<sup>th</sup> February 2009)

#### **1. Discuss any Issues from the Previous Meeting Minutes**

#### **2. Background to PNGSDP:**

- SDP took over the 52% BHP share of the OTML Mine in 2002
- Mission – Promoting development that meets the needs of the present generation and establishes the foundation for continuing progress of future generations of Papua New Guineans.
- Focus on Western Province ahead of mine closure in 2013

#### **3. Background to Western Province Sustainable Aquaculture (WPSA):**

- First major project for PNGSDP on the ground in Western Province (100% grant funded at present – K 28 M)
- Hatchery & associated social development projects approved 2006
- Land title issues delayed Hatchery constructions throughout 2007
- Civil constructions contract awarded to Curtain Brothers in June 2008

- Building constructions contract awarded to Yatala Property Developers in January 2009 – prioritised building schedule (Hatchery operational by end June 09)
- Business Plan recognised a need for technical strengthening once operational
  - Hatchery Manager Understudy
  - Additional Hatchery Technician (special projects incl. tagging & safety/hygiene)
  - ACIAR Steering Committee
- Note a disc copy of the original Business Plan and latest site pictures will be sent to Helena next week

#### **4. Site Visit Options in 2009:**

- When the Hatchery Building is fully operational & opened in June
- When all buildings are completed in October
- When the first fingerlings are delivered to the trial sites (somewhere in between)
- As desired by the committee

#### **5. Assistance Required from the Committee:**

- General opinion on Hatchery salt water filtration based on the water quality results by ALS in Brisbane & current plans/materials from Aquasonic in line with the review by Les Rodgers (discuss emails with Mike re filtration, pond fertilisation & tank colour etc)
- General thoughts on the potential impacts of Port/dredging induced Sulphur leachate – Ian to update on preliminary study contracted through FRC Environmental in Brisbane
- Assistance with identifying algae, rotifers and zooplankton during staged larval rearing pond blooms (options – Uni student – anytime from March to June)
- Discuss broodstock conditioning so fish are in spawning condition once moved into the Hatchery (something for Craig)
- Discuss Commercial Trial Experimental Design (Ian to send email beforehand)

#### **6. Any Other Business:**

- Next teleconference and a proposed schedule (monthly?)
- Importance of recording information (cc all responses to Helena to minute?)
- Reading bass otoliths

### **NOTES on the Second Teleconference held 12<sup>th</sup> February 2009 2:00 pm NSW time**

**Participants:** Geoff Allan, Ian Middleton, Craig Foster, Mike Rimmer (joined briefly but dropped out); Helena Heasman took notes.

- To avoid the problem with Telstra Phone Conferencing and the ring-in method from Indonesia, Helena has registered with self-hosted phone conferencing. This is a good solution for regular (or impromptu) conferencing and Helena will phone you all at a pre-determined time in future. It was agreed that we should hold teleconferences monthly, preferably when Ian is in Cairns, and continue email correspondence in the interim.
- Ian gave us some background to PNG Sustainable Development Program (SDP). SDP was established by BHP in response to major problems with environmental damage in the Fly River from the mine. The ownership of the mine was



transferred to PNG and the SDP was established as the vehicle. SDP was registered in Singapore and took over the 52% BHP share of OTML mine in 2002. It was originally anticipated that when the mine closed in 2013, there would be sufficient income for 40 yrs. However, it now seems there will be sufficient income for 100 years. SDP collects profits from BHP but has no say in the operational running of the mine.

- The focus for projects will be in Western Province – North, Middle and South Fly regions. WPSA is the first large scale 100% grant-funded project to be delivered in Western Province. SDP has committed K28 million for a commercial hatchery, stock enhancement program, conservation of wild barramundi nursery habitat and aquaculture development. Because of issues with land title, a new site of 8.1 Ha was selected and purchased in late 2007 to overcome these problems (Section 65, Allotment # 10, Daru). Civil constructions began in July 2008 and the building Constructions contract was signed in January and it is hoped that the hatchery will be operational by July with fingerlings available by September.
- Ian pioneered the first barramundi hatchery in Madang 10 years ago producing 100,000 fingerlings/year. There are no other marine fish hatcheries in PNG. A commercial prawn farm has been established in New Britain and production of *Penaeus monodon* has commenced but total production is still relatively low.
- The Business Plan for the barramundi hatchery recognised that the success of the venture was strongly dependant on Ian Middleton. To offset this risk, the SDP Board, Chaired by Ross Garnaut, supported two initiatives. Firstly, the creation of an “understudy” for Ian (Assistant Hatchery Manager) who will be trained to be able to take over and the second the Advisory Committee (supported by ACIAR). Mr Greg Bani, previously from OTML and an ex-resident from Daru, has been appointed as Assistant Hatchery Manager. (Havini Vira declined the job offer because of the location). Two other key technical positions have also been filled. They are Kaupa Kia, who will be responsible for special projects (safety, hygiene & tagging) and Efran Aid, who will be responsible for other aspects of hatchery operation (barramundi production). Kaupa has had extensive experience with aquaculture, primarily with freshwater aquaculture. Efran worked with Ian in Madang. General labourers will be sourced from local Daru residents. The aim of the Advisory Committee is to provide expertise to the WPSA Program (through Ian).
- The Business Plan contains time-frame and objectives of the project. 65% of the budget will be allocated to civil and buildings construction and 35% to operations. ~K2 million has been set aside for fees, contracts etc. It is anticipated that the hatchery will be operational in July and all buildings completed by November. A disc copy of the BP and latest site photos has been sent to Helena. (Post script: the disc arrived but files were corrupted and couldn't be opened.)
- The first commercial trials will be run with 26,000 fish. Ian would like to discuss trial design with Craig – trialling different feeds, density, pontoons etc. Ian envisages that by 2015 there will be fish cages in the river run by a community of farming families producing 400,000 fish/year. When OTML is gone, local communities will need a cost-effective sustainable industry to bring in an income.
- There will be potential for land-based farmers to purchase fingerlings; NFA want fish for re-stocking; the Rural Development Bank in PNG approached Ian to investigate recirc systems in Australia with the objective of establishing small systems in remote urban communities in PNG with good water supply.
- Craig asked if the trials are to be carried out in the Fly River. 3 of the 5 freshwater trials to be held in Lake Murray, centre of WP. The other 2 trials to be carried out in ‘oxbow’ lakes (= billabongs). Craig brought up the question of off-flavours in fish grown in Lake Murray produced by blue-green algae. Ian said that Lake Murray is very clean but has quite a bit of leaf litter. Geoff explained that purging in clean water is the only guaranteed solution to off-flavour but other industries (e.g. USA catfish industry) only harvested fish after their flavour was checked and when off-

flavours weren't present. Ian reports that there is no off-flavour in wild fish caught in the Fly River, possible because they spend considerable time in the estuary and migrating throughout the strongly flowing Stickland & Fly Rivers.

- There was some discussion about the Advisory Committee's first site visit – whether to visit in June when the hatchery opens and the Board is in town; or whether to wait until November when accommodation on-site will be available with the completion of construction; or to coincide with the first delivery of fingerlings (September). The Committee could meet The Board during their September meeting in Port Moresby then tour experimental sites and the hatchery. Ian suggests 10 days would be required to cover everything. It was agreed that the first option should be first week in June.
- Geoff and Helena left the teleconference at 3:00 pm to attend another meeting. Ian and Craig continued discussions. We discussed broodstock maturation and the trials. Further I have since sent a trip option keeping to a week for Geoff.

**AGENDA for the Third Teleconference of the ACIAR/PNGSDP Steering Committee: 1300 (Cairns Time, Thursday 26<sup>th</sup> March 2009)**

**1. Review & Discuss any Issues from the Previous Meeting Minutes**

- Background information for Mike Rimmer as required and brief summary of conversation between Ian and Craig after Geoff & Helena departed (trials & brood-stock conditioning)

**2. Update on Hatchery Building Constructions:**

- Completion of civil works
- Mobilisation to site by Yatala Property Developers

**3. Western Province Sustainable Aquaculture (WPSA):**

- Management Appointments
  1. Assistant Hatchery Manager
  2. Habitat Conservation Project Manager
- Filtration & water issues discussed with Geoff & agreed by phone early March
- Note a second disc copy of the original Business Plan and latest building designs and site pictures have been sent to Helena

**4. Site Visit Options in 2009:**

- When the Hatchery Building is fully operational & opened – from 31<sup>st</sup> August
- As desired by the committee

**5. Assistance Required from the Committee:**

- Update on the potential impacts of Port/dredging induced Sulphur leachate
- Assistance with identifying algae, rotifers and zooplankton during staged larval rearing pond blooms (options – Uni student – anytime from March to June) – fertilisation schedule from Mike
- FOCUS - Discuss Commercial Trial Experimental Design details, specifically feed

**6. Any Other Business:**

- Contact for reading bass otoliths? Ian sourced this locally.
- Next teleconference date
- 

**NOTES on Third Teleconference held 26<sup>th</sup> March 2009 2:00 pm NSW time**

**Participants:** Geoff Allan, Ian Middleton, Craig Foster, Mike Rimmer (joined briefly but dropped out); Helena Heasman took notes.

Telstra conferencing is still proving problematic with Indonesia. It appears that some Indonesian telcos block toll free numbers. It is now possible for us to call out to bring you into the conference as well as you being able to call in. Geoff is going to call Mike to fill him in on the discussions.

1. While Mike was with us, Ian repeated some of the background information. Hatchery is now under construction and due for completion by July. Board meeting to be held 31<sup>st</sup> August and Ian suggests the field trip should be planned for early September. Broodstock were gradually coming back into condition and Ian asked if the vitamin/mineral pre-mix can be fed to broodstock daily – Geoff replied yes – 0.3% of ration. It was mentioned that a sand filter was not the optimum form of filtration but would be sufficient at start up. If necessary a ‘polygeyser’ can be retrofitted in the future.
2. Civil works on site are complete although a blown fuse on the pumping station switchboard has delayed testing of the water reticulation system.
3. WPSA has appointed an Assistant Hatchery Manager who will be arriving on 6<sup>th</sup> April (Gregory Bani). Habitat Conservation Project Manager (ex OTML) started last Tuesday (Charles Tenakanai). One last technician to be appointed. A second disc with the Business Plan, building designs and site photos have been sent to PSFI (received).
4. Site visit options were discussed as per proposed itinerary emailed by Ian on 2<sup>nd</sup> March. It was suggested arriving in Port Moresby on Monday 31<sup>st</sup> August.
5. FRC environmental people (BNE) are doing an EIS of the hatchery site and intake point as a precaution against possible ASS impacts from Port dredging and reclamation mangrove removal. Investigations are expected to include a management plan to mitigate against the probable impacts. This will probably not happen for another two years. Ian will forward reports when complete. Geoff suggested Jes Sammut and Mike Dove should look at the reports with their respective backgrounds and expertise in acid sulphate soils.

Ian requested assistance with identifying algae, rotifers & zooplankton. He used to rely on pond bloom colour to identify algae in the past however would like to use a more accurate method. It was suggested that a Uni student might help conduct a small project to compare blooms around the water intake point with those of pond blooms. Geoff will contact Rocky de Nys from James Cook University to see if he knows of any suitable students while Mike might know of someone in Indonesia who could assist. Ian would like Mike to provide his fertilisation schedule using locally available fertilisers and organic matter.

Experimental designs were discussed:

- Trial different pontoon types (2 plastic types – 1 from Taiwan, 1 from Canada; 1 Madang style timber pontoon )
- Trial different feeds (fresh garfish & herring and imported & home made pellets)
- Trial different cage numbers and sites (7 cages in the South Fly and 9 cages in the Middle Fly)

Dicing machines have been ordered from AGK in Germany. Ian said that it was quicker to dice than cut by hand. Craig asked if it was more of a ‘chopper’ than a mincer and asked to see specifications of the machine (since emailed). These trials will be conducted mainly by uneducated farmers under limited supervision. Craig asked why the farmers wouldn’t eat the fish? Ian replied that they are being paid and will operate under a bonus system whereby they inherit the infrastructure when (if) the project is successfully completed. Several of the farmers have also had practical grow out training in Madang. Craig suggested massive factorial experiments including sites, pontoons, stocking and feeds might be a bit daunting for the farmers. He said to limit the aims of the feed trials for simplicity by only doing 2 replications. One option would be to start with 100 mm fish, feed them on pellets to 100 g in order to eliminate early cannibalism (can be as high as 40%), count remaining fish and commence trials then. The main objective of these trials

is to determine economics of fresh vs. pelleted feed (or a combination of both) and performance and growth of fish in various sites. The committee will thrash out firm objectives during the site visit in September. Craig asked if there were health controls in place. Ian replied that he was starting with 100mm fish and relying on his experience from Madang to keep stocking densities low and eventually feed only once a day. If using 4 mm pellet, once a day should be sufficient. The fresh fish to be used are gar fish from the Middle Fly sites (30 to ea/kg) and herring from the South Fly sites (30-50 to ea/kg). The sites were chosen for abundance of available fish. Note K1.00 = AU\$0.45

6. Ian has sourced a local person for reading bass otoliths (John Russell at Northern Fisheries Centre in Cairns). Next teleconference will be in about one month.
7. As a follow up of the above conversation regarding simplification of the trials I proposed the following changes while conducting the latest site workshops:
  - 2 weeks acclimation on pellets
  - 2 weeks on the respective trial feeds
  - Begin trial
  - Conduct the trial in 3 month segments allowing more continual grading of fish across the sites and more control/assessment of progress
  - Propose to feed twice daily for the acclimation period and first 3 month experiment only (once daily thereafter) while volumes relatively small/more manageable
  - Processing facilities in both regions will be assisting with feed collection, processing & storage
  - Note the currently proposed feed variations are replicated once only under the current design

Assuming you have all received the necessary information by now and it was not corrupted this time I would appreciate comments from the panel on this by email before our next teleconference so we can focus on specific ideas.

My next trip to Cairns and a month on from the previous teleconference will be Thursday 30<sup>th</sup> April & Friday 01<sup>st</sup> May – could you please email all regarding availability.

**AGENDA for the Fourth Teleconference of the ACIAR/PNGSDP Steering Committee: 1300 (Cairns Time, Friday 15<sup>th</sup> May 2009)**

**1. Review & Discuss any Issues from the Previous Meeting Minutes**

- Background information for Mike Rimmer as required; bringing Mike up to date on the two previous teleconferences.
- Disc received and distributed by Helena.

**2. Update on Hatchery Building Constructions:**

- Latest on the pumping station
- Yatala Property Developers progress with Hatchery construction

**3. Western Province Sustainable Aquaculture (WPSA):**

- Commercial trial training & site preparation
- Broodstock status
- Hatchery operating equipment in country
- Contacted Ridley's regarding feed supply

**4. Site Visit Options in 2009:**

- September as discussed during the 3<sup>rd</sup> teleconference

## **5. Assistance Required from the Committee:**

- Latest on the fertilised ponds
- FOCUS – Review the latest information sent by Ian (separate reports & addition to 3<sup>rd</sup> teleconference minutes) and discuss options for the Commercial Trial Experimental Design

## **6. Any Other Business:**

- Daru Port Project deferred indefinitely
- Next teleconference date

## **NOTES on Fourth Teleconference, Friday 15<sup>th</sup> May 2009**

**Participants:** Geoff Allan, Ian Middleton, Mike Rimmer and Helena Heasman were all available but the attempted three-way teleconference did not work because of problems reaching Mike Rimmer in Indonesia. Separate conversations were held between Geoff Allan and Ian Middleton and Geoff Allan and Mike Rimmer.

**Apologies:** Craig Foster.

1. Geoff discussed progress with Ian and complimented him on the advances made with construction of the hatchery. Ian discussed his need for information about live food and the difficulties finding a good guide to pond zooplankton that is relevant to barramundi culture. The QDPI&F labs at Cairns have located some reports on plankton and Ian collected these after the telephone call. We still need to see if anyone at QDPI&F has the zooplankton guide and advice on sampling procedures.
2. Geoff and Ian discussed the proposed experimental sampling design and Geoff reiterated concerns expressed by all the Steering Committee that the experimental plan for the first farming trials be kept as simple as possible. Ian subsequently sent a revised sampling plan, Geoff emailed back suggestions and Ian responded clarifying some of the key factors influencing decisions about the farming trials. (Email traffic is copied below). Ian also subsequently sent the Steering Committee details of the training procedures he used to help ensure those people who will participate in the trials are as fully trained as possible.
3. Geoff discussed communication problems with Mike Rimmer and agreed to change the arrangements for the next meeting. Geoff relayed some of the discussions about progress with construction of the hatchery and the experimental plan.
4. Next meeting to be arranged.

**EMAIL CORRESPONDENCE REGARDING EXPERIMENTAL PLANS FOR FARMING TRIALS:**

Dear Ian

I understand. Let's talk to discuss other option. One possibility is to include everyone at the start as you have planned but to rationalise after 3 months (or at some other time) and focus on a careful evaluation of feeds at a single or small number of locations. I know the operator "error" will be the biggest variable and this other option would allow us to select the appropriate operator for more detailed feeding trials.

I am looking forward to talking with you about your new job. Congratulations again on this role. I am sure you are the right person to move this forward. From an ACIAR perspective, I am looking forward to working with you to help develop aquaculture (and other fisheries livelihood) opportunities in Western Province.

We are rationalising the ACIAR project in the Western Province after QDPI&F restructure. Evizel is leaving QDPI&F and with the Ok Tedi DF restructure, it makes sense to have a look at where we are up to and to regroup and go forward. At this stage our intention is to incorporate the Western Province activities in the new inland project we are developing and would love to work with you and the new Ok Tedi and Fly River Development Foundation (have I got that right?) to assist with developing aquaculture in the Western Province. We are looking for a PNG project "manager" (although that might not be the exact title), probably based in Goroka or Aiyura and responsible for coordinating a range of activities with NGOs, govt agencies, etc as well as communicating with farmers, etc. It is this role we have discussed informally with Havini. Let's discuss options here as well. With regard to the WP, I think we all want the same things - sustainable livelihood opportunities. I think ACIAR might be able to help with aquaculture.

Finally, let's get on to the teleconference after you and I have a chat. Next time we will organise a call up teleconference (where an operator calls rather than the committee members having to call in) and hopefully that will solve the problems with Indonesia.

I look forward to speaking with you.

Best regards, Geoff

Dear Geoff,

Your email just received in Cairns tonight, thanks for this.

I will call you to discuss in more detail however a quick response to some of your points:

Firstly we can't eliminate any sites, we have spent a great deal of time with the respective communities and have been through an arduous selection process for those actually involved in running the trials (18 months in the making) and they have since had mostly theory but also some practical training. I will send you the written summary of the latest round of training/awareness I gave them.

Further, we have already imported the Taiwanese pontoons and the timber ones are built or in construction and now that the program is being handed over I am more limited on budget.

A couple of minor changes that have already been addressed - Komovai (MF) will now be 2 cages and they will test the 100% herring diet. Note the Levame site only has 2 cages.

Lake Kwipi will also be increased to 2 cages and Parama reduced to 2 cages in the SF. Parama & Kwipi will do the 100% garfish so our cage numbers table will look like this:

No	Region	Site	Feed	Pontoon	Cages
1	Middle Fly	Seb's Bay	Farm-made	Madang	2
			Ridley	Madang	2
2	Middle Fly	Levame	Farm-made	Madang	2
3	Middle Fly	Komovai	Herring	Taiwanese	2
4	Middle Fly	Miwa	Herring	Taiwanese	1
5	Middle Fly	Usukof	Herring	Taiwanese	1 ? 2
1	South Fly	Parama	Garfish	Taiwanese	2
2	South Fly	Bobo/Daru Is	Ridley	Madang	2
3	South Fly	Lake Kwipi	Garfish	Candock	2
4	South Fly	Katatai	Ridley	Taiwanese	1

My understanding was that we agreed to eliminate the mixed/combo diets to keep the experiment simpler for the farmers ie, just 100% diets of each feed variant for at least the first 3 months.

Other than the social justification note that the Katatai site (SF) is in a river typical of many potential sites that could be farmed however it is a risky site and I would really like to see how the fish go over a 12 month period (growth & survival) regardless of any meaning it may have comparatively. This is an ideal one to just carry through if there are no disasters.

In the Middle Fly the Miwa and Usukof sites are similar - they all are really but the system is so vast it was important for us to be seen to spread the participation (Usukof in the north of the system, Sep in the middle and Miwa in the south).

Possibility - we can probably afford to add another cage to Usukof so this would also be 2 cages.



To assist with our thinking on who should do what - MF I have the most faith in Sep, Usukof & Komovai so they should have the most demanding feed type - 100% herring or in the case of Sep the greatest number of cages.

In the SF - Lake Kwipi, that said the Parama group has had the most training and have wild garfish populations close by.

After the first 3 months we should then decide based on performance who should go with the combination diets or just keep going through to 6 months as is after removing the slow and fast growing fish. We would pick a couple of farmers to then carry through to 12 months and start again with the best farmers with a 50%:50% combo feed or whatever we feel will be the winning diet.

GOAL - after 12 months be able to come up with a best practice grow out farming model to seek funding to expand the number of pontoons in both the MF & SF - commercialisation through the so called family farmer groups.

See what you think then we can discuss further (would like to have a phone discussion before the next teleconference to get some agreement on the above - Craig/Mike feel free to weigh in/email your thoughts - so we are not going around in circles too much at the next teleconference).

On Havini he told me he wants to take the ACIAR job but also advised he is the only candidate and will be POM based from January. I discussed with him the possibility of delaying his start till mid next year and tying in the hatchery with the ACIAR program from then on and he was happy to do that if ACIAR allowed it. I need to discuss with you if this is possible in ACIAR's eyes.

Note I signed the contract on Wednesday 17th and formal announcements were made the following day so it is now official. My first day will be the 27th July and the hatchery will be formally handed over in February hence it would be great if I could have Havini around through the transition and at least the first half of the trial period (even till the end March would be a great help). Poor bloke, I gave him a bit of grief about it all because we had just been through how I wanted to restructure his role with OTDF into pure aquaculture/fisheries.

I sent an email to Helena re our next teleconference but have not had a response as yet, I am available most of next week?

Regards

Ian

PS - Numbers here - Jody's mobile 0404672688 / house 07 40337326 but will let you consider the above and hopefully hear from the others first - lets aim to talk it through early next week and follow through with the teleconference by weeks end?

Will also email you all the latest site pic's - just about ready for ultra bond roof and walls & note all the hatchery operating materials are now on site in Daru

Dear Ian

Sorry for the unacceptable delay in responding to you about the experimental design. I will probably pose questions you have already answered so sorry in advance if this is the case.

My summary of the current plan is:

9 sites (5 in middle Fly and 4 in south fly).

5 diets (herring; garfish; Ridley pellets; farm-made pellets)

2 cage designs (Madang timber; Taiwanese plastic).

If we keep all sites I recommend the best approach is as follows:

No	Region	Site	Feed	Pontoon	Cages
1	Middle Fly	Seb's Bay	Farm-made	Madang	2
			Ridley	Madang	2
2	Middle Fly	Levame	Farm-made	Madang	2
			Ridley	Madang	2
3	Middle Fly	Usukof	Herring	Taiwanese	1
4	Middle Fly	Miwa	Herring	Taiwanese	1
5	Middle Fly	Komovai	Herring	Taiwanese	1
6	South Fly	Parama	Garfish	Taiwanese	3
7	South Fly	Bobo/Daru Is	Ridley	Madang	2
8	South Fly	Katatai	Garfish	Taiwanese	1
9	South Fly	Lake Kwipi	Ridley	Taiwanese	1

I believe this is a very large experiment but given the fact that most sites are unreplicated, it will not allow very many comparisons. The only genuine comparisons are between Farm-made feed and Ridley pellets at Seb's Bay and Levame. These two sites would allow a simple 2 factor ANOVA with 2 levels for each fixed factor and two replicates for each combination. It would allow a comparison of site (Seb vs Levame) and Diet (farm-made vs Ridley).

All the rest of the sites would just give anecdotal information on performance at different sites. This is useful but probably not essential. I would much prefer to see an increase in the number of cages at Seb's and Levames to 8 cages each allowing 4 diets to be compared (farm-made vs Ridley vs fresh chopped herring vs fresh chopped herring & Ridley). Even six cages at each of Seb's and Levame's to compare 3 diets would be useful.

My next advice would be to remove some of the other sites. In the Middle Fly, if you are able to increase Seb's and Levame's to 6 or 8 cages, I would delete the other sites from the experiment.

For the South Fly, I would try to increase the number of cages at Parama to at least 4 and compare Ridleys and Garfish. Including the channel site makes sense, using Ridley's or garfish. It would be ideal if the number of cages could be increased to 4 here as well to compare the diets. I would delete Katatai and Lake Kwipi.

This would give the following design (changes beyond the number of changes you have indicated as available are indicated in bold italics):

No	Region	Site	Feed	Pontoon	Cages
1	Middle Fly	Seb's Bay	Farm-made	Madang	2
			Ridley	Madang	2
			<b>Herring</b>	<b>Madang</b>	<b>2</b>
			<b>50% Ridley: 50% Herring</b>	<b>Madang</b>	<b>2</b>
2	Middle Fly	Levame	Farm-made	Madang	2
			Ridley	Madang	2
			<b>Herring</b>	<b>Madang</b>	<b>2</b>
			<b>50% Ridley: 50% Herring</b>	<b>Madang</b>	<b>2</b>
3	South Fly	Parama	Garfish	Tawianese	2
			Ridley	Tawianese	2
4	South Fly	Bobo/Daru Is	Garfish	Madang	2
			<b>Ridley</b>	<b>Madang</b>	<b>2</b>

This design would allow a 2 factor ANOVA with 4 levels for the fixed factor diet, 2 levels for the fixed factor site and two replicates for each combination. It would allow a comparison of site (Seb vs Levame) and Diet (farm-made vs Ridley vs herring vs 50% Ridley and 50% herring). This design also allows a 2 factor ANOVA with 2 levels for

each fixed factor of diet and site and two replicates for each combination. It would allow a comparison of the South Fly sites (Parama and Bobo/Daru Is) and Diet (Ridley vs garfish) (this assumes the results are not affected by the different cage types, Madang and Taiwanese. Finally, the design would allow a 1 factor ANOVA to compare effects of site (4 fixed levels, Seb's, Levame, Parama and Bobo/Daru Is) with 2 replicates for each, all fed Ridelys. For all experimental designs, we have to assume that operator does not affect results. This is a big assumption and we need to discuss the best way to minimise operator effects (great information, payment, commission, bribery, etc).

In summary, there would be 4 sites rather than 9. There are more cages in this analysis and therefore slightly more fish and feed but I don't think that would be a show stopper. If you couldn't increase the number of cages as indicated by bold italics I still recommend the other changes and you would only have 14 cages - less fish and feed.

Anyway, another item for discussion. I do think a 3 month trial is appropriate with redesign after 3 months. At that stage you could bring in additional farmers/sites and you would have good information to give them.

I look forward to a chat. Call me directly or we can wait for the next telemeeting. I am looking forward to hearing about your new job. I have had indirect contact with Havini and I want to discuss that with you as well. There is a possible option for an ACIAR funded position in the highlands.

Best regards, Geoff

Dear Geoff,

As per our phone conversation please note the following thoughts on the new look trial design:

**Middle Fly (5 sites)**

2 x oxbows (Komovai 1 cage & Levame 2 cages) note however that I can easily increase the Komovai experiment to 2 cages.

3 x Lake Murray (Miwa & Usukof 1 cage each & Sep's bay 4 cages)

Sep's pontoons will be 2 x 2 cages rather than 1 x 4 cages.

Given there is general agreement on the acclimation method and time we discussed the need to have greater replication by site rather than by region and to reduce/simplify the variants.

If we assume the increase at Komovai to 2 cages then there are only the two sites with one cage each, these are both in Lake Murray and are both deep pockets within the lake (less than an hour apart) so in a way they could also be considered a replica. Note that all Lake Murray locations have a significant abundance of herring.

So in a way we now have 5 replicated opportunities by site with 3 diets to test - 100% home made pellets; 100% fresh/diced herring; 100% ridley's noting it was agreed to drop out the 50:50% variants in this first stage. First stage will be 2 x 3 month trials run consecutively.

After the first phase the best farmers/sites will be selected to conduct a second phase which will be the 50:50% mix, again for 6 months. Remaining farmers (unless total failures) will continue through with 100% herring for a final 6 months to ensure there is no deficiency from feeding only a single fish species for that period of time.

The natural thing to do is to have each of the three Lake Murray sites test one of each variant.

Sep - as he will have 2 replicas essentially side by side and he will be in the most accessible location to receive feed by plane from Obo and should do the ridleys and home made feed.

Miwa & Usukof should both do the herring (may give them an extra paid person to assist - labour cost incidental at the end of the day).

Levame will have all ridley's and komovai all herring (closest to help - OTML/Obo Station - with Lake Murray type herring densities).

For the second phase we will start again with a new batch of hatchery fish using the two best sites/farmers from the first phase (each with one replica) to do a 6 month 50% herring:50% ridley trial AND/OR other variants we may decide at the time based on the outcomes of phase 1. As noted above the other farmers will continue a 100% herring trial. All the way through we will run the trial in 3 month batches, making decisions at the conclusion of each period how many fish to grade out etc.

### **South Fly (4 sites)**

1 x ocean channel site (2 cages)

2 x estuary sites (Parama with 3 cages available & Katatai 1 cage)

1 x FW lake (1 cage)

This time we only have the two variants given the revised design - 100% garfish and 100% ridleys.

I will have the channel & FW lake all Ridleys, Parama (using 2 cages only) & Katatai all garfish.

Same as above applies for phase 2.

Hope this makes sense and is at least a good starting point for discussion.

On other matters I have picked up a couple of manuals from Richard at the NFC - "A Guide to Phytoplankton of Aquaculture Ponds - collection/analysis/ID" by Chris Stafford. I have had a look through and it looks good including pictures of what the little buggers (diatoms) look like under the microscope.

I am leaving on Sunday to do an anchor deployment trip throughout the Middle Fly so will discuss some of these possibilities with the respective farmers.

Regards

Ian

### **AGENDA for Fifth Teleconference of the ACIAR/PNGSP Steering Committee** **Tuesday 15<sup>th</sup> September 2009**

#### **Review and discuss any issues from previous meeting minutes**

- Further discuss conversation between Geoff and Ian after the last failed teleconference
- Ian to provide background on his new role as CEO for OTFRDP and the continuing link with the WPSA Program

#### **Update on hatchery building construction**

- Yatala Property Developers progress with hatchery construction
- Aquasonic Team schedule for commissioning

### **West Province Sustainable Aquaculture (WPSA)**

- Discuss and agree on final cage culture trial experimental design\Latest from Ridley's regarding feed supply and maturation diet
- Conservation project scoping trip update

### **Site visit options in 2009**

- As I have now settled into the new role at OTDF, we should firm up the site visit options – mid October to early November best for me

### **Assistance required from the Committee**

- Technical aspects of the cage culture trial experimental design
- Transferring the broodstock from the holding facility to the hatchery

### **Other business**

- Daru Port Project deferred indefinitely
- Issues from the panel
- Next teleconference date

### **NOTES on the Fifth Teleconference**

**Participants:** Geoff Allan, Ian Middleton, Mike Rimmer and Helena Heasman

1. A very successful hook-up between all parties. Separate conversations were held between Geoff Allan and Ian Middleton and Geoff Allan and Mike Rimmer following the last failed teleconference. The panel congratulated Ian on his new appointment as CEO of the Ok Tedi Fly River Development Program (OTFRDP). Ian explained that he would continue the linkage with the Western Province Sustainable Aquaculture (WPSA) Program under PNGSDP. The OTFRDP is responsible for 9 areas, 600,000 people and has 1 billion Kina to invest between now and 2013. SDP and OTML will continue to buy fingerlings and Ian will have control of the hatchery over a longer term. OTFRDP has more independence from MTML and is predominantly focussed on delivery. Ian is reviewing all projects and plans to regionalise management. Different regions have different needs. The business plan will be complete by 30 March and the entity will be up and running by 30 June. Greg Barney is playing an important understudy role to Ian. Greg and Havini may be involved in future teleconferences – perhaps towards the end of the year.
2. Update on construction. Opening has been postponed until November as the barge carrying materials was delayed. The hatchery building is finished and painting to be completed before the Aquasonic commissioning on 12-16 October. There are some pumping issues – the intake pipeline isn't able to pump 24 hrs – only on 2.6 m tides. It may be that the pipeline is too small or that it sits up too high. Production might have to be scale down. A report is being prepared on the pumping problems and Ian will report back at the next teleconference. (Hatchery plans are attached at Appendix 3).

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## **6. PNGSDP/ACIAR Barramundi Program Steering Committee: Report following PNG Site visit December 2009**



Trip Report.pdf

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## **7. Conclusions and recommendations**

Conclusions and recommendations are contained within the Trip Report (Section 6).



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## 8. Appendixes

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### 8.1 Appendix 1: Project Proposal



Project Proposal.pdf

## 8.2 Appendix 2: PNG SDP 2009 & 2010 Steering Committee Costs

PNGSDP 2009 & 2010 STEERING COMMITTEE COSTS								
Assistance/Support	Unit Cost		No. of Units	2009	2010	Total Cost	Effective Date	Comments
<b>WP SUSTAINABLE AQUACULTURE LTD</b>								
POM Accommodation	1,800	per trip	4	7,200	3,600	10,800	1-Jan-09	Pre booked by PNGSDP - Holiday Inn or equivalent
DAU Accommodation	600	per trip	4	2,400	1,200	3,600	1-Jan-09	Pre booked by PNGSDP
Lake Murray/OBO Accommodation	900	pa	1	900	0	900	1-Jan-09	Booked through OTML
POM/Daru & return Travel	3,000	return trip	2	6,000	3,000	9,000	1-Jan-09	Maximum 2 Round trips per annum
Daru/Lake Murray/Obo & return Travel	2,250	pa	1	2,250	0	2,250	1-Jan-09	1 Round trip per annum
M'Fly Field Trip Staff & Resources through OTML	2,550	pa	1	2,550	0	2,550	1-Jan-09	Staff/fuel/logistics to support orientation trip to the Middle Fly growout sites
S'Fly Field Trip Resources through Daru office	1,050	pa	1	1,050	0	1,050	1-Jan-09	Fuel/logistics to support orientation trip to the South Fly growout sites
Per diem outside POM	1,200	per trip	2	2,400	1,200	3,600	1-Jan-09	Expenses in Province
<b>TOTAL COST OF PNGSDP SUPPORT</b>			<b>PGK</b>	<b>24,750</b>	<b>9,000</b>	<b>33,750</b>		

Note that all figures are in PNG Kina (K 1.00 = AUD 0.59) - When this budget was first drawn up K 1 = AUD 0.40

Total Cost of PNGSDP Support = K 33,750 or AUD \$19,783 - When this budget was first drawn up K33,750 = AUD 13,500

Site visits to the Middle & South Fly cage culture sites will be a one off orientation trip for the entire term

While all members make the first orientation trip it is expected that any one member will be recalled to Daru NO more than once throughout the term

Consequently all associated costs are halved in 2010

**At this point there has not been any allowance made for admin staff costs to take/compile minutes & printing etc during PNG trips or for teleconference expenses - determine once ACIAR costs established to ensure approx 50:50 split**

<b>ACIAR SUPPORT</b>								
Airfares - Geoff NTL-BNE-NTL	200	return trip	2	400	200	600		Pre-booked by ACIAR
Airfares - Geoff BNE-POM-BNE	1200	return trip	2	2400	1200	3,600		Pre-booked by ACIAR
Airfares - Craig HOB-BNE-HOB	300	return trip	2	600	300	900		Pre-booked by ACIAR
Airfares - Craig BNE-POM-BNE	1200	return trip	2	2400	1200	3,600		Pre-booked by ACIAR
Airfares - Mike JAK-CNS-JAK	1350	return trip	2	2700	1350	4,050		Pre-booked by ACIAR
Airfares - Mike CNS-POM-CNS	600	return trip	2	1200	600	1,800		Pre-booked by ACIAR
Per diem in POM 2 days for 3 people	600	per trip	2	1200	600	1,800		Pre-booked by ACIAR
<b>TOTAL COST OF ACIAR SUPPORT</b>			<b>AUD</b>	<b>10900</b>	<b>5450</b>	<b>16,350</b>		

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### 8.3 Appendix 3: PNGSDP ACIAR Presentation 0508



PNGSDP ACIAR  
Presentation 0508.pc

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## 8.4 Appendix 4: Hatchery plans



HATCHERY 101.pdf



HATCHERY 102.pdf



HATCHERY 103.pdf



HATCHERY 104.pdf



HATCHERY 105.pdf



HATCHERY 106.pdf