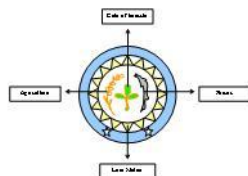




Fisheries Development in the Com-Tutuala-Jaco Island Region - Final Report



Timor-Leste Coastal / Marine Habitat Mapping, Tourism & Fisheries Development Project



Date: November 2012

Acknowledgement

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Dr Julie Lloyd (DPIFM, NT Government), Narciso Almeida de Carvalho (MAF-Fisheries)

5 November 2012.



Executive Summary (English)

Project Title: Fisheries Development in the Com-Tutuala-Jaco Island Region

Project Leaders: Julie Lloyd (NT Fisheries, DPIFM), Narciso de Carvalho (MAF-Fisheries)

Project Participants: Julie Lloyd (DPIFM), Chris Errity (DPIFM), Karl Howard (DPIFM), Kane Dysart (DPIFM), Jamie Damaso (DPIFM), Narciso de Carvalho (MAF-Fisheries), Carlos Jesus (MAF-Fisheries), Jose Monteiro (MAF-Fisheries), Celestino Da Cunha Barreto (MAF-Fisheries), Gregorio dos Santos (MAF-Fisheries), Rafael Pereira Gonçlaves (MAF-Fisheries)

Project Summary

The objective of this collaborative project was to examine fisheries-related activities which had the potential to increase the economic base of the population within the Com-Tutuala- Jaco Island region without compromising the social and cultural values of the Fataluku people. To achieve this objective the potential of the following fisheries-related activities was investigated:

- Recreational fishing
- Artisanal capacity building including fish handling techniques, business skills and fishing co-operatives
- Increasing Timor-Leste women's role in fishing
- Development of a Community Consultation and Marine Ranger programs similar to those developed by NT Fisheries
- Development of ecotourism fishing lodges

The findings of this study indicated that the recreational fishing potential is very good, particularly for spear fishing. Jaco Island also offers the recreational fisher the opportunity to fish for marlin, sailfish, tuna and reef fish all in the same area.

However, it is recommended that recreation fishing numbers are kept low. This would minimise the impact on the community culturally and the demand for resources (such as water), which is in limited supply. It is felt that a strategy for tourism similar to that developed by aboriginal communities in Arnhem Land would provide economic benefits to the community while minimising social impacts. It would be beneficial if representatives from the Tutuala community and Haburas Foundation could undertake a study tour of Arnhem Land communities which are successfully engaged in ecotourism, to observe how they run and market their business.

In addition to ecotourism there is also the opportunity to obtain additional income by providing a small research station. This could be built within the same complex as the ecotourism village. The area around Jaco Island is very interesting from a scientific and biodiversity perspective. The establishment of the Nino Konis Santana National Park is an indication of this. The research station could provide facilities for both marine and terrestrial scientists.

The artisanal fishing capacity could be improved with assistance from organisations such as Secretariat of the Pacific Community (SPC) or FAO. This should also include training in fish handling and marketing which would assist in increasing the value of fish that are caught.

The role of women in fishing should be encouraged and promoted by developing links with women in fisheries operations within Australia, particularly the NT Aquarium fishery which has similar species to Timor-Leste and a high level of women participants.

NT Fisheries programs such as the Aboriginal Consultative Committee and the Community Marine Ranger Program have assisted communities to develop stronger links with the Government and have provided a formal forum for aboriginal people to bring issues which affect them to the Government's attention as well as providing training and employment within the communities. These programs could be used as a model for the development of similar programs in Timor-Leste. It would be beneficial for Timor-Leste fisheries officers to travel to the Northern Territory and spend time with counterparts in the Indigenous Liaison Group with NT Fisheries to discuss these programs in further detail and observe first-hand how it operates within the communities in Arnhem Land.

Sumáriu (Tetum)

Titulu Projetu: Fisheries Development in the Com-Tutuala-Jaco Island area.

Lider sira Projetu nian: Julie Lloyd (NT Fisheries, DPIFM), Narciso de Carvalho (MAF-Fisheries)

Partisipante sira iha Projetu ne'e: Julie Lloyd (DPIFM), Chris Errity (DPIFM), Karl Howard (DPIFM), Kane Dysart (DPIFM), Jamie Damaso (DPIFM), Narciso de Carvalho (MAF-Fisheries), Carlos Jesus (MAF-Fisheries), Jose Monteiro (MAF-Fisheries), Celestino Da Cunha Barreto (MAF-Fisheries), Gregorio dos Santos (MAF-Fisheries), Rafael Pereira Gonçlaves (MAF-Fisheries)

Sumáriu

Projetu ida-ne'e ninia objetivu mak atu haree ba atividade ne'ebé iha relasaun ho peska, ne'ebé iha potencialidade atu hasa'e ekonomia-baze populasaun iha rejiaun Com-Tutuala-Jaco ninian, no sei la kompromete ema Fataluku sira-nia valór sosiál no kulturál. Atu hetan objetivu ida-ne'e, halo ona investigasaun ba potencialidade husi atividade sira ne'ebé iha relasaun ho peska hanesan tuir mai ne'e:

- Peska rekreativu
- Kapasitasaun artezenál, inklui téknika kona-ba oinsá atu lida ho ikan, koñesimentu komersiál no kooperativa iha área peska ninian
- Promosaun ba feto Timor-Leste nia papél iha área peska nian
- Dezenvolvimentu kona-ba Komité Konsultivu Aboríjine no Guarda Marinha nia programa sira ne'ebé hanesan ho programa sira ne'ebé *Northern Territory (NT) Fisheries* desenvolve ona
- Dezenvolvimentu kona-ba guarida (lodges) ba peska eko-turizmu

Rezultadu husi estudu ida-ne'e hatudu katak peska rekreativa iha potencialidade di'ak tebes, liliu kona-ba peska ho diman (spear fishing). Illa Jaco oferese mós oportunidade ba peskadór rekreativu sira atu peska ikan *marlin*, *sailfish*, ikan-atún no ikan-meti (reef fish) iha fatin ida de'it.

Maibé, iha lia-menon ida katak presiza mantein númeru peska rekreativu ne'e ki'ik nafatin. Medida ida-ne'e bele hamenus inpaktu ba comunidade nia moris, iha ninia aspetu kulturál, no ba ezijénsia kona-ba rekursu sira (hanesan bee) ne'ebé ninia kuantidade limitadu. Estratéjia ba turizmu, hanesan ho estratéjia ne'ebé comunidade aboríjine sira desenvolve iha Arnhem Land, bele fó benefísiu ekonómiku ba comunidade no hamenus inpaktu sosiál. Di'ak tebes se representante sira husi comunidade Tutuala no Fundasaun Haburas halo vizita-estudu ida ba comunidade sira iha Arnhem Land, ne'ebé envolve ho susesu iha eko-turizmu, atu bele haree oinsá comunidade sira-ne'e hala'o no komersializa sira-nia negósiu.

Hatutan tan ba eko-turizmu, iha mós oportunidade atu hetan rendimentu adisionál bainhira oferese estasaun-peskiza ki'ik oan ida. Bele tau estasaun-peskiza ne'e iha duni uma sira ne'ebé harii iha vila eko-turizmu nia laran. Área sira hadulas Illa Jaco ne'e interesante tebes, husi perspetiva sientífiku no bio-diversidade. Harii Parke Nasionál Nino Konis Santana ne'e sinál ida ne'ebé hatudu ne'e duni. Estasaun-peskiza ne'e oferese fasilidade ba sientista sira kona-ba tasi nian (marinho) no rai nian.

Ho tulun husi organizasaun sira hanesan Pacific Community (SPC) ka Food and Agriculture Organisation (FAO), ita bele hadia peska artezenál ninia kapasidade. Tulun ne'e tenke mós inklui formasaun kona-ba oinsá atu lida no halo komersializasaun ba ika, ne'ebé bele tulun atu hasa'e ikan ne'ebé ita kaer ninia valór.

Tenke mós fó korajen no promove feto nia knaar iha kontestu peska nian, liu husi ligasaun ho feto sira ne'ebé envolve iha operasaun peska nian iha Australia laran, liliu iha *NT Aquarium Fishery* ne'ebé iha ikan (species) hanesan ho Timor-Leste ninian no ne'ebé feto sira iha envolvimentu aas.

Programa sira husi *NT Fisheries*, hanesan Komité Konsultivu Aborijine no *Community Marine Ranger Program*, fó ona tulun ba comunidade atu dezenvolve ligasaun maka'as ho Governu no oferese ona forum formál ida ba ema aborijine sira atu foti problema ne'ebé afeta sira-nia moris ba Governu, no mós fó formasaun no servisu iha comunidade sira. Bele uza programa hirak ne'e hanesan modelu ida hodi dezenvolve programa sira hanesan ne'e iha Timor-Leste. Di'ak tebes ba Timor-Leste se funsionáriu sira husi área peska nian ba to'o iha Northern Territory no hela iha ne'ebá iha tempu balu nia laran ho sira-nia parseiru sira iha *Indigenous Liason Group with NT Fisheries* atu diskuti ho detalle boot liu tan kona-ba programa sira-ne'e no haree rasik ho matan oinsá mak programa ne'e funsiona iha comunidade sira iha Arnhem Land nia laran.

Sumário Executivo (Portugese)

Título do Projecto: Fisheries Development in the Com-Tutuala-Jaco Island Region.

Líderes do Projecto: Julie Lloyd (NT Fisheries, DPIFM), Narciso de Carvalho (MAF-Fisheries)

Participantes no Projecto: Julie Lloyd (DPIFM), Chris Errity (DPIFM), Karl Howard (DPIFM), Kane Dysart (DPIFM), Jamie Damaso (DPIFM), Narciso de Carvalho (MAF-Fisheries), Carlos Jesus (MAF-Fisheries), Jose Monteiro (MAF-Fisheries), Celestino Da Cunha Barreto (MAF-Fisheries), Gregorio dos Santos (MAF-Fisheries), Rafael Pereira Gonçaves (MAF-Fisheries)

Sumário

O objectivo deste projecto é examinar as actividades relacionadas com a pesca que têm o potencial de aumentar a base económica da população na região Com-Tutuala-Jaco sem comprometer os valores sociais e culturais dos Fatalukos. Para alcançar este objectivo, investigou-se o potencial das seguintes actividades relacionadas com a pesca:

- Pesca recreativa
- Capacitação, nomeadamente, em técnicas de manuseamento do pescado, técnicas de negócios e cooperativas de pesca
- Aumento do papel de mulheres timorenses na pesca
- Desenvolvimento de programas de Comité Consultivo Aborígene e Guardas Marinhos, semelhantes aos desenvolvidos pelo Northern Territory Fisheries
- Desenvolvimento de alojamentos para ecoturismo de pesca

Os resultados deste estudo indicam um bom potencial da pesca recreativa, especialmente para a caça submarina. A ilha de Jaco também oferece ao pescador recreativo a possibilidade de pescar espadim, espadartes, atuns e peixes de recife numa mesma área.

No entanto, é recomendado que o número de pescadores recreativos seja mantido baixo. Deste modo, minimizar-se-ia o impacto cultural na comunidade e sobre os recursos (como água) que são limitados. Uma estratégia para o turismo, semelhante à desenvolvida por comunidades aborígenes em Arnhem Land, poderia trazer benefícios económicos à comunidade, minimizando os impactos sociais. Seria benéfico organizar uma visita de estudo de representantes da comunidade de Tutuala e da Fundação Haburas, a comunidades de Arnhem Land, que se dedicam com sucesso ao ecoturismo, de modo a observarem como estas gerem e comercializam o seu negócio.

Para além do ecoturismo, há também a oportunidade de obter rendimento adicional pela dotação de uma pequena estação de investigação. Esta poderia ser construída no mesmo complexo de ecoturismo. A área circundante de Jaco é muito interessante de um ponto de vista científico e de biodiversidade, com o que é indicado pelo estabelecimento do Parque Nacional Nino Konis Santana. A estação de investigação poderia oferecer condições para cientistas marinhos e terrestres.

A capacidade artesanal de pesca pode ser melhorada com assistência de organizações internacionais como o Secretariat of the Pacific Community (SPC) ou a FAO. Esta assistência deveria incluir formação em técnicas de manuseamento e comercialização do pescado que ajudariam a aumentar o valor do peixe capturado.

O papel das mulheres na pesca deve ser encorajado e promovido, pelo desenvolvimento de ligações a mulheres envolvidas em operações de pesca na Austrália, principalmente na pescaria de peixes de aquário no Northern Territory que tem espécies semelhantes às de Timor e um elevando número de mulheres participantes.

Programas do Northern Territory Fisheries como o Comité Consultivo Aborígene e o Programa Comunitário de Guardas Marinhas ajudaram as comunidades a desenvolver ligações mais fortes com o Governo e tornaram-se um fórum formal onde os aborígenes podem trazer à atenção do Governo assuntos que os preocupam, bem como um local onde se pode dar formação e emprego dentro das comunidades. Estes programas poderiam ser usados como modelos para o desenvolvimento de programas semelhantes em Timor-Leste. Seria benéfico para os funcionários da DNPA (Direcção Nacional de Pescas e Aquicultura de Timor-Leste) irem ao Northern Territory e passar algum tempo com as contrapartes no Grupo de Ligação Indígena do Northern Territory Fisheries para discutir com mais pormenor estes programas e observar, *in loco*, como funcionam com as comunidades de Arnhem Land.

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1 INTRODUCTION

1.1 Background to the Project

Timor-Leste has one of the lowest GDP per capita in the world and has the lowest Human Development Index (HDI) of any of the ASEAN countries (UNDP, 2006). Around 40% of the population live below the income poverty line which is set at \$0.55 per capita per day, with the majority of this group living in the rural areas (UNDP, 2006).

Hence there is an immediate need in Timor-Leste to increase living standards, ensure food security for the local population, provide employment and rebuild the country's infrastructure. While progress has been made since Independence, particularly in Dili, however in the remote rural areas there is a need to improve basic infrastructure and provide opportunities for employment and training. As part of a strategy to address these needs, the Timor-Leste Government has sponsored "The Timor-Leste Coastal/Marine Habitat Mapping for Tourism and Fisheries Development Project", which is aimed at the development of ecotourism and fisheries in the remote north eastern section of Timor-Leste. This project is one of six projects undertaken in a research partnership between the Timor-Leste Government and Charles Darwin University, and encompasses the following six sub-projects:

- *Coastal/Marine Habitat Mapping – Timor Leste*
- *Coastal & Marine Ecotourism on the North Coast of Timor Leste*
- *Megafauna Surveys for Ecotourism Potential*
- *Jaco (Jaku) Marine Park – Timor Leste's First Marine Protected Area (MPA)*
- *Fisheries Development in the Com-Tutuala- Jaco Island area*
- *River Catchments and Marine Productivity in Timor Leste – Caraulun Catchment to Coast*

These sub-projects are being undertaken by Australian Institute of Marine Science (AIMS), James Cook University (JCU), Australian National University (ANU), Charles Darwin University and the Northern Territory Departments of Primary Industry Fisheries and Mines (DPIFM) and Natural Resources Environment and Arts (NRETA) in collaboration with Timor-Leste Ministry of Fisheries and Forestry (MAFF).

This report describes the work undertaken by staff from the Timor-Leste Ministry of Fisheries and Forestry (MAFF) and the Northern Territory Department of Primary Industry Fisheries and Mines (DPIFM) on "Fisheries Development in the Com-Tutuala-Jaco Island area"

1.1.1 Background of the Region

The area around Jaco Island is renowned for its coral reefs, pristine waters, and spectacular landscape and has been identified as an area for potential tourist development (particularly ecotourism).

The study area lies within the District of Lautem, a region renowned for its sandy beaches, lush tropical vegetation and rugged, mountainous landscape. The remoteness of this area has preserved many of the endemic flora and fauna, as well as cultural links from the past as observed from the number of cave paintings, stone sarcophagi and animalistic shrines.

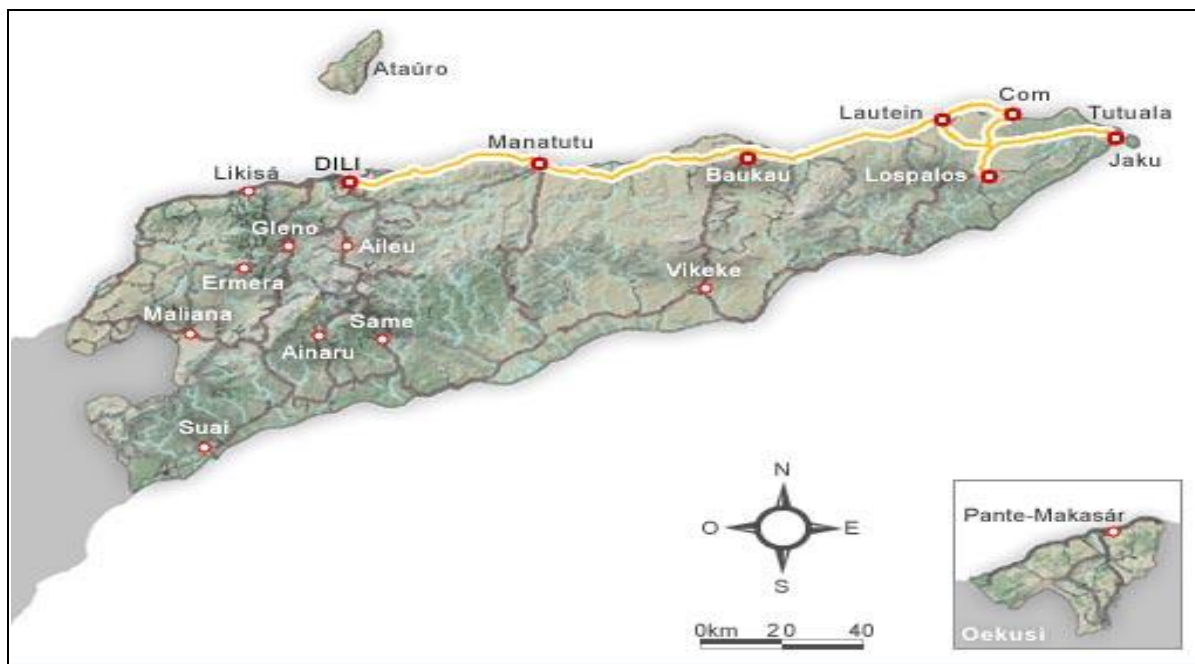


Figure 1 Map of Timor-Leste.

The uniqueness of this region has been recognised in Timor-Leste as demonstrated by the declaration of the Nino Konis Santana National Park.

1.1.2 Social and cultural structures

While Catholicism is the primary religion, animistic traditions underline this belief system, and customary practices are still strong in Fataluku society.

Relationship with the land is an integral part of Fataluku society, and the also extends to the natural resources contained within the land. The rights to the land, sea and natural resources contained within it have been bestowed in mythical times from the founding ancestors. The harvesting of these resources forms part of the complex social exchange relationships relating to social obligation and reciprocity which are a fundamental part of the Fataluku social structure. The basis of this is the agnatic groups (ratu) and affinal alliances. The agnatic groups are the

family of origin groups which are maintained through the paternal line and the affinal alliances are created by marriages between ratus (McWilliam, 2007).

1.1.3 Socio-economic situation in the region

Within this eastern region of Timor-Leste artisanal fishing and subsistence farming provide the main source of income for the majority of the communities. This is supplemented to a limited extent in some areas by the sale of traditional tais (traditional weaving) as well as basket weaving and other crafts. There is also a small amount of tourism focused around Com, Jaco Island and Valou beach. Significant impediments to economic development in this region is the lack of infrastructure; particularly electricity and the poor state of the roads.

In Com, there is a Chinese fishing company “Parkway”. This company’s operations are primarily focused on the Sahul Banks. Fish are unloaded in Com, but the catch is transferred to a mother ship and transported to Asian markets. Although this company is undertaking construction of office buildings and wooden boats, this is being carried out by Chinese nationals and it appears that there is only a small amount of flow on income from these operations into the local community.

1.2 Project goals

The purpose of this project was to undertake a pre-feasibility study to determine what fisheries capacity building could be undertaken in this remote, pristine region of Timor-Leste which would link with the ecotourism focus of the over-arching research partnership project.

The specific project objective was to examine ways to increase the economic base of the population through fisheries-related activities within the Com-Tutala- Jaco Island region without compromising the social and cultural values of the Fataluku people.

To achieve this objective the potential of the following fisheries-related activities was investigated:

- Recreational fishing
- Artisanal capacity building including fish handling techniques, business skills and fishing co-operatives
- Increasing Timor-Leste women’s role in fishing
- Development of a Community Consultation and Marine Ranger programs similar to those developed by NT Fisheries
- Development of ecotourism fishing lodges

2 STUDY DESIGN PLAN

The design of the study was undertaken in three phases:

- a) Desktop study and field planning strategy
- b) Reconnaissance trip undertaken in September 2007
- c) Field work undertaken in October 2007.

2.1 Desktop study

The first stage of the project was to gain a comprehensive understanding of the region in terms of physical environment, infrastructure, logistics for field work, social structure and culture of the local communities, as well as the Timor-Leste government's strategy for Fisheries development. An investigation was also undertaken on what fisheries projects had previously been undertaken in Timor-Leste since Independence to ensure that there was no duplication of work.

Due to the small project budget as well as ongoing civil unrest in Timor-Leste there was limited opportunities for Northern Territory (NT) staff to spend much time in Timor-Leste, particularly in the earlier planning stages of the project. Therefore the desktop study was crucial in providing this background information on all aspects of the project.

Concurrent with the desktop study we developed a field planning strategy to determine the field work logistics and this was continually refined as more information from the desktop study became available. The original plan was to do a reconnaissance trip several months before the field work to see the sampling area first hand and from this trip determine the logistics of undertaking a field program. Unfortunately due to the on-going civil unrest, the reconnaissance trip was delayed several times and eventually undertaken one month before the field work. This delay meant that the purpose of the reconnaissance trip changed from a fact-finding trip to assist in planning, to one which was aimed at confirming the information and planning approach that had been determined in the desk top study. Hence the desktop study became a much larger component of the project than originally anticipated.

The prime methods for this investigation were:

- a) Internet
- b) Northern Territory Department of Primary Industry Fisheries and Mines (DPIFM) registry files on projects and assistance given to Timor-Leste
- c) Speaking with people either currently or previously involved in marine activities in Timor-Leste.
- d) Scientific and "grey" literature.

2.2 Reconnaissance trip

A reconnaissance trip was undertaken to enable the Australian project participants to gain a better understanding of Timor-Leste, the field site and the logistics of conducting the planned work. It also gave project participants from both countries the opportunity to meet each and discuss project expectations and the roles each organisation would play in each project.

The reconnaissance was undertaken from 17-23 September 2007. A full description of this trip is found in Appendix 1.

2.3 Field trip

The field trip to investigate the recreational fishing potential and fisheries development within the Com-Tutuala-Jaco Island region was undertaken from 15-28 October 2007. A full description of this trip is found in Appendix 2.

3 INFORMATION EVALUATION

3.1 Information from desktop study

The desktop study provided valuable information which enabled the project team to focus on the aspects of the project brief that would be logistically feasible and potentially best suited to the needs of the community in this region.

Key Information from the desktop study is outlined below:

3.1.1 Physical environment and field logistics

A large amount of information on the physical environment was provided by the Google Earth web site. This provided the Northern Territory (NT) researchers with a good overview of the geographic features of the Com-Tutuala-Jaco Island area and coastline. Valuable information was also provided by Ms Patricia Puig who has visited Tutuala numerous times over the past seven years as part of her PhD studies. Ms Puig's description of the physical environment around Tutuala, and Jaco Island provided valuable insights into the logistical difficulties of sampling in this area. Therefore the decision was made to base field operations in Com, which provided a more accessible harbour and travel to Jaco Island and other sampling sites from there.

Accommodation at the time of planning the project was not available for a large number of people in Tutuala, however there is now a newly completed ecotourism village at Valou Beach where field work could be under taken in the future.

3.1.2 Fisheries undertaken in this region

Descriptions of fishing activity were provided by Mr and Mrs Puig who had visited Tutuala and Jaco Island area shortly before this project started. They advised us that fishers in this area confined themselves to the shallow inshore areas, and would travel across to fish around Jaco Island, but did not fish the deeper waters where the currents were very strong.

The Puig's observed that fishing was from small canoes; some with outboard engines. They used handlines to fish for reef fish and rocks were used for sinkers. Spear fishing was undertaken with handmade spears and wooden handmade goggles.

Mr Sasha Muller, who had run a dive company for several years in Timor-Leste, also provided information on fishing techniques that he had observed during his time in Timor-Leste.

3.1.3 Previous fisheries projects undertaken in Timor-Leste

From our investigations we found the following fisheries projects had been undertaken since Independence:

- Emergency assistance to the artisanal fisheries sector of East Timor through the supply of fishing gear (FAO, 2001).
- Contrasting the effects of fishing effort on the abundance of three exploited reef fishes in Dili Harbour, East Timor (AusAid, 2003).
- Australia East Timor fisheries management capacity building project (AusAid, 2003-2006)
- Assessment of existing aquaculture technology and infrastructure in East Timor (Crawford Fund, 2005).
- Training of East Timorese fisheries officers in fisheries licensing and control procedures (Crawford fund, 2005).

The reports from these projects gave us valuable insight into what fisheries work had been undertaken, what had succeeded and what still required attention. Most of these projects are aimed at the whole of Timor-Leste, whereas this project is aimed at the community level in one area.

3.1.4 Timor-Leste strategic plan for Fisheries

The Ministry of Agriculture, Forestry and Fisheries in Timor-Leste is finalising a document entitled “**The Future for Fisheries**”, which outlines the policies and strategies that Timor-Leste will adopt regarding the sustainable development of its fish resources. Five key objectives are outlined in the plan as follows:

- Optimum use and management of Aquatic Living Resources
- Habitat conservation

- Fishing Industry development
- Aquaculture Industry development
- Development of Fisheries Institutions

The principles that form the basis of this strategic plan are:

- Sustainable development
- Informed decision making
- Community participation
- Capacity building
- Gender
- Private sector based development
- Efficient provision of government services
- Cost recovery
- Transparency.

Recommendations from this project will link-in with the strategic vision for fisheries development in Timor-Leste.

3.1.5 National Park

The establishment of the Nino Konis Santana National Park and a Marine Protected Area (MPA) associated with this is an integral part of the Timor-Leste Government's commitment to preserving fish habits and managing their living resources as indicated in the "Future of Fisheries" document. Our project falls within this National Park and therefore all recommendations for fisheries capacity building will be aligned with the objectives of the Nino Konis Santana National Park.

3.1.6 Social and cultural structures

Discussions with Mrs Puig's about her visits to Tutulua provide valuable insights into the social and cultural structure of this community. Likewise input from Dr McWilliam during team meetings and the literature he provided assisted in obtaining a regional perspective of the area. From these discussions we noticed that there were strong parallels between traditional Timor-Leste society and traditional aboriginal culture in Australia. These similarities were far greater than between our Western society and Fataluku culture. Therefore we sought assistance from the

Aboriginal liaison team within the NT Fisheries Division to determine if successful projects such as the Aboriginal Fisheries Consultative Committee and Marine Ranger programs, developed by Fisheries would be applicable to Timor-Leste. Mr Karl Howard from the Aboriginal Liaison team was brought into the project to assist in this task.

3.1.7 NT Aboriginal fisheries programs

As indicated in section 3.1.6., early discussions with anthropologists with expertise in Timor-Leste culture, suggested that fisheries programs developed by the NT Fisheries Aboriginal liaison team may be applicable to the communities in Timor-Leste. Therefore a detailed description of these programs is given below.

3.1.7.1 NT Marine Ranger Program

The Northern Territory Government began funding community sea ranger groups in 2002 under the Indigenous Community Marine Ranger Program and continues to allocate annual grants of \$60, 000 to eight sea ranger groups. These grants are tied to special conditions, specifying the reporting requirements for each group.

Fisheries funded Marine Ranger groups are:

- Anindilyakwa Sea Rangers (Groote Eylandt);
- Djelk Sea Rangers (Maningrida);
- Gumurr Marthakal Rangers (Galiwinku);
- Lianthawirriyarra Sea Rangers (Borrooloola);
- Mardbalk Marine Rangers (Warruwi);
- Numbulwar Numburindi Ama-Lhagaya-Yinyung Sea Rangers (Numbulwar);
- Thamarrurr Sea Rangers (Wadeye); and,
- Tiwi Marine Rangers (Tiwi Islands).

Marine Rangers patrol their local waters for any unusual vessel movements which may indicate foreign fishing incursions, fish kills, marine debris, unmarked or unattended crab pots or fishing nets (including reporting of licence numbers and pot counts) or sacred site incursions. The Marine Rangers also play an important educational role within their communities for both visitors and locals. In addition, many of the rangers have gained qualifications as Boating Safety Inspectors for recreational and pleasure craft. Marine Ranger groups have also been engaged in a number of search and rescue activities.

The Indigenous Community Marine Ranger Program has assisted in the employment of some 47 Aboriginal rangers. Rangers have gained valuable skills and training that are capable of being used in other professions such as the fishing industry. In 2007, one ranger gained part-time employment as a Fishing Tour Operator.

It is felt that a similar program could be established in Timor-Leste to provide training and employment to the local communities.

3.1.7.2 Aboriginal Fisheries Consultative Committee

The Northern Territory Government began the establishment of Aboriginal Fisheries Consultative Committees (AFCC) in 1993. The committees were set up as a consultation process. The purpose of the establishment of these committees was to provide a forum for discussions between Aboriginal locals, Fisheries, NT Police, Northern Territory Seafood Council, Amateur Fishermen's Association of the NT and the Northern Land Council (NLC). This also provided the Northern Territory Government an opportunity to inform Aboriginal people on management practices and any relevant matters regarding sea country issues. Aboriginal members use this forum to raise matters of importance relating to sea country. The committees also provide a mechanism for the Aboriginal members to share their expertise and local knowledge with Government agencies and departments. They promote co-operation between Aboriginal groups, people from nearby coastal communities, the Northern Territory Government, Recreational and Commercial fishing industries.

The AFCC represent approximately two thirds of the NT coastline. There are currently seven AFCC, but only 3 are operating at the moment. These 3 consist of the Anindilyakwa Consultative Committee, Manbuynga Ga Rulyapa Consultative Committee, and the Tiwi Coastal Waters Consultative Committee.

The committees generally meet twice per year and meetings usually take place in the relevant community to allow for greater participation. The meetings are Chaired/Convened by Fisheries staff and the Minutes reported by the Fisheries Group Aboriginal Liaison Officer. The Minutes from each meeting are forwarded to members and guests and are also forwarded to the Minister and Chief Ministers Office.

It is felt that many of these issues are also relevant to Timor-Leste communities and that a similar body could be established to provide a link between the central government and the communities.

3.1.8 Cultural ecotourism in Arnhem Land

Several aboriginal communities in Arnhem Land have successfully engaged in ecotourism fishing lodges and it is felt that a similar enterprise could be undertaken in Timor-Leste.

There are strong parallels with this eastern region of Timor-Leste and Arnhem Land, both in terms of remoteness and desire of the local communities to preserve their culture and traditional life style, but also recognising the need for income and employment opportunities.

Arnhem Land covers an area of 97,000km² and is one of the five regions of the Northern Territory. It was declared an Aboriginal Reserve in 1931 to assist in preserving the culture and traditions of the indigenous people. Its remoteness and limited access has ensured that much of the NT coastline has remained in a pristine condition.

The NT has always been a magnet for recreational fishing, with the most sort-after species being Barramundi. In more recent years, many recreational fishers have been seeking the more remote and pristine conditions for the "wilderness experience". This has led to several local recreational fishing companies joining in partnership ventures with local aboriginal clans. This allows the local communities to obtain much needed income both in the form of rental for the

land upon which the tourist village is built and employment of community members as tourist guides, dancers and other cultural activities. This has resulted in limited and controlled development of tourist resources within the community, without impinging upon the lifestyle of the community. It also gives tourists the chance to engage in community life and to obtain a better understanding of the cultural life of the aboriginal people who are custodians of the area. As tourist groups are deliberately kept small (usually less than 12 people), this ensures that these groups do not overwhelm the community. It is also accepted that cultural responsibilities, such as funerals will take precedence over any planned tourist activities.

An example of such a joint venture is the Arnhem Land Barramundi Lodge which has been set up in partnership with the Bawinunga Aboriginal Corporation (BAC) in Maningrida; a distance of approximately 400 km from Darwin by road. The BAC comprises the 16 clans of this region and has been set up to coordinate economic development and employment opportunities for the clans in this region.

This Lodge offers a complete fishing and cultural experience, with activities such as bird watching, nature tours and aboriginal cultural tours to complement the fishing experience. The cultural tours are interactive and guests spend time visiting the different clan estates, visiting ancient rock art sites and experiencing the natural beauty of the region from rocky uplands, woodland and floodplains to beaches and mangroves.

As this area has no electricity, generators are used to provide electricity. The accommodation is comfortable, but not luxurious and is designed to blend into the environment. Full details can be found on <http://www.barralodge.com.au/>.

The key to the success of these fishing lodges in Arnhem Land has been to keep numbers small and to target the exclusive high priced end of the market. The natural resources in both areas are limited and fragile and can't withstand high numbers of tourists. In both areas water is limited and generators must be used for electricity. Due to the remoteness of the areas, everything must be bought in, which makes tourist operations expensive to run. In Arnhem Land tourist operators have realised that dedicated recreational fishermen are willing to pay high prices for a unique fishing experience in a remote pristine environment with good quantities of sports fish. It is felt that the same formula could be applied to the Tutuala-Jaco Island area.

In summary, the desktop study provided key information in the following areas:

- Physical environment and sampling logistics
- Social and cultural aspects of Fataluku society
- Potential for improved efficiency of artisanal fishing methods
- Improved fish handling methods
- Successful examples of cultural eco tourism undertaken by indigenous communities.

3.1.9 Outcomes of Reconnaissance trip

The reconnaissance trip was undertaken to enable the Australian project participants to gain a better understanding of Timor-Leste, the field site and the logistics of the planned work. It also gave project participants from both countries the opportunity to meet each and discuss project expectations and the roles each organisation would play in each project.

In addition to visiting the Com-Tutuala-Jaco Island area where the project was based, project participants also spent a day on Atauro Island visiting an ecotourism resort and observing the fishing methods of the Atauro Island fishermen.

The reconnaissance trip enabled project participants to agree upon the same approach, it also gave Australian project participants a better understanding of the conditions in Timor-Leste. This trip also gave preliminary information about the skill levels of the fishermen of Timor-Leste and their fish handling techniques. It appears that the fishermen of Atauro Island are very skilled and their fishing methods are more complex than those used by fishers in the eastern area of Timor-Leste.

Details of this reconnaissance trip are found in Appendix 1.

3.1.10 Outcomes of field trip

To investigate the potential of recreational fishing, we used a number of different methods and recreational fishermen with an exceptionally high level of experience. A full description of the methods used and results from this trip is found in the trip report in Appendix 2.

As this was a small project with a limited budget, investigations were qualitative rather than quantitative. A combination of methods was used to obtain an overall picture of the fisheries potential rather than fish abundance per se.

The findings from this trip indicated that the recreational fishing potential is very good particularly for spear fishing. Jaco Island also offers the recreational fisher the opportunity to fish for marlin, sailfish, tuna and reef fish and undertake spear fishing all in the same area, and close to shore.

4 DISCUSSION

4.1 Recreational fishing potential

The week of field work undertaken around Com and Jaco Island indicated that this area showed good recreational fishing potential; however the results from this study are qualitative and should be regarded as preliminary. A more detailed survey would be required to determine seasonal patterns, tidal and current variations, as well as differences in spatial abundance of target species.

Jaco Island is unique as it offers the recreational fisher, the opportunity to engage fishing for a diversity of species, both reef and pelagic species in the same area.

It appears that the best reef fishing in the Com area is found on the edge of the reef in the 20-50 m depth range. Away from the reef edge there is a steep drop to a sandy habitat which is devoid of fish. The reef fishing around Jaco Island is more extensive as there is substantially more reef habitat. This habitat extends from the shore to approximately 200 m offshore, after which there is a drop to the abyss of the Wetar Strait. Jaco Island also has the advantage of providing shelter and therefore fishing could be undertaken in all weather conditions.

As this study utilised a number of different fishing techniques at different times of day and conditions, it was not possible to determine with certainty the best time of day for fishing the target species. However the general observations were that the late afternoon from 4.30 pm onwards was better for reef fishing. Little reef fishing was undertaken in the early predawn/dawn period as we were usually hauling the trammel net or travelling to Jaco Island. Observing the local fishermen it was noted that they targeted reef fish using handlines starting pre-dawn and finishing by 10 am or spear fishing, which is undertaken in the mornings and late afternoon. Trolling for pelagics was undertaken in the late afternoon until sun set. No fishing was observed during the day in this region, although on our previous visit to Timor Leste we observed fishermen at Autero Island using gillnets during daylight hours to catch fusiliers and scads.

We believe that the recreational spear fishing potential is enormous, particularly at Jaco Island. Dog-tooth tuna, one of the most highly prized fish for spearfishermen due to its strength and speed was observed in large numbers around Jaco Island relatively close to shore. This is a huge advantage for spearfishermen who normally travel considerable distance offshore to find these species. Mr Sellers' recent article in the magazine "Australia Spearfishermen" (Appendix 3) has led to serious interest in the spear fishing fraternity both within Australia and overseas. As a result an elite group of top Australian spearfishermen are planning a spear fishing expedition to Valou Beach and Jaco Island in October 2008. This expedition headed by Mr Sellers, includes Dr Adam Smith, Mr Brett Vercoe, Dr Richard Pilliens, Mr Anelo Loi, Mr Geoff Becrott and Mr Ric Faleau. The group intend to stay for one week, and base themselves at the ecotourism village at Valou Beach, and hire local boats when required. Having this group of highly respected spearfishermen visit the area will assist in putting Timor-Leste on the map as a first-rate spear fishing destination.

The project team found the pelagic species harder to locate. There appeared to be a lack of bait schools and sea birds, and without these indicators it was hard to locate schools of pelagics to target. Therefore efforts were concentrated on following current lines and this resulted in finding a reasonable number of fish schools. Despite having good strike rates, the number of pelagics landed was low. This was due to several reasons including difficulty keeping the vessel on the fish marks and maintaining the vessel at the correct speed when the lines were struck. Although a reasonable number of pelagic species were encountered, they were not in the abundance that we expected when compared with similar habitats in the Northern Territory. It is uncertain whether this was due to seasonal factors or whether there has been netting of the waters for tuna by Indonesian fishermen resulting in a decline of pelagic species. We also noted few sharks compared with similar environments in Australia. This was observed both visually

when diving and there were few encounters when line fishing, which may indicate that there has been significant netting of these waters.

The development of recreational fishing is specifically linked to the policy objective optimum use and management of living aquatic resources. Under this objective, goal 1.6 recognises the value of marine tourism, such as recreational fishing and states that this activity can co-exist with subsistence artisanal fishing (Timor-Leste Government report, 2006). Therefore development of recreational fishing in Timor-Leste is strongly aligned with the Government's vision for fisheries development within the country.

4.2 Development of recreational fishing and its effect on the local community

The development of a recreational fishing industry is not expected to have any significant adverse effects on the local community. The local fishermen concentrate on the protected inshore waters, whereas the recreational fishers would focus on the deeper waters, for species such as marlin, sailfish, and tuna, which are prized for their strength and speed. In inshore waters, recreational fishers target the delicate tasting species such as coronation trout, coral trout and snappers, whereas the local community prefers the stronger tasting species such as trevally, mackerel, wahoo.

However, it is recommended that recreation fishing numbers are kept low and targeted to the exclusive high priced end of the market. This would minimise the impact on the community culturally and the demand for resources such as water, which is in limited supply. It is felt that a strategy for tourism similar to that developed by aboriginal communities in Arnhem Land would provide economic benefits to the community while minimising the social disturbance. There are many parallels between the communities in Timor-Leste and Arnhem Land in terms of remoteness, limited employment opportunities, and the desire to improve the economic standards within the community without sacrificing their culture or natural resources. The Haburas Foundation has been working with the community of Tutuala to promote the development of ethical tourism within this region. Together with the local community they have built an ecotourism resort (Figure 2) at Valou Beach opposite Jaco Island, which will provide a base for tourists to enjoy this area and to provide employment for the community, both directly at the ecotourism resort and indirectly through sale of art wares and souvenirs.



Figure 2 Ecotourism village at Valou Beach.

The Haburas Foundation has also spent time explaining to the community the principals of ecotourism; focusing on the importance of maintaining culture while providing economic development and sustainable management. Therefore the community of Tutuala is well placed to increase tourist numbers.

In addition to this ecotourism venture which is targeted to the budget end of the market catering primarily for back packers and foreign workers, there is also the potential for an upmarket lodge where the requirements of overseas guests are well understood and catered for. This resort should also be run along ecotourism principals, and would also employ staff from the local community, but the management of the resort would require staff with considerable experienced in this area. Likewise fishing tour operators experienced in game fishing would also be needed. However the community could engage in a partnership arrangement with an outside operator in a similar manner to the communities in Arnhem Land.

It would be beneficial if representatives from the Tutuala community and Haburas Foundation could undertake a study tour of Arnhem Land communities which are successfully engaged in ecotourism, to observe how they run and market their business. There may also be opportunities in the future for joint marketing campaigns to promote cultural ecotourism within the Timor-Leste-Australia region.

In addition to ecotourism there is also the opportunity to obtain additional income by providing a small research station. This could be built within the same complex as the ecotourism village. The area around Jaco Island is very interesting from a scientific and biodiversity perspective. The establishment of the Nino Konis Santana National Park is an indication of this. The research station could provide facilities for both marine and terrestrial scientists.

The research facilities do not need to be complex. There are many such facilities throughout remote areas within Australia and other countries which could be used as a model for a similar facility at Valou Beach.

The development of ecotourism resorts also links with goal 1.6 of the Government's policy objective for optimum use and management of living aquatic resources and its strategy of educating communities about the value of marine tourism (Timor Leste Government report 2006).

4.3 Artisanal capacity building

It was observed that fishing pressure by the local people is relatively light, and is subsistence fishing practiced together with farming. Fishing is limited to a few hours a day in the early morning or late afternoon. Most fishermen are content to catch enough for to satisfy their family's need and sell only within the village or to the occasional tourist. A few fishermen sell their fish in Baukau and Los Palos, but these are small quantities a few times a week. Hence, the greatest immediate need is to improve markets, handling and filleting.

There is also a need to improve the efficiency of artisanal fishermen. In many cases fishermen are forced to use less efficient methods as they do not have the money to buy better equipment. An example of this is the home made lures which are used by fishermen in Com and Tutuala. Although these fishermen would prefer to use the lightweight artificial lures produced in Australia, they are prohibitively expensive. Likewise the homemade spears are no match for the larger stronger fish, but commercially produced spears are unaffordable for the average fishermen. Unless some form of financial assistance, e.g. grants, low-cost loans, is given to purchase fishing equipment it is unlikely fishermen in the present situation could afford to upgrade their fishing techniques.

From our observations fishermen at Com and Tutuala-Jaco Island area appear to use a limited number of fishing techniques; there may be other low-cost artisanal fishing techniques which may improve fishing efficiency. There has been extensive research and training undertaken by the Secretariat of the Pacific Community (SPC) in artisanal fishing methods and an expert from this organisation or other similar organisations could assess whether improvements could be made in fishing efficiency, and provide the relevant training if required.

Improvements in artisanal fishing capacity are directly linked to the Government's policy objective of developing a sustainable, efficient and profitable fishing industry.

4.4 Fish handling practices

Fish handling methods are generally very poor throughout Timor-Leste. The common practice we observed during our two visits was to display fish without ice on road-side stands or hang fish from trees for hours during the heat of the day. The majority of fish we saw showed obvious signs of purification. While ice is in limited supply, there are other ways of keeping fish cool and extending their freshness, however no attempt appeared to be made to do this. The Secretariat of the Pacific Community has excellent training programs targeted to developing countries and very good training manuals (which are available on their web site). Improvement in fishing handling techniques is needed if there is to be an expansion of ecotourism. There is also underutilisation of the potential market targeting foreign workers. The reluctance of this group to purchase local fish is mainly due to its poor quality. Simple improvements in this area would result in significant increases in income for fishermen, particularly in Dili.

Small ice making machines are available and information on appropriate machines was given to Timor-Leste Fisheries Officer's during our initial reconnaissance visit. An excellent FAO publication on the use of ice on small fishing vessels FAO Fisheries technical paper 436) is available from the FAO web site <http://www.fao.org/fishery/> and provides useful information on the use of ice and chilled sea water in vessels ranging from dug-out canoes to refrigerated tanks on larger vessels. It also describes the different types of ice, methods for production of ice, advantages and disadvantages of different types of ice and chilling systems, information on insulated containers, and estimation of quantities of ice needed with respect to fish holding containers.

While fishermen do smoke and dry fish, the product we observed was of poor quality. Improvements in these techniques would also assist in increasing fishermen's income. Many of the fishing communities are remote areas with poor roads and therefore it is not feasible to send fresh fish to Dili or the larger towns, however good quality smoked and dried fish could be transported to these larger centres.

4.5 Business assistance and training

There are other improvements artisanal fishing capacity, including development of business and marketing skills which could be utilised from other developing countries; however this would require an expert, possibly from the SPC to assess what improvements could be made and provide the necessary training. This would require funding either from internal sources or through aid money.

4.6 Improving the involvement of women in fishing

Women in Timor-Leste have a marginal role in fishing. They participate in activities such as the sea worm festival and shore base activities such as picking shellfish from rocks at low tide (Figure 3). However they do not appear to have a role in the commercial fisheries. The development of an Aquarium fishery has been identified as a potential fishery which Timor-

Leste women could become involved. In the Northern Territory, there are a significant number of women participating in this fishery and they also play an active part in the fishery committee. It would be beneficial if a selected number of women from the communities of Com and Tutuala could undertake a study tour of Aquarium fishery operations in the Northern Territory and develop links with women in this area in Australia. The Australian organisation, "Women in Agriculture Association" could be approached to build links with women in Timor-Leste to assist in empowerment of women, by developing business and marketing skills.



Figure 3 Woman harvesting shellfish from the reef at Com.

4.7 Fisheries Consultative Committees

Timor-Leste fisheries officers showed considerable interest in the Aboriginal Fisheries Consultative Committees which had been established by the Northern Territory Government to provide a formal forum for discussions between the local communities, NT Government and other stakeholder groups such as the Amateur Fishermen's Association, NT police and NT Seafood Council. This provides a forum for aboriginal people to raise issues of concern relating to their sea country, for the Government to inform aboriginal people of relevant management issues and to promote co-operation between the groups.

Discussions with fishermen in different communities on both our visits to Timor-Leste expressed frustration at not being able to put their views directly to the central Government. Therefore it is felt that a similar model could be established in Timor-Leste to provide a link between the central government and the communities. It would be beneficial for Timor-Leste

fisheries officers and representatives from the communities to spend time with officers from the NT Fisheries Aboriginal liaison Group and visit communities which are engaged in this process.

4.8 Marine Ranger Program

The Marine Ranger Program, described in detail in section 3.1.7.1, has been a successful program that has provided training and employment in eight communities in Arnhem Land. Although the program has only been going six years and has a small budget, it has provided valuable surveillance information, as well as information on marine debris, fish kills and fishing infringements. The Marine Rangers also provide an educational role within their community for both visitors and locals. The skills that the rangers obtain through this program are also transferable to other professions, thereby enhancing employment opportunities outside their community.

This program could be used as a model for a similar program in Timor-Leste as the boating skills and marine training would be equally applicable to communities in Timor-Leste. It would be beneficial for Timor-Leste fisheries officers to travel to the Northern Territory and spend time with counterparts in the Indigenous Liaison Group with NT Fisheries to discuss the program in further detail and observe first-hand how it operates within the communities in Arnhem Land.

The promotion of a Community based Fisheries Management Strategy and active co-management between communities and the Government features prominently in the “*Future for Fisheries*” policy and strategy document.

5 RECOMMENDATIONS

5.1 Further development of ecotourism

The development of a community-based ecotourism village at Valou Beach provides an excellent foundation for the further development of ecotourism in this area. The Haburas Foundation has developed a successful partnership with the local community which includes education in the principals of ecologically sustainable development as well as practical assistance in the construction of the ecotourism village. Further development of this ecotourism venture would be assisted with further financial support and training. It would be beneficial if representatives from the Tutuala community and Haburas Foundation could undertake a study tour of Arnhem Land communities which are successfully engaged in ecotourism, to observe how they run and market their business.

There is also a niche for an upmarket lodge targeting overseas guests, particularly those interested in fishing the pelagic species and game fish such as marlin and sailfish in the deeper waters.

5.2 Artisanal fishing capacity building

There is also a need to improve the efficiency of artisanal fishermen. This could be achieved through grants or low-cost loans to purchase better fishing equipment.

There may be other low-cost artisanal fishing techniques which could improve fishing efficiency. An appraisal of the artisanal fishing efficiency could be undertaken by an expert from SPC or FAO to determine if other fishing techniques should be introduced.

5.3 Fish handling practices

Fish handling methods are generally very poor throughout Timor-Leste. It is recommended that an expert in fish handling and marketing techniques be engaged to provide training in this area. Improvement in fishing handling techniques is needed if there is to be an expansion of ecotourism. There is also underutilisation of the potential market targeting foreign workers as this group is reluctant to purchase local fish due to its poor quality. Simple improvements in this area would result in significant increases in income for fishermen, particularly in Dili.

5.4 Involvement of women in the Fishing industry

Women in Timor-Leste have a marginal role in fishing. It would be beneficial if a selected number of women from the communities of Com and Tutuala could undertake a study tour of fishing operations in Australia where women have active involvement. The development of links with women in fishing in Australia should be encouraged. The Australian organisation, "Women in Agriculture Association" could be approached to build links with women in Timor-Leste to assist in empowerment of women, by developing business and marketing skills.

5.5 Fisheries Consultative Committees

Community based groups such as the Marine Ranger program and the Aboriginal Fisheries Consultative Committees could be used as a model for a similar program in Timor-Leste. It would be beneficial for Timor-Leste fisheries officers to travel to the Northern Territory and spend time with counterparts in the Indigenous Liaison Group with NT Fisheries to discuss the program in further detail and observe first-hand how these programs operate within the communities in Arnhem Land.

6 CONCLUSIONS

The objective of this project was to examine fisheries-related activities which had the potential to increase the economic base of the population within the Com-Tutala- Jaco Island region without compromising the social and cultural values of the Fataluku people. Three main focus areas which showed the greatest potential for linking with the ecotourism focus of the other partnership projects.

These were:

- Recreational Fishing
- Community engagement and Marine Ranger program
- Artisanal fisheries capacity building

The study indicated that the recreational fishing potential is very good particularly for spear fishing. Jaco Island also offers the recreational fisher the opportunity to fish for a marlin, sailfish, tuna, reef fish and undertake spear fishing in the same area.

The local communities in this area are keen to have some limited tourism as long as it is ecologically sustainable and culturally undestructive. It is believed that the development of a recreational fishing tourism would be suitable for this area and be aligned to these goals. A small research station could also be incorporated into the same facility and would assist in bringing in additional foreign income outside the tourist period.

The artisanal fishing capacity could be improved with assistance from organisations such as SPC and FAO and also improvements in fish handling and marketing would assist in increasing the value of fish that are caught.

The role of women in fishing activities should be encouraged and promoted by developing links with women in fisheries operations within Australia, particularly the NT Aquarium fishery which has similar species to Timor-Leste and a high level of women participants.

NT Fisheries programs such as the Aboriginal Consultative Committee and the Community Marine Ranger Program have assisted communities to develop stronger links with the Government and have provided a formal forum for aboriginal people to bring issues which affect them to the Government's attention as well as providing training and employment within the communities. These programs could be used as a model for a similar program in Timor-Leste.

7 REFERENCES

Mc Williams, A. (2007). Customary claims and the public interest: Fataluka resource entitlements in Lautem. In “East Timor Beyond Independence”. (Damien Kingsbury and Michael Leach, editors). Monash University Press, Clayton.

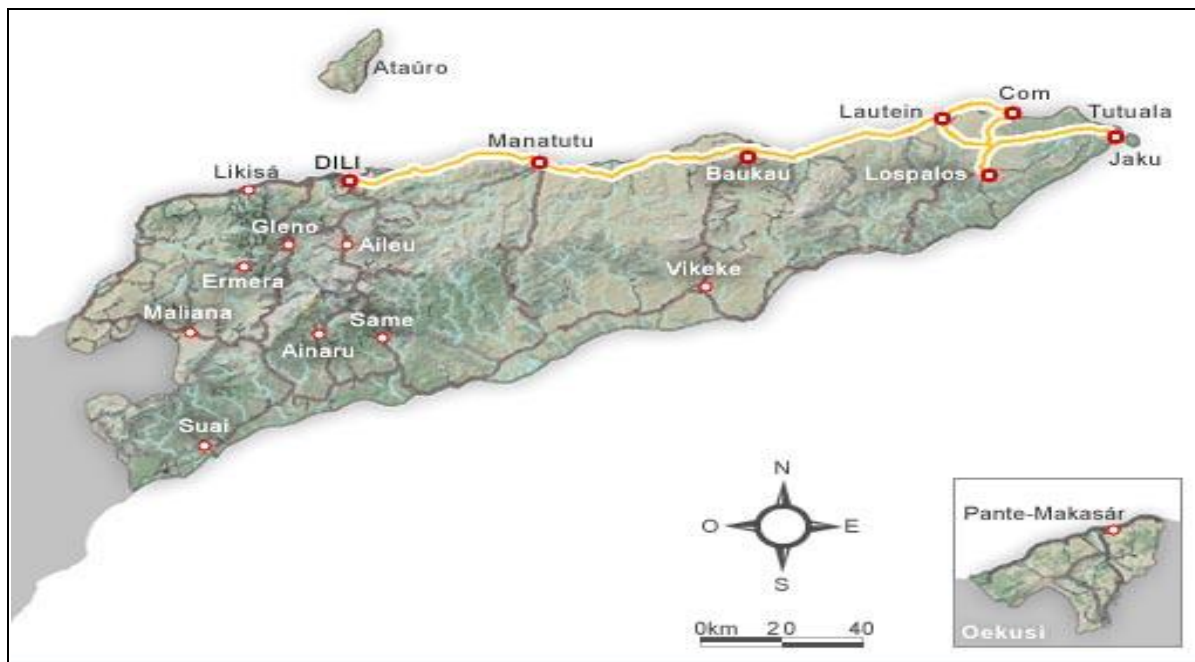
Timor-Leste Government (2006). The Future for Fisheries: a Policy and Strategy for the responsible development and management of the Fisheries of Timor-Leste, NDFA, MAFF.

Appendix 1.

RECONNAISSANCE TRIP REPORT

Timor-Leste

17-23 September 2007



Prepared by

Julie Lloyd

Chris Errity

Karl Howard

Introduction

A reconnaissance trip was undertaken to enable the Australian project participants to gain a better understanding of Timor-Leste, the field site and the logistics of conducting the planned work. It also gave project participants from both countries the opportunity to meet each and discuss project expectations and the roles each organisation would play in each project.

Initially this reconnaissance trip originally scheduled for June 2007, but was delayed until September 2007 due to civil unrest during 2007 in the lead up to the Presidential elections

Meeting of project participants

The initial meeting of all project participants took place on 17 September at the Ministry of Agriculture, Forestry and Fisheries in Dili, where NT staff were welcomed by Snr Mr. Acácio Guterres (National Director of Fisheries and Aquaculture) and Snr Narciso de Carvalho (Director of Fisheries Resources Management). Introductions were made and Ms Lloyd apologised for NT volunteer staff who were unable to attend due to NT Government concerns about insurance coverage. She explained that the purpose of the visit by NT staff was to meet with Timor-Leste collaborators on the project, to visit the proposed sampling sites to determine field logistics for the field trip next month and to meet with community groups in the area to introduce project staff and explain what we would be doing during our field studies. She also explained that after undertaking a desk top study of what fisheries projects had been undertaken in Timor-Leste and speaking with as many people as possible in Darwin who had knowledge of the Com-Tutuala-Jaco Island area, there appeared to be three main focus areas which showed the greatest potential for linking with the ecotourism focus of the Charles Darwin University research projects.

These were:

- Recreational Fishing
- Community engagement and Marine Ranger program
- Artisanal fisheries capacity building

Mr Karl Howard spoke about the Indigenous Marine Ranger program in Arnhem Land (NT) (section 3.2.1.), which he leads and the Aboriginal Fisheries Consultative Committees (section 3.2.2.) which provide a link between the indigenous communities and government. This has enabled the communities to bring local issues to the attention of the Fisheries Division and to have a more active role in management of their fisheries resources. Mr Howard also spoke about how the indigenous communities in Arnhem Land have retained control of small ecotourism operations in their communities.

Mr Errity spoke about his recreational fishing expertise and the potential for the development of recreational fishing in Timor-Leste, particularly at the high priced end of the market. He gave

examples of the successful establishment of fishing lodges in partnership with local communities in Arnhem Land.

Ms Lloyd explained that the fisheries capacity building within the project was aimed at increasing efficiency while still maintaining harvesting at an artisanal level. She cited material from the SPC which had successfully achieved this. She also noted the need to improve fish quality and mentioned that the project would be looking at ways to achieve this, including low-priced ice for fishers.

Ms Cathy Molnar (Department of Protected Areas and National Parks) joined the meeting and apologised for the absence of her colleague Snr Manuel Mendes (Director of Protected Areas and National Parks).

It was agreed that a meeting should take place the following day between Ms Molnar, Snr Manuel Mendes, MAF staff and NT Fisheries staff to ensure that there was no overlap or conflict in aims between the two projects.

Trip description

Tuesday 18 September-Atauro Island

The following day project participants travelled to Atauro Island to speak with local fishermen about their fishing methods and what species they caught. The majority of fishing vessels were small dug-out canoes with outriggers for stability; some had small 15 hp outboards. During our visit some local fishermen returned to the beach with a large catch of fusiliers caught using a 3" gill net (Figure 1). A few surgeon and jobfish were also caught. From our observations and discussions with fishermen, it appears that spearing fish with locally made wooden spear guns, gillnetting and handline fishing are the most common methods for capturing fish. The gill nets used are predominately monofilament with a 2 m drop and an average mesh size of 3 inches.

Fishers were shown a copy of a Timor Leste fish guide and asked to point to the species they caught locally and with what method. It appears that snappers, sweetlips, emperors, trevallies and cods are caught by spear fishing and hand lining, whereas gill nets target smaller species such as fusiliers and scads. Other species targeted by spear fishing include surgeon fish, wrasses, parrot fishes and also painted crayfish and octopus.



Figure 1.1 Fishermen on Atauro Island clearing a gill net.

Mr Howard noted that some fishing techniques used by the local people are similar to those used by Indigenous coastal people in the Top End. For example he observed the Atauro Island women went out in waist-deep water and fished the outgoing and incoming tide, something he has seen many times in Arnhem Land.

Another interesting observation he made was how the men in the canoes all circled large schools of fish and herded them up like dolphins and either used spears on the larger fish or used the three inch mesh net to catch their food for the day for all village people. The similarities of the hunter gatherer lifestyle that Timorese people (villagers/farmers in particular) do on a daily basis are almost identical to Indigenous coastal people in the Top End.

There is a small eco-tourism venture on Atauro Island, which focuses on activities such as snorkelling, diving and fishing. The accommodation is huts made from local materials.

After returning from Atauro Island, NT staff met with Ms Cathy Molnar, Manuel Mendes, Snr Carlos Jesus, Snr Narciso de Carvalho at Hotel Dili for further discussions on the project in relation to the Nino Konis Santana National Park project.

Ms Molnar and Snr Mendes explained the background and present status of the Nino Konis Santana National Park. Discussions centred on community engagement and other links between the projects. Snr Mendes offered to send one of his staff members on the recognisance trip to Com, Ms Lloyd accepted and thanked him for this offer.

Wednesday 19th September

NT staff travelled to Com accompanied by the following Timor-Leste staff:

- Jose Monfeiro (Fisheries Resources Management)
- Rafael Pereira Gonçlaves (Marine Park, Protection and Conservation)
- Celestino Da Cunha Barreto (Fisheries Resources Management)
- Pedro Pinto (Manager National Park)
- Carlos Jesus (Fisheries Resources Management)

Thursday 20th September

Prior to visiting Tutuala we visited the Agriculture and Fisheries District headquarters at Lospalos (a two hour drive from Com) where we were welcomed by Almeida Fernandes Xavier (Head of Agriculture and Fisheries) and his staff. Snr Xavier was very pleased that we took the time to provide an overview and was very interested in the project. He is looking forward to seeing the outcomes being implemented for his district. We were also introduced to Snr Olavio Monteiro (District Administrator).

From Lospalos we proceeded to Valou Beach, opposite Jaco Island, which had been identified as a sampling site. We saw recently constructed tourist amenities (see Figure 2) and spoke with a local fisherman who was working as the security guard. He was shown a copy of the fish guide and asked what species were found in the area. He reported seeing nearly all fish listed, with hammerhead sharks being the only species not seen. He mentioned that he occasionally had problems with sharks biting the fish as they were being hauled. He fished mainly with handlines and trolling from a canoe (Figure 3). He also mentioned that many pelagic and snapper species were caught in this area around Jaco Island.



Figure 1.2 Tourist amenities on Valou beach opposite Jaco Island.

There was also evidence of smoking racks on the beach (Figure 4). We asked about this and it was explained to us that the fish were butterflyed for smoking.



Figure 1.3. Project staff examine a local fishing boat.



Figure 1.4 Bamboo racks for smoking fish.

We travelled approximately 500 m down the road to an ecotourism village that our Timor-Leste collaborators told us was being constructed as a partnership venture between the Tutuala community and a NGO group (Figure 5).



Figure 1.5. Ecotourism village under construction adjacent to a beach near Jaco Island.

We drove back to the village of Tutuala where we spoke with the village Head (Antonio Fonseca) who told us that the community of Tutuala had met and agreed to an ecotourism venture and had decided how it should occur. He said ecotourism was to be based upon three principals:

- Culture
- Economic Development
- Sustainable Management

These principals were to be underpinned by six criteria for the development of ecotourism.

- Transportation
- Accommodation
- Food
- Souvenirs
- Cultural Events
- Security

He told us that the last five criteria need to be provided by the community and the first by the Timor-Leste Government. They want tourists to engage with the community and the direct benefits to go to the community.

Snr Jose Monferia who spoke the local dialect explained the purpose of our visit to the Village Head (Snr Fonseca). Snr Monferia explained that we would be back in three weeks with a large boat and fishing gear including nets to undertake research sampling. I asked him to tell Snr Fonseca that any fish we catch would be given to the community. Snr Fonseca offered the assistance from his fishermen to help us in our sampling and I thanked him for his support.

Upon our departure NT staff presented Snr Fonseca with a gift of 12 boxes of fish hooks for the fishermen in his village.

Friday 21 September

We spent the day at Com looking over fishing operations. We initially walked to the village from the Com Resort where we noted a few aluminium boats with outboard engines; however the majority of the boats are canoes with outriggers. The main fishing methods are spear fishing, trolling, handlining and gill netting.

We were introduced to Snr Anselmo Frernades Xavier, a fisherman from Com who showed us fish he had caught a couple of nights ago. These included a large yellow-fin tuna, red bass and

long-nosed emperor (Figure 6). Snr Xavier caught these species trolling and with handlines (Figure 7).

The fish were well looked after and kept on ice in a large esky. Snr Xavier explained that he had a buyer in Baukau who he rang when he had enough fish. He usually fished three nights, and then rests two nights.



Figure 1.6 Snr Anselmo Frenades Xavier (right) showing some of his catch.



Figure 4.7 Fishing gear used by Snr Xavier.

We then proceeded to the Com jetty where we observed a local boat unloading as we arrived. Fish had been taken from gill nets and placed in four litre plastic buckets for transportation to Lospalos for sale. Fish were taken from the boat to the motorbike as quickly as possible.

We then visited the Chinese fishing company “Parkway” construction site at the end of the Com jetty where we were shown around by the Timor-Leste Harbour Master. Construction of office building etc was being undertaken by Chinese labourers. A large wooden boat was being built. We were told that this boat was to be used for transportation of live fish from Com fishermen to holding cages a short distance offshore for the live fish trade.

Parkway staff requested that we do not take photographs. Pathways also own four vessels which operate on the Sahul Banks and unload at Com where a mother ship takes the fish to Asian markets.

From Com we were taken 7 km to an Industrial zone where a Fisheries lab was being constructed. We were told that this lab will undertake quality control tests on fish.

Saturday September 22

Project staff returned to Dili

Sunday 23 September

NT staff departed Dili for Darwin

Reconnaissance trip outcomes

The reconnaissance trip enabled project participants to agree upon the same approach, it also gave Australian project participants a better understanding of the conditions in Timor-Leste and allowed us to finalise logistics; both in terms of how we would sample, as well as what we would need to bring and what was available locally.

This trip also gave us preliminary information about the skill levels of the fishermen of Timor-Leste and their fish handling techniques. It appears that the fishermen of Atauro Island are very skilled and their fishing methods are more complex than those used by fishers in the eastern area of Timor-Leste.

Appendix 2.

FIELDTRIP REPORT

Timor-Leste

15-28 October 2007



Prepared by

Julie Lloyd

Chris Errity

Kane Dysart

Jamie Damaso

Introduction

The second trip to Timor-Leste was undertaken from 15-28 October 2007. The purpose of this trip was to undertake the necessary field work to investigate the recreational fishing potential and fisheries development within the Com-Tutuala-Jaco Island region.

As this was a small project with a limited budget, investigations were qualitative rather than quantitative. A combination of methods was used to obtain an overall picture of the fisheries potential rather than fish abundance per se.

A 40 foot charter boat, Island Lady (Figure 1) was hired for field work. The decision to hire a large vessel from Dili rather than small local dinghies was due to the fishing gear we intended to use and the need to travel long distances and target deeper waters offshore. Field operations were based in Com as this provided the best Port facilities for a large boat and accommodation for a large group of people.



Figure 2.1 “Island Lady” charter boat used for field work.

To investigate the potential of recreational fishing, we used a number of different methods and recreational fishermen with an exceptionally high level of experience. The recreational team consisted of Chris Errity, Kane Dysart and Richard Sellers and logistical support was provided by Julie Lloyd, Jamie Damaso and Santos, and Jose Monifero (MAF).

Field work consisted of the following components:

- Investigation of the recreation fishing potential using a number of popular recreational fishing methods.
- Investigation of the potential of a commercial fishery in deeper water (100-150 m) using a dropline machine
- Documentation of fishing techniques presently used by commercial fishermen in the Com-Tutuala-Jaco Island region.
- Discussions with local fishermen to ascertain what limitations they experience with respect to both fishing and marketing.
- Investigate the potential of cultural ecotourism similar to Arnhem Land.

RECREATIONAL FISHING METHODS

Field work was undertaken over seven days and the following recreational fishing techniques were used:

Jigging

Involves fishing with heavy Game fishing tackle to target pelagic and reef fish. The jigs used in this project were lead and made in the likeness of small baitfish. They ranged from 50-150 g and came in a variety of colours. Fishing depths ranged from 10-70 m depending upon the species targeted.

Jigging involves free spooling the jig until it reaches the bottom, then jigging it in an erratic action using the rod tip to attract the fish's attention. This works particularly well on reef fish. When targeting pelagic species in the mid-water the jig is dropped to the bottom before being reeled in at top speed to induce a strike.

Reef Fishing

This involves using fresh mackerel fillet as bait on heavy Game fishing tackle with a basic paternoster reef fishing rig, where the hook is placed above the sinker. We used 8/0 size J-hooks in depths ranging from 10-40 m.

Trolling

Lures of varying sizes and designs on heavy Game fishing tackle were trolled over long distances targeting shoals, reef edges and current lines for pelagic species such as Spanish mackerel, tuna and wahoo. The average troll speed was around 7 knots and this allowed both surface lures and diving minnows to work well. When trolling for a variety of species it is important to put out a spread of lures that cover all depths. We also used fresh rigged skipping gar rigs to try and attract strikes from billfish we had sighted in the area, particularly sail fish.

We had three lines out most of the time with one skirted lure on the surface, a skipping gar rig on the surface and a deep diving minnow obtaining depths of up to 8m. Most strikes occurred on the deep diving lures, although we also had success with lures that swam at depths to 5m they were not hit as often as the deeper diving lures. A teaser was also used when trolling. This consisted of a line placed about 10 metres from the back of the boat with a daisy chain of brightly coloured plastic squids splashing around in the prop wash of the boat. This attracts the pelagic species towards the boat where they will hopefully see the lures and strike them.

Casting

We also tried casting large poppers around the reef edges in the hope of catching pelagic species like Spanish mackerel, giant trevally and dogtooth tuna. Large spin stick rods with large high speed retrieve spinning reels were used for this type of fishing. Poppers are large surface lures that create much splash and commotion when retrieved quickly. They take on the appearance of a baitfish fleeing a predator.

Commercial fishing method

An automated dropline reel was used to investigate the potential reef fishing off the deeper ledges around 100-150m in depth. This was attached to the side of the vessel. The reel was spooled with a 1000m of 200lb braided line and had a heavy monofilament 200lb leader rigged with five 10/0 circle hooks. The bait used was fresh mackerel fillet. The hooks were rigged above a large lead sinker weighing close to a kilo.

Fishing was undertaken by travelling over the ledges looking on the sounder for rocky bottom with signs of fish. Once a school was located, the line was dropped onto it. When a “nibble” was felt the line was hauled immediately. Lines were left for a maximum soak time of 15 minutes, if no significant “nibbles” were felt in that time, the line was hauled and another fish school was sought.

Field Work

Monday 15 October

The Northern Territory project participants (Julie Lloyd, Chris Errity, Kane Dysart and Jamie Damaso) arrived in Dili on Monday 15 October and spent the day undertaking the necessary organisation for the field trip to Com.

Tuesday 16 October

The remaining NT participant Richard Sellers arrived in Dili. As there were delays in the sampling gear that had been shipped to Dili clearing Customs, it was decided to spend the day investigating recreational fishing spots around Dili and travel to Com the following day. The NT team headed to the Christa Ray statue where Mr Sellers went diving. The currents were very strong which made diving difficult; however during his 40 minute dive he saw a Maori Sea Perch and several small snappers (*Lutjanus* spp.).

Wednesday 17 October

After spending the morning waiting for boxes of gear to clear Customs without success, it was decided that Northern Territory and Timor-Leste participants would set off to Com and Captain Jim Cato, owner of the charter vessel, would continue to follow up with Customs on obtaining the sampling gear and bring it on the boat to Com the following day. Project participants arrived in Com at 5 pm.

Thursday 16 October

It was decided to do as much land-based fishing as possible around Com until the charter vessel arrived.

Messers Sellers and Errity went diving on the beach outside the Com resort from 7-9 am. Mr Sellers speared a rainbow runner, cod and crayfish, but missed his shot at large mackerel. He also saw a large trevally which he estimated to be around 20 kg, a rosy jobfish, green jobfish, long nosed emperor, Maori Seaperch and Sweetlip. Mr Errity observed a red bass, a sea bream and various snapper species.

Mid-morning the team walked from the Com Resort to the Com jetty, to see what fish could be observed around the pylons. The jetty is a very substantial concrete structure, which was constructed during Indonesian occupation for military purposes. It is approximately 300 metres long, although sections of it have fallen into disrepair due to concrete cancer. However it is still usable and large fishing vessels owned by the Chinese Company Parkway are able to berth and unload there without any apparent problems. Although it needs some repair it is still a valuable infrastructure asset for the area.

Our general impression from walking around the Com Jetty was that this area is fairly devoid of fish, probably due to spear fishing by locals.

We observed a local fisherman's catch which included coronation trout and red bass. These had been caught by line fishing.

Mid afternoon (2-4 pm) was spent fishing. Mr Dysart caught a blue-finned trevally off the rocks 2 km from Com in deep water using "a popper" and Mr Sellers speared a Spanish mackerel.

Friday 19 Oct

The next morning the team continued fishing in the general area around the Resort. Mr Errity observed Long Toms, Barracuda, Queenfish and Permi. Although Mr Sellers sighted numerous fish while diving during this period he was not successful in spearing any.

During this time a local fisherman brought in 3 yellow spot cod, coronation trout, red bass, 3 rosy jobfish (2 large, 1 small), an emperor, a trevally and assorted cod. There were approximately 12 fish in total.

The following general observations were made by Mr Sellers while diving in the area around Com:

- Most fish life is found approximately 1 km west of the Resort where currents were running parallel to the coast.
- Outside the Resort and village the bottom is mostly sand and weed with not much fish life until the fringing reef is reached approximately 40 m from the shore. The first section of the reef is in about 5 m of water; however most fish observed here were small, probably because this is the ledge favoured by local spearfishermen. A second “drop off” is about 50 m from the first and drops about 20 m. This is the area where local fishermen line fish as it is too deep for them to spearfish. The fish on this ledge are larger. The reef then drops to 100m, then 300m approximately 500 m from the shore.

Our charter boat (Island Lady) arrived at mid-day and we spent the afternoon onboard travelling between Com jetty and sandstone cliffs at the entrance to Com. The aim of the afternoon trip was to go over this area with the sounder to gain a general impression of the grounds and to look for suitable ground for line fishing and the trammel net. Two fishing rods were set with lures and were trolled behind the boat. Mr Damaso caught a large trevally (around 6 kg) on one of these lines. From 5.0-5.30 pm we drifted over the ledge in 18-25 m with 3 rods using a jigging technique. No fish were caught and little fish life was seen on the sounder. Fishing ceased at 5.30 pm, and from 5.30-6 pm was spent looking for ground which would be suitable for setting the trammel net. This is sampling net, fifty metres in length with a two metre drop. It consists of three panels of mesh; the two outer panels have 4 inch mesh diameter and the inner panel consist of a one inch mesh. This net is very effective for catching a wide size range of fish and a large variety of species. It was felt that the trammel net would give a better picture of the species composition and would complement the recreational fishing gear we were using as this was targeted towards specific species.

Saturday 20th Oct

The trammel net was set from 5.30-7.30 am. It was set immediately adjacent to the Com jetty in 2 m of water on the incoming tide. A small quantity of fish was caught (Table 1). However Mr Errity observed a large school of fish swimming beside the net as he went out to haul it. The water was very clear and the fish could probably see the net in the pre-dawn light.

9.00-12.30 am.

The morning was spent fishing from the charter vessel at Hero Point, approximately 10 km to the east of the Com resort. This is where local fishermen were observed line fishing for pelagic species as there are very strong currents in this area. This area was trolled for an hour but only one giant trevally was landed, although a few fish were lost. We then changed to bait fishing on the reefs in 20 m water for the remainder of the morning and several coronation trout were landed. During this time Mr Sellers went spear fishing in this area to get the underwater

perspective. He did not observe as much fish life in this area to the east of Com resort compared with the previous day's dive to the west of Com Resort. He noted that there was hardly any bait fish. The bottom was smooth, heavy rock, with thin fringing reef, dropping sharply to sand. There were also caves in which he observed squirrel fish, butterfly cod, slaty sweetlip. These are fish that like protection and are not seen in other areas. He swam for 1.5 hrs and observed blue-lined trevalley, Maori Sea Perch and many small rosy jobfish. Swimming was difficult due to swinging currents. However he felt it would probably be a great pelagic spot.

From 3-5 pm trolling was undertaken along a second ledge in 20 m water, but no fish were caught.

In Late afternoon (between 5.30-6.30 pm), a local fisherman was observed bringing in 6 good size parrotfish. A second fisherman had 1 surgeon fish, 2 trigger fish. These fish had been speared.

The general impression for the day was that the fishing around Com for pelagic species was slow, although there appeared to be good numbers of coronation trout.

Sunday 21 October

NT staff departed for Jaco Island on the charter vessel at 7 am, while Timor-Leste officers went to Tutuala to speak with local fishermen.

It was decided to troll while travelling to Jaco Island, a distance of 20 km. The troll gear consisted of deep diving minnows, rigged with garfish as bait and a skirted surface lure. During the journey there were a few strikes and a Spanish mackerel and a Wahoo were landed. We were surprised that there were not more strikes given the depth and current conditions, but we noticed few schools of bait fish which probably contributed to the poor catch of pelagics.

The waters around Jaco Island were very clear and large areas of coral reef could be clearly seen from the boat. Mr Sellers was dropped off to go spear fishing while we trolled. We caught a Wahoo, but dropped several fish. After two hours Mr Sellers was picked up. He had speared a large coral trout estimated to be around 12 kg (Figure 2). He had also seen about 20 large dog-tooth tuna diving on one ledge alone in 10-20 m depth range, which is an unusually shallow area to find these fish. This ledge was one of many in the area, and therefore it is expected that these other ledges would also hold good quantities of dogfish tuna. The advantage of the Jaco Island area is the large number of dog-tooth tuna; a prize game fish which is targeted because of its strength by both spearfisher men and line fishermen. The shallow depth range which they inhabit around Jaco Island is also an advantage.

The afternoon was spent anchored on a reef edge just off Jaco Island in approximately 15 m of water, where the team landed a long-nosed emperor, coronation trout and a coral cod while bait fishing. Mr Sellers headed off for another dive and immediately speared a large trevalley and a Spanish Mackerel, returning these fish to the boat to avoid attracting sharks, he set back to the same ledge where he speared a huge dogtooth tuna (Figure 3). Mr Sellers' adventures in unsuccessfully attempting to hold onto this large fish and his subsequent success in spearing an even larger dogtooth tuna are described in his article for the fishing magazine, Australia

Spearfishermen (Appendix 3), in which Mr Sellers conveys the excitement this area has for the avid spear fisherman. After the success of Mr Sellers catch we headed back to Com.



Figure 2.2 Richard Sellers holding a large coral trout which he speared at Jaco Island.



Figure 2.3 Dogtooth tuna speared by Mr Sellers at Jaco Island.

The trammel net was set from 17.45-20.00 in 1.5 m of water from the beach outside the Com Resort. A total of 37 fish were caught, the majority were the small snapper *Lutjanus lutjanus* (Table 1).

Monday 22 October

Having spent several days investigating the recreational potential around the Com area, it was decided to use the dropline machine to target the 100-130 m depth range. This depth range is not usually targeted by local fishermen. We worked our way along a ledge using the echosounder to look for suitable “rocky” ground. Unfortunately the bottom appeared to be predominately sand. The dropline machine was set whenever fish life appeared on the sounder. There were a few bites and the bait was stripped from the hooks. This appeared to be a greater problem when we drifted into the shallower 70-90 m depth range which smaller fish inhabit. After 2 hours of dropline fishing without any success it was decided to change over to rods and jigs, and over the next one and half hours the team caught 6 coronation trout. The conditions were generally very windy and it was felt that this also contributed to the lack of success in landing any fish with the dropline as it was difficult to stay in position on fish schools.

The afternoon was spent fishing at Hero Point in 20 m water. Two hours were spent trolling for pelagics, however only one Spanish mackerel was caught. After changing to jiggging the reef edges using an assortment of jigs ranging from 60-100 g, 11 fish were caught during the last hour

of fishing from 16.30-17.30 with the dominant species being coronation trout, coral cod and paddletail snapper (Table 2).

The trammel net was set in the same position as the previous night from 18.00-20.00 with little success; only 2 fish were caught.

Ms Lloyd had discussions with Snrs. Santos and Jose about the responses that the Tutuala fishermen had given the day before.

Tutuala Fishers responses:

1. *How many fishermen are there in Tutuala?*

A total of 120 fishermen, broken up into 14 groups. Each group has 5-6 men. These groups are not family groups, but based experience; working relationships.

2. *How many boats are there?*

Total of 16 boats. Five fibre glass boats donated by Japanese company in Los Palos, who are a boat building company for Timor-Leste. Rest are traditional.

3. *How many boats have engines?*

Twelve boats have engines. These are 15 HP Yamaha or Enduro. The engines were donated by the Chinese government in 2000.

4. *Do they target particular species?*

No, there are no target species.

5. *Do they fish every day?*

Fishermen go out every day, catch fish, then wait on the beach for tourists; usually 3-4 hours. Then they carry the fish to the village 8 km away and sell it for whatever price they can get. Usually US\$ 3 for a large fish.

6. *What fishing methods do they use?*

Line fishing and spear fishing. They do not use nets, because it catches on the coral reef in shallow water. Currents are too strong in other areas.

7. *What do they use for bait?*

Chicken flesh or lures from Australia.

8. *What time of day do they fish?*

Line fishing commences before dawn (any time between 3-8 am) and is finished by 10 am. Spearfishing is also undertaken in the morning. Trolling occurs in the afternoon between 3-6 pm.

9. *Are women involved in fishing?*

No women are involved in fishing, but they hope to be more involved in other aspects of fishing such as processing and selling.

10. *What is the most popular fish, i.e. what do the people prefer to eat?*

Trevally, mackerel and marlin are all popular fish.

Tuesday 23 October

The next day Mr Errity, Damaso and Dysart returned to Jaco Island departing at 6 am, and trolled to Jaco Island catching a Spanish mackerel at Hero Point. Halfway between Hero Point and Jaco Island, trolling was conducted along an edge in 20-50 m water where Wahoo began striking at the lines, although none were landed.

Once Jaco Island was reached, they trolled around the island to look for Wahoo and dogtooth tuna, but without success. It was then decided to anchor on the same ledge where Mr Sellers had caught his big dogtooth tuna and reef fish. Fishing was quiet until the tide turned, then schools of fusiliers and long toms emerged along the reef ledge on the incoming tide, followed by Spanish mackerel. Three coronation trout and one flag-tailed cod were landed during the two hour session. It is thought that when currents are strong the fish go into deeper water to hide and when the tide turns and conditions calm down, the fusiliers and other bait fish emerge, which in turn attracts the pelagic species

With the emergence of fish, poppers were thrown through the large bait schools on spin gear, which were retrieved at speed. A couple of dogtooth tuna (around 30 kg) were hooked immediately, but lost. However there were several more strikes of dogtooth tuna before the bait school dispersed and the fishing went quiet.

Trolling was undertaken on the way back from Jaco Island without success. It was hard to know where to troll as no bait fish were seen. Two schools of small tuna were observed, but not much else.

On the way back to Com they stopped at Hero Point and spent an hour jigging from 17.00-18.00. This session was very successful and 19 fish were landed, predominately small snapper, coronation trout and coral cod. It is during this time in the late afternoon that the local fishermen also fish Hero Point and six boats were observed along the coast near Hero Point. All had outboard motors.

Wednesday 24 October

The morning was spent fishing Hero Point using jigs. Five fish were caught with coronation trout being the dominant species. In the afternoon fishing was undertaken around Com with coronation trout again dominating the catch.

Ms Lloyd stayed behind at the Resort and met with Snr Narcisco de Carvalho and discussed observations from the field work and proposed recommendations based on work to date. It was also decided to visit the rock art on the caves near Tutuala and the ecotourism village at Valou beach.

Thursday 25 October

This was the final day fishing at Jaco Island. Mr. Errity, Damaso, Dysart and Snrs. Santos and Monfeiro went on the boat. Again trolling was undertaken from Com to Jaco Island, with a couple of Wahoo landed on the way. Three dogtooth tuna were landed on a point from the mainland just before Jaco Island. It was decided to try jigging and bait fishing in the deeper water reef off Jaco Island, but only coronation trout and small cod were landed as the larger fish were too strong for the fishing gear.

Ms Lloyd, Snr Narcisco de Carvalho and several of his colleagues from MAF set off to Tutuala. Arrangements had been made the day before for our visit to the rock art, as this is a sacred site and certain rituals must be preformed there before visitors from outside this area can visit.

We met our guides in Tutuala and drove approximately 3 km from the village to the trail that leads to the caves. For most of the way, the path to the rock art is well made with concrete steps. We were told that this was done by the Indonesians during occupation as this was a popular site to visit.



Figure 2.4 Rock art on cave walls near Tutuala.



Figure 2.5 View from caves where rock art is found. Jaco Island can be seen in the background.

The afternoon was spent at Valou beach looking over the ecotourism village which was nearing completion. We were very impressed by the progress which had been made since our last visit. All the bungalows, ablution blocks and the restaurant had been finished, and final touches were being made to the interiors of these buildings. We were told that tourists had already stayed there (Figure 6).



Figure 2.6 Ecotourism village at Valou Beach constructed by local community and Haburas Foundation.

This project is being undertaken by the Haburas Foundation, an environmental non-government organisation committed to environmental education and environmental management projects to improve the lives in Timor-Leste's communities. They are also committed to reviving the Tara Bandu; the customary traditional law that governs the management of the natural resources.

Most of the workers on this project were volunteers and it was impressive to see how much had been achieved and the dedication of this group. There was obviously a good working relationship with the local community and a dedication to ensuring that the community understood the principals of eco management.

Friday 26 October

Fishing was undertaken only in the morning as the charter vessel needed to leave at mid day to get back to Dili before dark. It was decided to try the dropline machine again, but this time, fish in the predawn/dawn period as we noticed this was when the local fishermen undertook line fishing. Unfortunately there was no success in landing any fish, although a few bites were experienced.

At 7 am it head to the deeper water offshore to catch billfish. Trolling was undertaken in about 2 km offshore in 1500m of water. Although a sailfish was hooked, it managed to throw the hook and escape.

Saturday 27 October

Project staff returned to Dili.

Sunday 28 October

NT staff departed Dili for Darwin.

Table 1. Catches from trammel netting.

Date	Area	Time set	Time Hauled	Common name	Species	Length (mm)	Depth (m)
20/10/2007	Com	Set 05.30	07.30	Black spot seaperch	<i>Lutjanus fulviflamma</i>	120	1.5
				Black spot seaperch	<i>Lutjanus fulviflamma</i>	140	
				Black spot seaperch	<i>Lutjanus fulviflamma</i>	145	
				Black spot seaperch	<i>Lutjanus fulviflamma</i>	145	
				Black spot seaperch	<i>Lutjanus fulviflamma</i>	150	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	153	
				Low-finned drummer	<i>Kyphosus vaigiensis</i>	165	
				Scad	?	140	
				Scad	?	135	
				Crescent perch	<i>Terapon jarbua</i>	110	
				Sardine	?	105	
				Blue sprat	<i>Spratelloides robustus</i>	72	
				Blue sprat	<i>Spratelloides robustus</i>	75	
				Herring	?	125	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	122	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	120	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	122	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	115	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	106	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	105	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	118	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	108	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	115	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	105	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	125	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	115	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	120	
				Goldstripe sardine	<i>Sardinella gibbosa</i>	110	

21/10/2007	Com	17.45	20.00	Maori seaperch	<i>Lutjanus rivulatus</i>	260	1.5
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	170	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	185	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	200	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	155	
Date	Area	Time set	Time Hauled	Common name	Species	Length (mm)	Depth (m)
21/10/2007	Com	17.45	20.00	Bigeye seaperch	<i>Lutjanus lutjanus</i>	200	1.5
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	175	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	165	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	170	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	175	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	195	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	160	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	175	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	180	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	170	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	185	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	175	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	175	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	180	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	160	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	170	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	175	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	185	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	160	
				Bigeye seaperch	<i>Lutjanus lutjanus</i>	170	
				Blackspot seaperch	<i>Lutjanus fulviflamma</i>	210	
				Blackspot seaperch	<i>Lutjanus fulviflamma</i>	210	
				Blackspot seaperch	<i>Lutjanus fulviflamma</i>	94	
				Silver biddy	<i>Gerres filamentosus</i>	110	
				Silver biddy	<i>Gerres filamentosus</i>	130	
				Silver biddy	<i>Gerres filamentosus</i>	140	
				Silver biddy	<i>Gerres filamentosus</i>	115	
				Goatfish	?	130	

				Goatfish	?	95	
				Rabbitfish	<i>Siganus canaliculatus</i>	125	
				Sweetlip	<i>Lethrinus sp.</i>	135	
				Moluccan seaperch	<i>Lutjanus boutton</i>	180	
22/10/2007	Com	Set 18.10	20.10	Silver bidy	<i>Gerres filamentosus</i>	135	1.5
				Squid	<i>Loligo sp.</i>	250	

Table 2. Catches from reef fishing and trolling.

Date	Area	Time	Gear	Common name	Species	Length (mm)	Depth (m)
20/10/2007	Hero Point	07.00 - 13.00	Rods/jigs	Coronation trout	<i>Variola louti</i>	445	20
				Coronation trout	<i>Variola louti</i>	315	
				Coronation trout	<i>Variola louti</i>	290	
				Coronation trout	<i>Variola louti</i>	325	
				Coronation trout	<i>Variola louti</i>	285	
				Coronation trout	<i>Variola louti</i>	255	
				Coronation trout	<i>Variola louti</i>	315	
				Coronation trout	<i>Variola louti</i>	310	
				Coral cod	<i>Cephalopholis miniata</i>	250	
				Coral cod	<i>Cephalopholis miniata</i>	245	
				White-lined cod	<i>Anyperodon leucogrammicus</i>	280	
				Flag-tailed cod	<i>Cephalopholis urodeta</i>	200	
21/10/2007	Jaco Island	08.30 - 12.00	Rods/Trolling	Barracuda	<i>Sphyræna barracuda</i>	1000	10
				Wahoo	<i>Acanthocybium solandri</i>	1050	70
				Giant trevally	<i>Caranx ignobilis</i>	750	10
			Rods/Bait	Coral cod	<i>Cephalopholis miniata</i>	300	10
				Long-nosed emperor	<i>Lethrinus olivaceus</i>	600	10
			Spear gun	Coral trout	<i>Plectropomus leopardus</i>	900	10
				Giant trevally	<i>Caranx ignobilis</i>	1000	15
				Spanish mackerel	<i>Scomberomorus commerson</i>	1050	15
				Dogtooth tuna	<i>Gymnosarda unicolor</i>	1500	20

Date	Area	Time	Gear	Common name	Species	Length (mm)	Depth (m)	
22/10/2007	Com	10.30-12.00	Rods/jigs	Coronation trout	<i>Variola louti</i>	300	15	
				Coronation trout	<i>Variola louti</i>	290		
				Coronation trout	<i>Variola louti</i>	345		
				Coronation trout	<i>Variola louti</i>	320		
				Coronation trout	<i>Variola louti</i>	330		
				Coronation trout	<i>Variola louti</i>	285		
22/10/2007	Hero Point	14.00-16.00	Rods/Trolling	Spanish mackerel	<i>Scomberomorus commerson</i>	1000	20	
		16.30-17.30	Rods/jigs	Coronation trout	<i>Variola louti</i>	345	20	
				Coronation trout	<i>Variola louti</i>	290		
				Flag-tailed cod	<i>Cephalopholis urodeta</i>	210		
				Black-tipped cod	<i>Epinephelus fasciatus</i>	250		
				Paddletail	<i>Lutjanus gibbus</i>	320		
				Bigeye trevally	<i>Caranx sexfasciatus</i>	340		
				Bigeye trevally	<i>Caranx sexfasciatus</i>	380		
				Bigeye trevally	<i>Caranx sexfasciatus</i>	375		
				Bigeye trevally	<i>Caranx sexfasciatus</i>	320		
				Bigeye trevally	<i>Caranx sexfasciatus</i>	345		
				Bigeye trevally	<i>Caranx sexfasciatus</i>	400		
23/10/2007	Jaco Island	08.00-12.00	Rods/Trolling	Spanish mackerel	<i>Scomberomorus commerson</i>	1100	20	
				Wahoo	<i>Acanthocybium solandri</i>	1060	70	
				Wahoo	<i>Acanthocybium solandri</i>	1250	70	
					Long tom	<i>Tylosurus sp.</i>	1080	20
		14.00-	Rods/bait	Coral cod	<i>Cephalopholis miniata</i>	305	20	

Date	Area	Time	Gear	Common name	Species	Length (mm)	Depth (m)
		16.00		Coral cod	<i>Cephalopholis miniata</i>	320	
				Coral cod	<i>Cephalopholis miniata</i>	290	
				Flag-tailed cod	<i>Cephalopholis urodeta</i>	240	
23/10/2007	Hero Point	17.00-18.00	Rods/jigs	Paddletail	<i>Lutjanus gibbus</i>	360	20
				Paddletail	<i>Lutjanus gibbus</i>	360	
				Paddletail	<i>Lutjanus gibbus</i>	360	
				Paddletail	<i>Lutjanus gibbus</i>	265	
				Paddletail	<i>Lutjanus gibbus</i>	270	
				Red-flushed cod	<i>Aethalopercu rogaea</i>	310	
				Coronation trout	<i>Variola louti</i>	360	
				Coronation trout	<i>Variola louti</i>	330	
				Coronation trout	<i>Variola louti</i>	490	
				Coronation trout	<i>Variola louti</i>	390	
				Coronation trout	<i>Variola louti</i>	270	
				Dogtooth tuna	<i>Gymnosarda unicolor</i>	530	
				Red bass	<i>Lutjanus bohar</i>	490	
				Blue-striped seaperch	<i>Lutjanus kasmira</i>	230	
				Coral cod	<i>Cephalopholis miniata</i>	280	
				Coral cod	<i>Cephalopholis miniata</i>	260	
				Coral cod	<i>Cephalopholis miniata</i>	280	
				Coral cod	<i>Cephalopholis miniata</i>	290	
				Lethrinid?	?	200	
24/10/2007	Hero Point	09.00-12.00	Rods/jigs	Coronation trout	<i>Variola louti</i>	280	20
				Coronation trout	<i>Variola louti</i>	300	

Date	Area	Time	Gear	Common name	Species	Length (mm)	Depth (m)
				Coronation trout	<i>Variola louti</i>	270	
				Coral cod	<i>Cephalopholis miniata</i>	240	
				Trigger fish	?	230	
24/10/2007	Com	17.30-19.00	Rods/bait	Coronation trout	<i>Variola louti</i>	320	25
				Coronation trout	<i>Variola louti</i>	290	
				Coronation trout	<i>Variola louti</i>	260	
				Coronation trout	<i>Variola louti</i>	320	
25/10/2007	Jaco Island	08.00-11.00	Rods/trolling	Wahoo	<i>Acanthocybium solandri</i>	1180	40
				Dogtooth tuna	<i>Gymnosarda unicolor</i>	940	
				Dogtooth tuna	<i>Gymnosarda unicolor</i>	710	
		12.00-15.00	Rods/bait	Triggerfish	?	650	25
				Triggerfish	?	700	
				Triggerfish	?	640	
				Silvertip shark	<i>Carcharhinus albimarginatus</i>	1200	
25/10/2007	Hero Point	17.00-17.45	Rods/jigs	Bigeye trevally	<i>Caranx sexfasciatus</i>	290	25
				Coral cod	<i>Cephalopholis miniata</i>	300	
				Coral cod	<i>Cephalopholis miniata</i>	280	
				Paddletail	<i>Lutjanus gibbus</i>	350	

Appendix 3.

Valuable websites were:

<http://earth.google.com/>, provides researchers with a good overview of the geographical features of the area and coastline.

<http://www.freeflowdiving.com/divesites.htm> provided pictures of fish we could expect to find in the area, pictures of Com and what facilities were there

<http://www.turismotimorleste.com/en/>. This is the Timor-Leste Government tourist web site.

<http://www.dutchpickle.com/east-timor/>. This site provides good background information about accommodation and out of the way tourist sites. It is aimed at the back packer tourist market, but is useful for any one travelling in Timor-Leste.

<http://www.spc.int/coastfish/Sections/Development/>. Secretariat of the Pacific Community (SPC) provides many useful articles on artisanal fishing gear, traditional marine research management and knowledge and fish handling techniques.