



## RESOURCE USE SURVEY OF CAUTION BAY

Esso Highlands Limited

### **PNG LNG Project**

December 2008



An ExxonMobil Affiliate

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Project Director	Carmel Coyne, David Gwyther		
Project Manager	Rebecca Hewlett		
Senior Consultant	Jessica Wiltshire, Amelia Jenkinson		
Consultant	Anne-Maree Goldman, Nicola Goldsmith		
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**Coffey Natural Systems Pty Ltd** ABN 61 005 041 878  
Level 21, 12 Creek St Brisbane QLD 4000 Australia  
T (+61) (7) 3002 0400 F (+61) (7) 3002 0444  
coffey.com

# CONTENTS

<b>1. INTRODUCTION</b>	<b>1</b>
1.1 Project Description	1
1.1.1 Upstream Development Components	1
1.1.2 LNG Facilities Development Components	3
1.1.3 Supporting Facilities and Infrastructure	3
1.2 Project Components Relevant to this Study	3
1.3 Study Objective	5
<b>2. METHODS</b>	<b>7</b>
2.1 Interviews with People from Local Villages	7
2.2 Interview with National Fisheries Authority	9
2.3 Interview with Expatriate Residents	9
2.4 Quantitative Survey	9
<b>3. RESULTS</b>	<b>11</b>
3.1 Interviews with People from Local Villages	11
3.1.1 Species Caught	11
3.1.2 Local Fishing Areas	11
3.1.3 Catch Volume	11
3.1.4 Fishing Techniques	11
3.1.5 Length of Fishing Trips	19
3.1.6 What Happens to the Catch	19
3.2 Interview with National Fisheries Authority	21
3.3 Interview with Expatriate Residents	21
3.4 Quantitative Survey	21
<b>4. DISCUSSION AND CONCLUSION</b>	<b>25</b>
<b>5. REFERENCES</b>	<b>27</b>

## Figures

1 Project overview: new and existing facilities and pipelines	2
2 Project components in Caution Bay and proposed exclusion zones	4
3 Fishing zones within Caution Bay	18

## Tables

1 Fishing interview participants	7
2 Fish species caught by people from local villages	12
3 Other marine species caught by local people	17
4 Observed use of reefs and mangroves between Boera and Papa	22

## **Plates**

1	Meeting at Boera village	8
2	Fresh tuna catch in Boera village	8
3	Women from Porebada village in a public motor vehicle taking fish to sell at local markets	20
4	Women selling fish at Koki Market, Port Moresby	20

## **Annexes**

A	Social Impact Assessment Report on Usage of Reefs and Mangroves between Boera and Papa	
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# **1. INTRODUCTION**

## **1.1 Project Description**

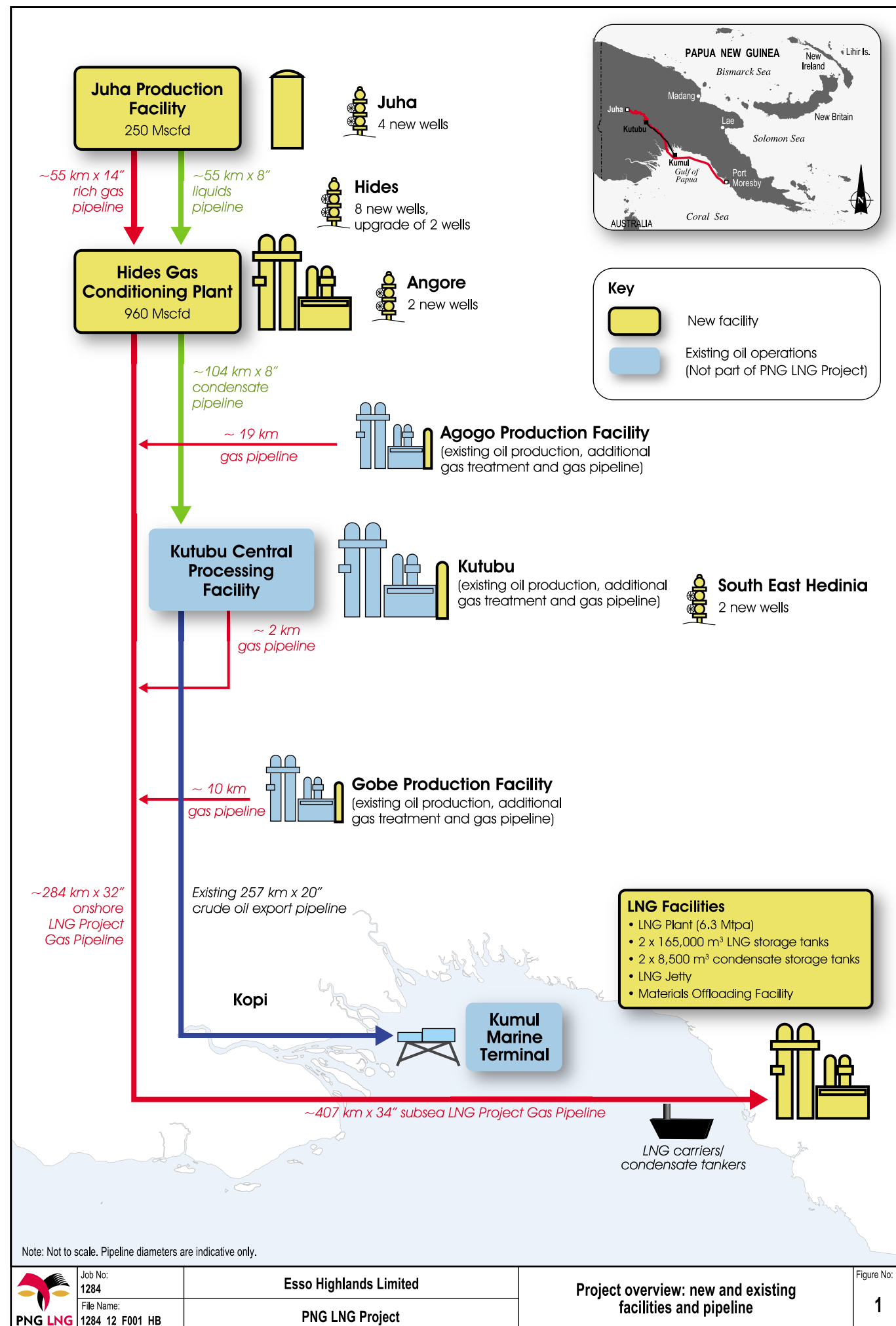
The Papua New Guinea Liquefied Natural Gas (PNG LNG) Project involves the development of a number of gas fields and facilities in a series of development phases to produce liquefied natural gas (LNG) for export. The development will also produce condensate. The development of the Hides, Angore, and Juha gas fields and blowdown of the gas caps at the existing Kutubu, Agogo and Gobe oil fields will supply the gas resources. An extensive onshore and offshore pipeline network will enable transportation of the gas to a new LNG Plant near Port Moresby and stabilised condensate to the existing oil processing and storage, and offloading facilities at the Kutubu Central Processing Facility and Kumul Marine Terminal respectively. Small amounts of condensate are also produced at the LNG Facilities site.

Esso Highlands Limited (Esso), a Papua New Guinea subsidiary of the Exxon Mobil Corporation (ExxonMobil), is the operator of the PNG LNG Project. The PNG LNG Project will be developed in five phases over a period of 10 years to ensure reliability and consistent quality of supply of LNG for over the 30-year life of the project.

A list of the proposed developments is provided below, and Figure 1 shows a schematic of facilities and pipelines:

### **1.1.1 Upstream Development Components**

- Hides gas field development:
  - Seven wellpads with a total of eight new wells and re-completion of two existing wells.
  - Hides gathering system including gas flowlines from new and re-completed Hides wells.
  - Hides Spine and mono-ethylene glycol (MEG) pipeline in the same right of way (ROW).
  - Hides Gas Conditioning Plant.
  - Hides–Kutubu Condensate Pipeline in the same ROW as the LNG Project Gas Pipeline.
- Juha gas field development:
  - Three new wellpads with four new wells.
  - Juha gathering system including gas flowlines from new Juha wells.
  - Juha Spine and Juha MEG Line in the same ROWs.
  - Juha Production Facility.
  - Juha–Hides pipelines right of way (ROW) containing three pipelines including Juha–Hides Rich Gas Pipeline, Juha–Hides Liquids Pipeline and Hides–Juha MEG Pipeline.
- Angore gas field development:
  - Two new wellpads with two new wells.
  - Angore gathering system including gas flowlines from new Angore wells.
  - Angore Spine and Angore MEG Line to Hides Gas Conditioning Plant, both in the same ROW.
- Gas from existing fields:
  - Gas treatment at the Agogo Production Facility and the new Agogo Gas Pipeline from the Agogo Production Facility to the LNG Project Gas Pipeline.



- Gas treatment at the Gobe Production Facility and the new Gobe Gas Pipeline from the Gobe Production Facility to the LNG Project Gas Pipeline.
- Gas treatment at the Kutubu Central Processing Facility and the new Kutubu Gas Pipeline from the Kutubu Central Processing Facility to the LNG Project Gas Pipeline.
- South East Hedinia gas field development: one new wellpad and two new wells; with a new gathering system including gas flow lines from the South East Hedinia new wells to the Kutubu Central Processing Facility in the same ROW as the Kutubu Gas Pipeline.
- Kopi scraper station.
- LNG Project Gas Pipeline:
  - Onshore: from Hides Gas Conditioning Plant to Omati River Landfall.
  - Offshore: Omati River Landfall to Caution Bay Landfall.

### **1.1.2 LNG Facilities Development Components**

- Onshore LNG Plant including gas processing and liquefaction trains, storage tanks, flare system and utilities.
- Marine facilities including jetty, LNG and condensate export berths, materials offloading facility and tug moorage.

### **1.1.3 Supporting Facilities and Infrastructure**

In addition to the principal gas production, processing and transport, and LNG production and export facilities, the project will involve the following permanent infrastructure and facilities:

- New roads and upgrade of existing roads.
- New bridges and upgrade of existing bridges.
- Upgrade of two existing airfields (upstream at Komo and Tari).
- New helipads (multiple).
- New wharf and an upgrade of the existing Kopi roll-on, roll-off facility.
- Water supply systems and pipelines, wastewater and waste management facilities.
- Operations Camps (at Hides, Juha and Tari).

A series of temporary works and access roads will also be required during the construction phase, including:

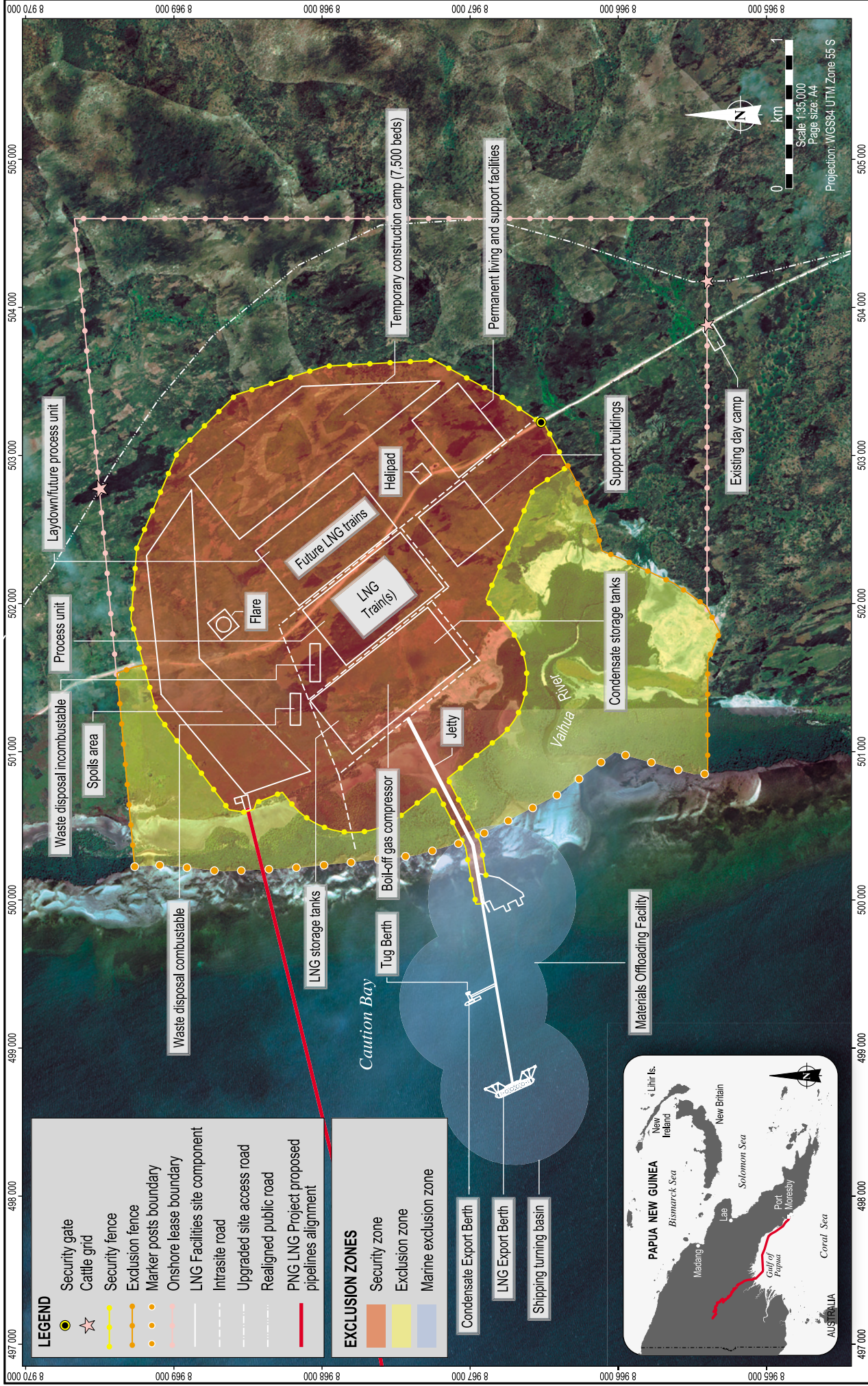
- Construction camps (multiple).
- Material/pipe laydown areas.

## **1.2 Project Components Relevant to this Study**

The geographic focus of this study is Caution Bay, which is adjacent to the LNG Facilities site. Project facilities that will be located in this marine environment include (Figure 2):


- An LNG export berth and a condensate export berth.
- The LNG Jetty to link LNG storage tanks and condensate storage tanks with export berths.
- A section of the offshore LNG Project Gas Pipeline and associated landfall.
- The Materials Offloading Facility.
- Tug permanent moorage.





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**1284**

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 **PNG LNG**

**Esso Highlands Limited**

**PNG LNG Project**

**Project components in Caution Bay and proposed exclusion zones**

Figure No:  
**2**

Note:  
Layout is indicative only.  
Final placement of all components is contingent on pending soil and geological data.  
Pipelines approximate the proposed alignment based on engineering data provided up to 1 October 2008.



For safety and security reasons, the project is proposing to implement an exclusion zone around the LNG export berth, condensate export berth and Materials Offloading Facility (see Figure 2).

### **1.3 Study Objective**

There are several villages located near the proposed LNG Plant, namely Lea Lea, Papa, Boera and Porebada (see Figure 3 in Section 3.1). Inhabitants of these villages regularly fish in Caution Bay. The fishing activities of villagers will potentially be impacted by the implementation of the project's proposed exclusion zone.

The objective of this study was to obtain information about fishing activities in Caution Bay, including the species caught, fishing methods used, areas fished, frequency of fishing activities and the number of people involved in fishing activities.

Resource Use Survey of Caution Bay  
PNG LNG Project

## 2. METHODS

The following parties were interviewed by Coffey Natural Systems' personnel over a four-day period in July 2008:

- Local people from Lea Lea, Papa, Boera and Porebada who undertake fishing activities.
- PNG National Fisheries Authority (NFA).
- Expatriate residents (third generation) who regularly fish in the Caution Bay area.

In addition, a quantitative survey was undertaken by Philip Sawi Kavan (subconsultant to Coffey Natural Systems) over a seven-day period in December 2007 that involved obtaining baseline information on usage of marine resources by local people in the reef and mangrove areas between Boera and Papa. This study is provided as Annex A and summarised here.

### 2.1 Interviews with People from Local Villages

Fishing interviews were conducted with local people from the villages of Lea Lea, Papa, Boera (Plate 1) and Porebada, and details of participants are provided in Table 1.

**Table 1 Fishing interview participants**

	Village and Date of Interview			
	Lea Lea 28 July 2008	Papa 29 July 2008	Borea 29 July 2008	Porebada 28 July 2008
<b>Estimated Village Population</b>	1,978 from 212 households	4,510 from 479 households	Approximately 1,500	Approximately 2,000
<b>Interviewers</b>	Jessica Wiltshire (Coffey Natural Systems) Amelia Jenkinson (Coffey Natural Systems) Peter Leahy (Esso Highlands Limited)			
<b>Approximate Number of Interviewees</b>	15	10	20	40

Local people participating in the interviews were asked about:

- Species caught.
- Local fishing areas.
- Catch volume.
- Fishing techniques.
- Transport.
- Length of fishing trips.
- What happens to the catch.



**Plate 1**  
Meeting at Boera village



**Plate 2**  
Fresh tuna catch in Boera village

When interview participants were asked where they fished, they were presented with maps of Caution Bay, which showed the islands and surrounding reefs. The participants either showed the interviewers where they fished, or drew their fishing areas on the maps themselves. New maps were used for each interview and the results were not shared amongst the different villages.

The interview participants were also shown a poster of common fish species<sup>1</sup>, to assist with listing the species caught, as fish names can vary between villages. Local names for many species were provided by the participants (see Section 3.1.1, Species Caught).

## **2.2 Interview with National Fisheries Authority**

The interviewers met with Papua New Guinea National Fisheries Authority officials at Port Moresby on 31 July 2008. The results of the interviews with people from the local villages of Lea Lea, Papa, Borea and Porebada were discussed, and also fishing in general in the Caution Bay area.

## **2.3 Interview with Expatriate Residents**

Interviews were conducted with third-generation expatriates Godfrey Seeto<sup>2</sup> and Jason Yip on 31 July 2008. Jason Yip is part of the Wild River Fishing Charter group responsible for taking groups fishing in the Galley Reach river basin (which flows into Caution Bay, north of Papa village). Both are experienced fishermen and divers who fish regularly (every weekend) from November to the end of May when the winds are southeasterly.

## **2.4 Quantitative Survey**

Observation of marine resource use in the area was undertaken using a boat. The survey recorded resource utilisation information including boat counts, number of people performing activities, age of people, types of activities, fishing methods utilised, duration of activity and catch information. Additionally, some local people from nearby villages were also interviewed to gather a general understanding of the importance of the marine resources in their daily routines.

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<sup>1</sup> 'Food fishes associated with coral reefs in Papua New Guinea'. Poster produced by the National Fisheries Authority, 2003.

<sup>2</sup> The Seeto Kui Organisation is a substantial multi-million Kina business with nearly 1,000 employees that distributes grocery, variety, supermarket, plumbing, hardware, construction, stationery and office supplies throughout PNG.



Resource Use Survey of Caution Bay  
PNG LNG Project

## 3. RESULTS

### 3.1 Interviews with People from Local Villages

#### 3.1.1 Species Caught

Local people from each village identified fish species commonly caught within coastal waters of Caution Bay (Table 2). Fish species caught comprise shallow water reef fish, such as coral trout, and larger pelagic fish including mackerel, barracuda and tuna (Plate 2). Local people also catch other marine fauna, details of which are provided in Table 3.

#### 3.1.2 Local Fishing Areas

The outer limits of the fishing areas are effectively delineated by reefs surrounding the outer islands of Daugo and Idihi (Figure 3). Popular fishing grounds include the fringing reef, isolated coral bommies in Caution Bay and reefs that surround Vari Vari, Bavo, Daugo and Idihi islands. Local people travel to these fishing grounds by banana boats, dinghies and outrigger canoes.

#### 3.1.3 Catch Volume

The catch rate is reliable, with all local-village fishing groups indicating that fish are caught on every expedition. The quantity of fish collected each day depends largely on the fishing method used. Fishermen on a good day can catch up to 100 fish, but average 50 fish per day. Fishing nets allow large quantities of fish to be caught with minimal effort, whereas fishing using a hook and line is one of the less efficient methods, with one fish caught approximately every 10 to 15 minutes. Fish caught are usually up to 1 m in size, although 2-m groupers are caught occasionally.

#### 3.1.4 Fishing Techniques

Often multiple fishing methods are used simultaneously (e.g., spear fishing while deploying fishing nets to maximise catch). Fishing is generally conducted in teams, with the number of participants varying across villages, although teams are usually comprised of 10 or more people. Fishing methods used include:

- **Long-line fishing:** Pelagic species, such as mackerel and tuna, are caught with long lines.
- **Bottom-line fishing (using one hook per line):** Bottom lines are used both within coastal waters and deeper waters. It is generally the most common technique used in the evenings and is rarely conducted in groups.
- **Hand-spear fishing:** This technique can be used at night in shallow waters with the aid of a spotlight to attract fish to the water surface.

**Table 2 Fish species caught by people from local villages**

Scientific Name	Common Name (Local Name)	Location within Caution Bay	Additional Comments Provided
LUTJANIDAE: Snappers, Jobfish, Sea Perch, Bass and Mangrove Jack			
Lutjanus argentimaculatus	Mangrove Jack	Fringing reefs	Red emperor are caught every week, ranging from 1 to 1.5 m in length, and are caught in approximately 40 m water depth
Symphorus nematophorus	Chinamin fish	Fringing reefs	
Lutjanus bohar	Red bass	Fringing reefs	
Symphorichthys spilurus	Sailfin snapper	Fringing reefs	
Lutjanus gibbus	Paddletail (tadir)	Fringing reefs, Vari Vari, Idihi and Bavo Islands	
Aprion virescens	Green jobfish (tadive)	Fringing reefs	
Lutjanus sebae	Red emperor	Deep water (40 m)	
SERRANIDAE: Cods, Coral Trout and Groupers			
Variola albimarginata	White-edged lyretail	Fringing reefs, deep and shallow water	Large groupers (up to 2 m in length) are caught occasionally
Plectropomus truncatus	Squaretail coralgrouper	Fringing reefs, deep and shallow water	
Aethaloperca rogga	Red-flushed rockcod	Fringing reefs, deep and shallow water	
Cephalopholis argus	Peacock rockcod	Fringing reefs, deep and shallow water	
Epinephelus fuscoguttatus	Flowery cod	Everywhere	
Epinephelus caeruleopunctatus	Ocellated rockcod	Everywhere	
CARANGIDAE: Trevallies, Jacks, Runners, Darts, Leatherskins and Scads (the ‘Moru’)			
Caranx ignobilis	Giant trevally (taia lola)	Along the coast and in deeper waters	
Caranx tille	Tille trevally	Along the coast and in deeper waters	
Caranx melampygus	Bluefin trevally	Along the coast and in deeper waters	
Elegatis bipinnulatus	Rainbow runner	Along the coast and in deeper waters	
Gnathodon speciosus	Golden trevally	Along the coast and in deeper waters	
Caranx sexfasciatus	Bigeye trevally	Along the coast and in deeper waters	

**Table 2 Fish species caught by people from local villages (cont'd)**

Scientific Name	Common Name (Local Name)	Location within Caution Bay	Additional Comments Provided
SCARIDAE: Parrotfish			
Scarus russelii	Eclipse parrotfish		
Scarus flavipectoralis	Yellowfin parrotfish		
Bolbometopon muricatum	Double-headed parrotfish		
Scarus dimidiatus	Saddled parrotfish		
Hipposcarus harid	Candelamoa parrotfish		
Scarus ghobban	Blue-barred parrotfish (vasiri)		
ACANTHURIDAE: Surgeonfish, Tangs and Unicornfish			
Acanthurus lineatus	Blue-lined surgeonfish	Fringing reefs, deep and shallow water	
Acanthurus xanthopterus	Yellowfin surgeonfish	Fringing reefs, deep and shallow water	
Acanthurus gahhm	Black surgeonfish	Fringing reefs, deep and shallow water	
Naso annulatus	Ringtailed unicornfish (yellow lalata)	Fringing reefs, deep and shallow water	
Naso hexacanthus	Sleek unicornfish	Fringing reefs, deep and shallow water	
Naso vlamingii	Vlaming's unicornfish	Along the coast, fringing reefs, deep and shallow water	
LETHRINIDAE: Emperors			
Lethrinus elongates	Longnose emperor	Fringing reefs, deep and shallow water	
Lethrinus ramak	Orange-striped emperor (dinini)	Everywhere, particularly fringing reef and atolls	
Lethrinus semicinctus	Black-blotch emperor (dabutu)	Everywhere, particularly fringing reef and atolls	
Monotaxis grandoculis	Humpnose big-eye bream	Fringing reefs, deep and shallow water	
Lethrinus hypselopterus		Fringing reefs, deep and shallow water	
Lethrinus kallopterus		Fringing reefs, deep and shallow water	

**Table 2 Fish species caught by people from local villages (cont'd)**

Scientific Name	Common Name (Local Name)	Location within Caution Bay	Additional Comments Provided
HAEMULIDAE: Sweetlips			
<i>Plectorhinchus orientalis</i>	Oriental sweetlips		
<i>Diagramma punctatum</i>			
<i>Plectorhinchus celebicus</i>	Celebes sweetlips		
<i>Plectorhinchus lineatus</i>	Diagonal-banded sweetlips		
<i>Plectorhinchus goldmanii</i>			
<i>Plectorhinchus chaetodonoides</i>	Many-spotted sweetlips		
BALISTIDAE: Triggerfish			
<i>Balistapus undulatus</i>	Red-lined triggerfish	Along the coast	
<i>Balistoides viridescens</i>	Blue-finned triggerfish	Along the coast	
<i>Pseudobalistes flavimarginatus</i>	Yellowmargin triggerfish	Along the coast	
SIGANIDAE: Rabbitfish and Spinefeet			
<i>Siganus puellus</i>	Blue-lined spinefoot (beki)	Along the coast	
<i>Siganus lineatus</i>	Golden-lined spinefoot (beki)	Along the coast	
<i>Siganus doliatus</i>	Barred spinefoot	Along the coast	
LABRIDAE: Wrasses			
<i>Cheilinus undulatus</i>	Double-headed Maori wrasse	Along the coast	
<i>Hemigymnus melapterus</i>	Thick-lipped wrasse	Along the coast	
<i>Cheilinus fasciatus</i>	Scarlet-breasted Maori wrasse	Along the coast	
MULLIDAE: Goatfish			
<i>Parupeneus indicus</i>	Indian goatfish (sio)	Everywhere including areas close to mangroves	
<i>Parupeneus pleurospilus</i>		Along the coast	
<i>Parupeneus barberinus</i>	Dash-dot goatfish	Along the coast	



**Table 2 Fish species caught by people from local villages (cont'd)**

Scientific Name	Common Name (Local Name)	Location within Caution Bay	Additional Comments Provided
KYPHOSIDAE: Drummers			
<i>Kyphosus lembus</i>	Brassy chub	Along the coast	
<i>Kyphosus cinerascens</i>	Blue seachub	Along the coast	
BELONIDAE: Longtoms and Needlefish			
<i>Tylosurus</i> sp.	Longtoms (longtom, kwarabada)	Everywhere	Large numbers observed from August to December
EPHIPPIDAE: Batfish			
<i>Platax teira</i>	Batfish (bebe)	Along the coast	
GERRIDAE: Silver Biddies			
<i>Gerres abbreviatus</i>	Short silverbelly (heala)	Fringing reef and along the coast close to mangroves	
<i>Gerres</i> sp.	Silver biddy	Along the coast	
MUGILIDAE: Mullet			
<i>Valamugil seheli</i>	Bluespot mullet (iobu)	Along the coast and fringing reef	Caught using nets
NEMIPTERIDAE: Monocle Bream			
<i>Scolopsis monogramma</i>	Monocle bream		
CENTROPOMIDAE: Sand Bass			
<i>Psammoperca waigiensis</i>	Sand bass		
HOLOCENTRIDAE: Squirrelfish			
<i>Sargocentron spiniferum</i>	Spiny squirrelfish		
HEMIRHAMPHIDAE: Garfish			
<i>Hemiramphus far</i>	Barred garfish (moa)	Along the coast and fringing reef	

**Table 2 Fish species caught by people from local villages (cont'd)**

Scientific Name	Common Name (Local Name)	Location within Caution Bay	Additional Comments Provided
POMACANTHIDAE: Angelfish			
<i>Pomacanthus sexstriatus</i>	Six-banded angelfish		
PELAGICS: Fishes from various families			
<i>Gymnosarda unicolor</i>	Dogtooth tuna (kidu kidu)	Outer reefs	Barramundi and barracuda are very rare, only caught once in a while  Mackerel caught by line fishing and trolling
<i>Scomberomorus commerson</i>	Narrow-barred Spanish mackerel (dae, mackerel)	Outer reefs	
<i>Sphyraena barracuda</i>	Barracuda (ono, barracuda)		
<i>Sphyraena putnamiae</i>	Sawtooth barracuda		
<i>Euthynnus affinis</i>	Mackerel tuna	Outer reefs	
<i>Auxis thazard</i>	Frigate mackerel (tuna, kidukidu)	Outer reefs	
<i>Thunnus albacares</i>	Yellowfin tuna	Outer reefs	
	Jammed mackerel (toro)	Fringing reefs	
<i>Katsuwonis pelamis</i>	Skipjack tuna (vaura vaina)		
ESTUARINE: Fishes from various families			
<i>Lates calcarifer</i>	Barramundi	Mouth of rivers	
<i>Lutjanus goldiei</i>	Black bass (dinaga)	Estuaries	

**Table 3 Other marine species caught by local people**

<b>Common Name (Local Name)</b>	<b>Village</b>	<b>Location within Caution Bay</b>	<b>Comments</b>
Dugong	Lea Lea, Boera		Rarely caught
Crayfish	Lea Lea	Vari Vari Island and fringing reefs	
Prawns	Lea Lea	Vari Vari Island	
Octopus	Lea Lea		
Sea cucumber (koema)	Lea Lea, Boera		
Sharks (tiger, whitetip and hammerhead) (hisuria)	All	Fringing reef and deep waters (dependent on the type of shark species)	
Squid	Lea Lea		
Stingray (white-spotted eagle ray – roroko)	Lea Lea, Papa	Along the reefs where there is white sand	
Turtle (gan)	Lea Lea, Boera		Diving with a spear gun catches less than one animal every month
Shell collecting (molluscs)	Porebada	Inner reefs and mangroves	Clamshells are rare but roku is common
Sea urchins	Papa, Boera	Fringing reefs	All colours and a variety of types



- **Free diving with a spear gun:** Spear guns are mainly reserved for catching large pelagic species including cod, red emperor, trout, sweet lip and grouper. A small wooden-and-polystyrene box attached to a long line that floats on the water surface can be used to store the catch without attracting sharks.
- **Dynamite fishing:** Although illegal, interviewees acknowledged it is used infrequently on outer reef areas. The dynamite is generally obtained from World War II unexploded ordnance.
- **Trap fishing (e.g., nets):** This is a common fishing practice involving individuals or several teams in canoes or boats. Nets cover up to 500 m.
- **Poison (from local vines):** This traditional fishing method that involves extracting a poisonous liquid from the root of the tuha or imuru vine and mixing it into the water is rarely used. Nearby fish die and float to the surface to be collected.
- **Night fishing with light:** Use of a light to attract small fish who attract larger fish. Lines with up to 6 hooks are used.
- **Trolling:** Towing a lure behind the boat.

A variety of bait is used for fishing and includes squid, yellowfin tuna and octopus. The local people interviewed stated that fish species are attracted to bait that they would naturally prey upon in the wild. For example, yellowfin tuna is used as bait for catching large pelagic species.

### 3.1.5 Length of Fishing Trips

Fishing is a daily activity carried out by all local villages along the coastline of Caution Bay. Most local villages go fishing both during the day (usually between 7 a.m. and 4 p.m.) and at night (between 8 p.m. and 10 a.m.). Duration of fishing trips varies and can be dependent on tides, weather conditions, distances travelled from the village, and catch rates.

### 3.1.6 What Happens to the Catch

A portion of the catch is kept for personal consumption and the surplus is taken by the women to local markets in Port Moresby in the afternoons (Plate 3). These markets include:

- Koki (Plate 4).
- Malaro.
- Boroko.
- Hohola.
- Rainbow.
- Garo.
- Gordons.

At the markets, the surplus catch is sold or exchanged for flour, sugar or rice products. Fish prices are based on species, with red emperor attracting the highest price. However, where motorised dinghies are used to travel to and from fishing areas, the selling price of the catch can be influenced by the cost of the fuel.

Public motor vehicles (PMVs) are used to travel to the markets in Port Moresby. When PMVs and other transportation are unavailable, surplus catch is sold 'door to door' within the village.





**Plate 3**

Women from Porebada village in a public motor vehicle taking fish to sell at local markets



**Plate 4**

Women selling fish at Koki Market, Port Moresby

In addition to local markets, surplus catch is sometimes sold to supermarkets (such as Boroko Foodstore, Rinbunan Hijau (RH) and Andersons). Supermarkets prefer larger fish species, such as mackerel, trevally, barramundi, black bass, mangrove jack and red emperor. Squid and sea cucumbers (bech-de-mer) are generally sold to Asian restaurants.

### **3.2 Interview with National Fisheries Authority**

The PNG NFA confirmed the information provided by people from local villages in regards to species caught within Caution Bay and were interested to hear that yellowfin tuna is caught.

### **3.3 Interview with Expatriate Residents**

The expatriate residents interviewed generally fish in the inner fringing reef areas and coral bommies using bottom-line fishing techniques. They navigate through Caution Bay with navigational charts and tend to fish more during the evening. They confirmed that juvenile red emperor (*Lutjanus sebae*), about 20 cm in length, are often caught along the coastal reefs at depths of 10 to 15 m. These fringing reefs are often referred to as the 'nursery reefs'. Godfrey Seeto said that five coastal reefs between Boera and Papa are thought to be spawning grounds for coral trout, hammerhead sharks and finger mark, as juveniles of these species are regularly caught along this section of the coast. He also stated that he sees a whale shark once every couple of years (with the last one sighted close to Boera Head).

### **3.4 Quantitative Survey**

Travel methods used by people from villages between Boera and Papa during the seven-day reef usage survey conducted by Phillip Sawi Kavan were consistent with information obtained by Coffey Natural Systems in July 2008. A total of 20 banana boats and 39 outrigger canoes were observed being used by local people for net fishing and line fishing respectively.

Participants of the survey included 179 males, 4 females and 14 children. Ages of males and females ranged from between 20 and 45 and the children from 6 to 14 years old. A total of 15 people was observed collecting resources from mangrove areas during the survey period.

During the day, men catch reef fish using nets and lines, while in the evenings they dive using spear guns. The results of the fishing and shellfish harvesting over each of the seven days are shown in Table 4.

Resource Use Survey of Caution Bay  
PNG LNG Project

**Table 4 Observed use of reefs and mangroves between Boera and Papa**

Day and Date	Type of Boat that Passed	Type of Boat Moored and Used for Fishing*	Males	Females	Age (Years)	Activity	Equipment Used	Mangrove Resource Use	Materials Collected or Hunted	Approximate Time Spent	All Year Round or Seasonal
1 7/12/07		5 BB	32		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		8 ORC	8		20-30	Fishing	Fishing line			4 to 5 hours	All year round
			17		20-45	Diving	Spear gun			4 to 5 hours	All year round
2 8/12/07			4		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		1 ORC	4		20-30	Fishing	Spear gun			4 to 5 hours	All year round
		1 D	1, 4 children	1	06-45	Fishing	Fishing net			4 to 5 hours	All year round
			4		20-30	Fishing	Hand spear	Crabs and fish	Looking for crabs and fish	4 to 5 hours	All year round
		1 HB	2	1	25-35	Research	Diving gear				
3 10/12/07	Cargo ship										
		4 BB	9		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		8 ORC	15		20-30	Fishing	Fishing line			4 to 5 hours	All year round
			2		20-30	Diving	Spear gun			4 to 5 hours	All year round
		1 HB	2	1	25-35	Research	Diving gear				
4 11/12/07		4 BB, 2 D	7		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		5 ORC	13, 7 children		20-30	Fishing	Fishing line			4 to 5 hours	All year round
		1 D	1, 3 children	1	5-30	Collecting		Firewood	Firewood	4 to 5 hours	All year round
			3		40-50	Cutting	Axe	Mangrove	Mangrove for house post	4 to 5 hours	All year round

Resource Use Survey of Caution Bay  
PNG LNG Project

**Table 4 Observed use of reefs and mangroves between Boera and Papa (cont'd)**

Day and Date	Type of Boat that Passed	Type of Boat Moored and Used for Fishing*	Males	Females	Age (Years)	Activity	Equipment Used	Mangrove Resource Use	Materials Collected or Hunted	Approximate Time Spent	All Year Round or Seasonal
5 13/12/07		1 BB	5		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		6 ORC	7		20-30	Fishing	Fishing line			4 to 5 hours	All year round
			4		20-30	Fishing	Spear gun			4 to 5 hours	All year round
			1	1	45 -55	Collecting		Crabs and clams	Crabs and clam shells	4 to 5 hours	All year round
6 14/12/07		5 BB	14		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		6 ORC	10		20-30	Fishing	Fishing line			4 to 5 hours	All year round
			1		20-30	Diving	Spear gun			4 to 5 hours	All year round
			1		50-56	Collecting		Snails to use as fishing bait		45 mins	All year round
7 15/12/07		1 BB	2		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		5 ORC	9		20-30	Fishing	Fishing line			4 to 5 hours	All year round
			3		20-30	Diving	Spear gun			4 to 5 hours	All year round

\*Key: BB – banana boat, D – dinghy, ORC – outrigger canoe, HB – hired boat.

Source: Annex A.



## **4. DISCUSSION AND CONCLUSION**

The inhabitants of the villages situated along the coast of Caution Bay, including Lea Lea, Papa, Boera and Porebada, are heavily dependent on the sea and mangroves for their livelihood including the gaps in the mangroves for access to the sea. Fishing is a subsistence activity performed mainly by the men of the villages on a daily basis and is a significant source of cash income.

The reef usage survey identified a division of labour on the basis of gender. Fishing was dominated by men; in the observation period, 179 men were fishing compared to only 4 women who did so in the company of their husbands and children, and not on a regular basis. Women are primarily involved in activities such as gardening, collecting firewood, crabs and clamshells, and fetching water from the well.



## **5. REFERENCES**

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# Annex A

**Social Impact Assessment Report on Usage of Reefs and Mangroves between  
Boera and Papa**



**SOCIAL IMPACT ASSESSMENT  
REPORT ON  
USAGE OF REEFS AND MANGROVES  
BETWEEN BOERA AND PAPA**

*Prepared by: Philip Sawi Kavan*

*18<sup>th</sup> December 2007*



## CONTENTS

1.	Introduction	1
2.	Data Collection	1
3.	Presentation and Discussions of Findings	1
	3.1 Presentation of Results	1
	3.2 Discussion of Findings	3
4.	Conclusion	4
5.	References	4

### Tables

Table 1	Observed utilisation of the reefs and mangrove between Boera and Papa	2
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## **1. Introduction**

A survey was undertaken over seven days in December 2007 to ascertain the baseline usage of marine resources by local villagers in reef and mangrove areas between Boera and Papa ('the survey area'), on the southwest coast of Papua New Guinea. The survey was conducted by Philip Kavan, who was employed by Esso Highlands Limited to collect the data to assist in the social impact assessment of the proposed Papua New Guinea Liquefied Natural Gas (PNG LNG) Project.

The data was collected by direct observation of activities and informal interviews with local villagers about their fishing habits.

## **2. Data Collection**

Observation of marine resource use in the area was undertaken using a boat. The following variables were recorded:

- Quantity and type of boats that passed through the area.
- Quantity and type of boats moored or anchored in the area.
- Quantity and type of boats used for fishing and other resource utilisation activities.
- Number of men, women and children undertaking fishing and other resource utilisation activities.
- Age of the people involved in fishing and other resource utilisation activities.
- Activities undertaken.
- Fishing methods utilised.
- Species caught and materials collected.
- Duration of the activity.

Some local people from nearby villages were also interviewed to gather a general understanding of the importance of the marine resources in their daily routines.

## **3. Presentation and Discussions of Findings**

### **3.1 Presentation of Results**

The results of the observations of fishing and shellfish harvesting over each of the seven days are shown below in Table 1.

The only boat passing between Boera and Papa (without mooring or anchoring) during the survey period was a cargo ship on day three. There was also one hire boat with three marine biologists from Australia (undertaking research for the environmental impact assessment for the proposed PNG LNG Project) that anchored for diving and snorkeling activities between Boera and Papa on days two and three of the survey.

**Table 1 Observed utilisation of the reefs and mangrove between Boera and Papa**

Day & date	Type of boat that passed	Type of boat moored & used for fishing	Males	Females	Age (years)	Activity	Equipment used	Mangrove gap use	Materials collected/hunted	Approximate time spent	All year round/ Seasonal
1 7/12/07		5 BB	32		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		8 ORC	8		20-30	Fishing	Fishing line			4 to 5 hours	All year round
			17		20-45	Diving	Fishing gun			4 to 5 hours	All year round
2 8/12/07			4		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		1 ORC	4		20-30	Fishing	Fishing gun			4 to 5 hours	All year round
		1 Din	1, 4 children	1	06-45	Fishing	Fishing net			4 to 5 hours	All year round
			4		20-30	Fishing	Spear	Crabs and fish	Looking for crabs and fish	4 to 5 hours	All year round
		1 Hired boat	2	1	25-35	Research	Diving gear				
3 10/12/07	Cargo Ship										
		4 BB	9		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		8 ORC	15		20-30	Fishing	Fishing line			4 to 5 hours	All year round
			2		20-30	Diving	Fishing gun			4 to 5 hours	All year round
		1 Hired boat	2	1	25-35	Research	Diving gear				
4 11/12/07		4 BB, 2 Din	7		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		5 ORC	13, 7 children		20-30	Fishing	Fishing line			4 to 5 hours	All year round
		1 Din	1, 3 children	1	5-30	Collecting		Firewood	Firewood	4 to 5 hours	All year round
			3		40-50	Cutting	Axe	Mangrove	Mangrove for house post	4 to 5 hours	All year round
5 13/12/07		1 BB	5		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		6 ORC	7		20-30	Fishing	Fishing line			4 to 5 hours	All year round
			4		20-30	Fishing	Fishing gun			4 to 5 hours	All year round
			1	1	45 -55	Collecting		Crabs & clam	Crabs and clam shells	4 to 5 hours	All year round
6 14/12/07		5 BB	14		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		6 ORC	10		20-30	Fishing	Fishing line			4 to 5 hours	All year round
			1		20-30	Diving	Fishing gun			4 to 5 hours	All year round
			1		50-56	Collecting		Snails to use as fishing bait		45 mins	All year round
7 15/12/07		1 BB	2		20-30	Fishing	Fishing net			4 to 5 hours	All year round
		5 ORC	9		20-30	Fishing	Fishing line			4 to 5 hours	All year round
			3		20-30	Diving	Fishing gun			4 to 5 hours	All year round

Key: BB – banana boat, Din – dinghy, ORC – outrigger canoe



Over the seven days of observation, 20 banana boats were used for fishing between Boera and Papa. Villagers in banana boats and dinghies used fishing nets to catch the reef fish, while occupants of the 39 outrigger canoes observed during the survey generally used fishing lines.

There were 179 males, 4 females and 14 children fishing during the seven days of observation (excluding the Australian marine biologists). Ages of males and females ranged from between 20 to 45 and the children from 6 to 14.

During the survey, a total of 15 people (10 men, 2 women and 3 children) were observed collecting resources in the mangrove areas.

### **3.2 Discussion of Findings**

The seven days of observation had identified a division of labour on the basis of gender. Fishing was dominated by men; in the observation period, 179 men were fishing compared to only 4 women. Those women who were fishing did so in the company of their husbands and children, and not on a regular basis.

The main tasks for the women are gardening, collecting firewood, collecting crabs, clam shells, and fetching water from the well. The women cook some of the fish caught by the men, with the remaining uncooked fish being sold at the market.

When the wind is blowing from the west, known as **lahara** (west wind) in the local language of Motu, crabs and clam shells are plentiful. During this time, the women would go into the mangrove two to three times a week to collect crabs and clam shells at low tide.

When the wind is blowing from the east, known as **lorabada** (east wind) in Motu, many fishermen go out onto the reef and out into the ocean to catch large fish such as mackerel.

Every night, men go out to the reef and dive with spearguns. Early in the morning, they take the local Public Motor Vehicle (PMV) from their village to Port Moresby City and sell their fish at KoKi and Hohola market.

If strong winds and rough seas prevent fishing on the reefs, villagers, in particular the Papa and LeaLea people, go to the Laloki River at the rear of the villages to fish and also go hunting in the bush.

The mangroves are an important resource to the villagers. They provide the women with crabs, clam shells and firewood. The men use the mangrove as material for building their houses, in particular for the main posts of the house. Snails for fishing bait are also sourced from the mangroves.

According to observations and collected data, fishing, collecting shellfish and cutting firewood and building materials appeared to consume between four to five hours daily per person and, according to anecdotal evidence, are undertaken all year round.

#### **4. Conclusion**

Observations on marine resource usage in the area between Boera and Papa indicated that both villages are heavily dependent on the sea and the mangrove gaps for their livelihood. During the day, men catching reef fish using the nets and lines, while in the evenings they use spearguns. Regardless of the size of the catch and the portion that is not consumed within the village, the uncooked portion is taken to Port Moresby City and sold at KoKi and Hohola market as a source of cash income.

Also, women go to the mangroves to collect crabs, clam shells and firewood at least on a weekly basis. The mangroves are also the source of snails for use as fishing bait, and provide the village people with housing materials.

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