

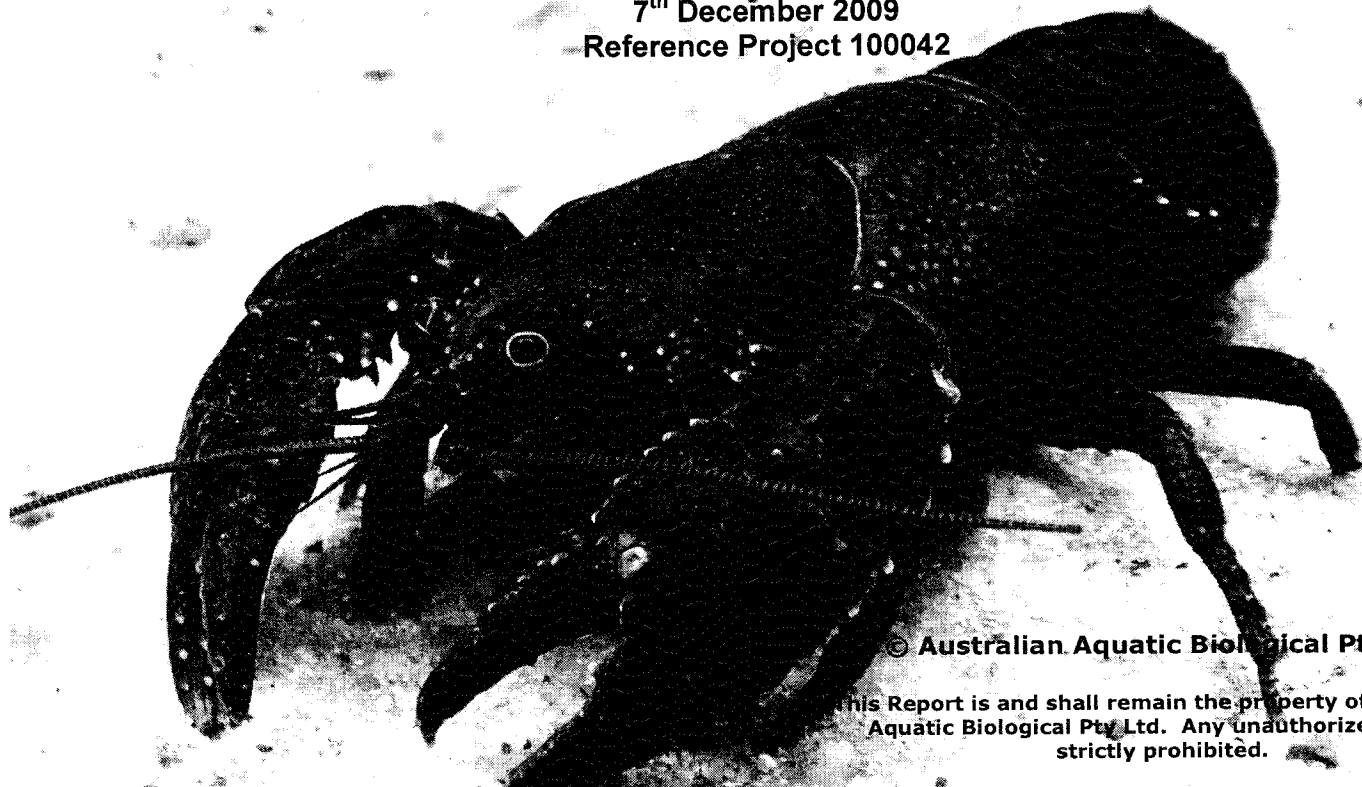


Aquatic Biological Survey Report

**Unmanned Watercourse
State Forest - Brown Moun
Near Bonang, Victoria**

Robert B. McCormack

**7th December 2009
Reference Project 100042**



© Australian Aquatic Biological Pty Ltd

**This Report is and shall remain the property of Australian
Aquatic Biological Pty Ltd. Any unauthorized use is
strictly prohibited.**

PO Box 3, Karuah, NSW, 2324 info@aabio.com.au

**Report to Bleyer Lawyers
Level 1, 550 Lonsdale Street
Melbourne, Victoria 3000 Australia**

Prepared by

Robert Browning McCormack

AABio Project No.: 100042

Cover Photos

Front

Top, the unnamed watercourse, tributary of the Bonang River in State Forest, Brown Mountain Victoria.

Bottom, The Bonang spiny crayfish *Euastacus* sp.

Back

The forestry coupe adjoining the Brown Mountain unnamed water course; harvested and burned as per forestry practices.

Disclaimer. Every effort has been taken to provide accurate information. The information supplied reflects the status of the knowledge base to-date; future research will likely increase this knowledge. The author accepts no liability for errors and omissions.

© Australian Aquatic Biological Pty Ltd

Acknowledgements

I would like to take this opportunity to acknowledge the following people for their assistance in the collection or preparation of information that has allowed this report to be completed.

- To the Australian Crayfish Project volunteers who have willingly given their assistance with biological surveys of East Gippsland
Chris Lukhaup
David Caldwell
Jason Coughran
Jo Edwards
Joseph Henderson
Stephen Chara
- Dr Jason Coughran, Environmental Futures Centre, Griffith School of Environment, Gold Coast Campus, Griffith University, Queensland, Australia, 4222.
- Dr Jim Fetzner, Assistant Curator of Crustacea, Section of Invertebrate Zoology, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA.
- The Victorian DPI Fisheries for all their support and assistance and provision of our Research Permit (RP957) allowing total biological survey of the whole of Victoria. Special thanks to Dick Brumley and Rebecca Jol who co-ordinated our survey efforts.
- The Victorian Department of Sustainability and Environment for the issue of our Research Permit (10004488) allowing biological survey of the whole of Victoria.

Abbreviations

AABio	Australian Aquatic Biological Pty Ltd
ACP	Australian Crayfish Project
DPI	Department of Primary Industries
DSE	Department of Sustainability and Environment
EEG	Environment East Gippsland
FFG Act	Flora and Fauna Guarantee Act 1988 (Vic)
OCL	Occipital Carapace Length
OSC	Orbost Spiny Crayfish
Trib	Tributary
VF	VicForests
Vic	Victoria

Contents

Cover photos	<i>i</i>
Disclaimer	<i>i</i>
Acknowledgements	<i>ii</i>
Abbreviations	<i>ii</i>
Contents	<i>iii</i>
1.0 EXPERT WITNESS STATEMENT	1
1.1 Name & Address	1
1.2 Qualifications and Experience	1
1.3 Areas of Expertise	1
1.4 Facts, matters and assumptions on which each opinion is based	4
1.5 That a particular question, issue or matter falls outside the experts field	4
1.6 Any examinations, tests or other investigations, etc.	4
1.7 A declaration that the expert has made all the enquires, etc.	5
1.8 Any qualifications of an opinion expressed in the report, etc.	5
1.9 Whether any opinion expressed in the report is not a concluded opinion, etc.	5
1.10 Acknowledgement of Expert Witness Code of Contact	5
2.0 INTRODUCTION	6
2.1 Background	6
2.2 Permits	7
2.3 Survey Area	7
2.4 Survey Methods	9
2.5 Survey Results from Methods	10
2.5.1 Visual Survey	10
2.5.2 Shell Remnants Survey	11
2.5.3 Trap Survey	11
2.5.4 Scoop Net Survey	12
2.5.5 Structure Lifting Survey	12
2.5.6 Burrow Excavation Survey	12
2.6 Survey Results	12
3.0 BROWN MOUNTAIN AQUATIC SURVEY REPORT	14
3.1 The Regional Crayfish Fauna	14

3.2 The Orbost Spiny Crayfish <i>Euastacus diversus</i>	14
3.3 The Bidhawal Crayfish <i>Euastacus bidawalus</i>	17
3.4 The Bonang Taxon <i>Euastacus</i> sp.	18
4.0 DISTRIBUTIONS	21
4.1 <i>Euastacus bidawalus</i>	21
4.2 <i>Euastacus diversus</i>	21
4.3 <i>Euastacus</i> sp.	22
4.4 <i>Euastacus claytoni</i>	22
4.5 <i>Euastacus kershawi</i>	23
4.5 The Status of the Knowledge Base	23
5.0 BROWN MOUNTAIN FORESTRY COUPES – INFO REQUESTS	25
11. What steps are necessary in order to ascertain, etc	25
12. On the basis of a site visit or visits to and surveys, etc.	26
13. With what level of confidence are you able to predict, etc.	27
14. Would the logging of any or all of the four Brown Mountain Forestry Coupes, etc.	28
6.0 POTENTIAL CONSERVATION ISSUES - DISCUSSION	28
15. To the extent that you find there to be an impact	32
16. You are asked to assume that VicForests will, prior to logging	32
7.0 THE PRECAUTIONARY PRINCIPLE	33
17. What is your understanding of the precautionary principle	33
8.0 CONCLUSION	33
Declaration	35
References	36
Map – Estimated Crayfish Distributions - East Gippsland	37
Map – VicForests - Coupes	38
Survey GPS Points	39
Survey Times – Brown Mountain	43
Brown Mountain Survey Map 1	44
Brown Mountain Survey Map 2	45
Brown Mountain Survey Map 3	46
East Gippsland Survey Map	47

1.0 EXPERT WITNESS STATEMENT.

1.1 Name and Address

Robert B McCormack
Research & Aquaculture Director
Australian Aquatic Biological Pty Ltd
ABN 38 127 431 118
PO Box 3 Karuah NSW 2324
P/F.: 02 4997 5160
Web: www.aabio.com.au

1.2 Qualifications and Experience

Robert B McCormack is a Technical Engineer starting his Engineering career as a trainee with Bradford Kendal Foundries in 1975. In 1980 Robert moved to MS Stainless Pty Ltd as the Sales Manager then General Manager in 1982. In 1983 Robert purchased a large, rural, waterfront property at Port Stephens NSW and developed this farm into an Aquaculture Facility. Over the next 20 years Robert developed the farm into the largest crayfish and Australian Bass farm in New South Wales. Robert published his first Aquaculture book in 1986 and started lecturing (aquaculture) at the Hunter Institute of Technology in 1987. He has published eight books and the last three crayfish related books ("*The Commercial Yabby Farmer*" "*Keeping Pet Yabbies*" and "*The Freshwater Crayfish of NSW*") are currently available from all good bookstores.

Since 2003, Robert has established other Aquaculture related businesses (Mid West Yabby and Fish Traders and RBM Aquaculture). He is also the Research and Aquaculture Director for Australian Aquatic Biological P/L. Robert is the President of the NSW Aquaculture Association, and has served on a broad range of advisory and statutory committees, including, Aquaculture Research Advisory Committee, Seafood Industry Conference, CSIRO – RIRDC steering Committee and the Land Based Aquaculture Consultative Group.

1.3 Areas of Expertise

Robert is the Research & Aquaculture Director for Australian Aquatic Biological P/L (AABio). AABio runs The Australian Crayfish Project (ACP) and the Australian Aquatic Biodiversity Survey (AABS), and Robert is the Team Leader for both of those projects. The ACP is particularly relevant, and involves recording and identifying every species of freshwater crayfish in Australia and the surrounding Islands with the aim of increasing the knowledge base on these animals. A full colour picture data base will be developed as well as a full specimen data base. Additionally, through the latest DNA technology a complete genetics data base of all Australian Crayfish will be generated.

As a result of the ACP, Robert will produce a series of text books on the freshwater crayfish of Australia. The first book "The Freshwater Crayfish of NSW" is currently available and both the Victoria and Queensland books are in preparation.

Robert is a Research Associate with the Carnegie Museum of Natural History, 4400 Forbes Avenue Pittsburgh, USA. He has experience in crayfish taxonomy, including the preparation of formal taxonomic descriptions for publication. He has published several scientific papers and has numerous others in preparation.

PUBLICATIONS

McCormack, RB. 1986 "*Yabby Farming*" Book

McCormack, RB. 1988 "*Yabby Farming the Crayhaven Way*" Book

McCormack, RB. 1994 "*The Yabby Farmers Handbook*" Book ISBN 0 646 20488 2

McCormack, RB. 2001 "*The Commercial Farmers Manual of The Yabby Cherax destructor*". Book ISBN 0 9578524 0 1

McCormack, RB. 2005 "*The Commercial Yabby Farmer*" Book ISBN 0 9576524 1 X

McCormack, RB. 2006 "*Pet Yabbies*" Book ISBN 0 9578524 3 6

McCormack, RB. 2008 "*The Freshwater Crayfish of NSW Australia*" Book ISBN 978-0-9805144-1-4

McCormack, RB. 2008 "*Keeping Pet Yabbies*" Book ISBN 978-0-9805144-0-7

SCIENTIFIC PAPERS

Coughran, J., McCormack, R.B., Daly, G. 2009. Translocation of the Yabby, *Cherax destructor*, into eastern drainages of New South Wales, Australia. Australian Zoologist. Vol 35 (1).

McCormack, R.B. & Coughran, J. 2008. *Euastacus maccai*, a new freshwater crayfish from the Great Dividing Range, New South Wales. Fishes of Sahul, Vol 22, (4).

McCormack, R. B., J. Coughran, J. M. Furse & P. Van-der-Werf, 2010 (in press). Conservation Of Imperiled Crayfish - *Euastacus jagara* (Decapoda: Parastacidae), a highland crayfish from the Main Range, South-Eastern Queensland, Australia. Journal of Crustacean Biology. 30(3).

O'Brien, A. Coughran, J. McCormack, R.B. 2009. (in press). On the existence of *Cherax rotundus* in the Severn area, south-eastern Queensland. Queensland Naturalist Dec 09

PUBLICATIONS IN PREPARATION

Coughran, J. & McCormack, R.B. (in prep). *Field Guide to the Freshwater Crayfishes of the Central Eastern New South Wales (Grafton to Sydney)*. (CD-ROM).

Coughran, J. McCormack, R.B. & Fetzner, J.W. (in prep). The Bonang Spiny Crayfish *Euastacus* sp. nov. A new crayfish from the highlands of eastern Victoria, Australia.

Coughran, J. McCormack, R.B. & Fetzner, J.W. (in prep). The Orbost Spiny Crayfish *Euastacus diversus* rediscovered and redescribed.

McCormack, R.B. & Ayhong S. (in prep). *Euastacus* n. sp., a new freshwater crayfish from the Great Dividing Range, New South Wales.

McCormack, R.B. & Coughran, J. (in prep). The Newcastle Yabby, *Cherax setosus* (redescription).

McCormack, R.B. & Coughran, J. (in prep). The Newcastle Yabby, *Cherax setosus* – aspects of biology, ecology and distribution.

McCormack, R.B. 2009. (in prep). "*The Freshwater Crayfish of Queensland Australia*" Book ISBN 978-0-9805144-2-1

McCormack, R.B. 2010. (in prep). "*The Freshwater Crayfish of Victoria Australia*" Book ISBN TBA.

McCormack, R.B. Coughran, C. (in prep). The Capture of Primary Burrowing Crayfish via Mist Net & Ring Snares.

McCormack, R.B. Coughran, J. Fetzner, J.W. (in prep). Conservation of Imperiled Crayfish — *Euastacus* sp. nov (decapoda: parastacidae), a freshwater crayfish from the upper reaches of the Snowy River, East Gippsland, Victoria, Australia.

McCormack, R.B. Horwitz, P. (in prep). *Gramastacus* n. sp. (Decapoda: Parastacidae): A new species of freshwater crayfish from coastal New South Wales, Australia.

McCormack, R.B. Horwitz, P. Coughran, J. (in prep). Conservation of Imperiled Crayfish – *Gramastacus* sp. nov. (decapoda: parastacidae), a lowland coastal crayfish from the central & mid north coast, New South Wales, Australia.

McCormack, R.B. Raadik, T. Coughran, J. (in prep). Conservation of Imperiled Crayfish — *Cherax sp nov.* (decapoda: parastacidae), a lowland flood plain crayfish of the Murray River.

McCormack, R.B., Raadik, T. (in prep). The Swamp Yabby *Cherax sp. nov.* (Decapoda: Parastacidae): a new species of freshwater crayfish from the Murray Drainage Basin, Australia.

1.4 Facts, matters and assumptions on which each opinion in this report is based.

Facts, matters and assumptions are as per individually listed in this report.

1.5 That a particular question, issue or matter falls outside the experts field of expertise.

No questions outside my field of experience are referred to in this report.

1.6 Any examinations, tests or other investigations on which the expert has relied, identifying the person who carried them out and that persons qualifications.

Additional morphological examinations were carried out by Dr Jason Coughran, Environmental Futures Centre, Griffith School of Environment, Gold Coast Campus, Griffith University, Queensland, Australia, 4222. Jason holds a PhD in freshwater crayfish biology, ecology and taxonomy and has over 10 years research experience in freshwater biology. He is the Chief Taxonomist with the Australian Crayfish Project, and is on the IUCN Freshwater Crab and Crayfish Specialist Group. An active researcher on Australian crayfish, Jason is an author of several scientific papers on the taxonomy, biology and management of spiny freshwater crayfish.

Genetic samples have been forwarded to Dr. James W. Fetzner Jr. Assistant Curator of Crustacea, Section of Invertebrate Zoology, Carnegie Museum of Natural History, Pittsburgh, Pennsylvania, USA. Areas of research include 20 years of experience working on the biology, conservation, population genetics, systematics and taxonomy of freshwater crayfishes at a global level. An additional 12 years of experience in bioinformatics and the dissemination of crayfish related taxonomic information via the internet. Professional crayfish-related activities include: Secretary for the International Association of Astacology, Editor of the *Crayfish News* newsletter, co-editor of the journal *Freshwater Crayfish*.

- 1.7** *A declaration that the expert has made all the enquires which the expert believes are desirable and appropriate, and no matters of significance which the expert regards as relevant have, to the knowledge of the expert, been withheld from the court.*

A signed declaration is included at the end of this report.

- 1.8** *Any qualifications of an opinion expressed in the report without which the report is or may be incomplete or inaccurate; and*

In my opinion the report is complete and accurate to the best of my knowledge.

- 1.9** *Whether any opinion expressed in the report is not a concluded opinion because of insufficient research or insufficient data or for any other reason.*

All opinions are set out in this report.

1.10 Acknowledgement of Expert Witness Code of Conduct

I, Robert Browning McCormack, declare that I have read the Expert Witness Code of Conduct (Form 44A) and agree to be bound by this code.

Robert B McCormack
7th December 2009

2.0 INTRODUCTION

2.1 Background

VicForests (VF) is a statutory body responsible for carrying out logging in Victorian State Forests. Environment East Gippsland (EEG) has initiated proceedings in the Supreme Court of Victoria challenging VicForests logging of certain forestry coupes in the Brown Mountain region.

Environment East Gippsland v Vic Forests
Supreme Court proceedings number 8547 of 2009

VicForests proposes to carry out logging of four coupes in State Forest on Brown Mountain in East Gippsland. The coupes on Brown Mountain are coupe numbers 840-502-0015, 840-502-0019, 840-502-0026 and 840-502-0027 as described in the Timber Release Plan approved on the 9th June 2009 (the Timber Release Plan) by the Secretary to the Department of Sustainability and Environment (DSE) (the Brown Mountain Coupes).

EEG's proceedings challenges the lawfulness of the logging of those coupes, broadly on the basis of whether VicForests has complied with its legal obligations under the Timber Release Plan (and Allocation Order which it relies upon), the Flora and Fauna Guarantee Act 1988 (Vic) (the FFG Act) and the Sustainable Forests (Timber) Act 2004 (Vic) (the Sustainable Forests Act). Specifically, EEG's proceeding deals with the legal obligations of VicForests concerning certain threatened species which EEG alleges are present or likely to be present in the coupes or which are likely to rely on the habitat provided by the coupes in some way. VicForests contends it has complied, and will continue to comply, with its legal obligations in relation to the threatened species.

Australian Aquatic Biological Pty Ltd (AABio) has been commissioned to supply an expert's witness report on the presence of the Threatened Orbost Spiny Crayfish *Euastacus diversus* in these coupes.

Bleyer Lawyers of Lonsdale Street Melbourne are acting for Environment East Gippsland on this matter. Bleyer Lawyers have issued Australian Aquatic Biological detailed instructions on the areas of interest that need addressing. These instructions for the Orbost Spiny Crayfish broadly include the following headings:

- Qualifications and Experience.
- The Species.
- Distribution.
- Conservation Status.
- East Gippsland.
- Brown Mountain.
- Precautionary Principle.

2.2 Permits

Permits for aquatic biological research in this region were supplied by:

- State Government of Victoria, Department of Primary Industries. Permit under the Fisheries Act 1995. General Research Permit Number: **RP957**. Aquatic research of the survey site re Brown Mountain was co-ordinated with Dick Brumley and Rebecca Jol of Fisheries Victoria.
- State Government of Victoria, Department of Sustainability and Environment. Research permit No: **10004488** pursuant to the provisions of the Flora and Fauna Guarantee Act 1988, the National Parks Act 1975 and the Crown Lands (Reserves) Act 1978 (Nature Conservation Reserves).

2.3 Survey Area

The survey area is an unnamed, small flowing temperate rainforest stream draining roughly north below Brown Mountain. The watercourse is one to two metres wide, ranges from shallow pools (typically up to ~300mm deep) to shallow riffle sections typically less than ~50mm deep.

The stream substrate included both coarse (sand/gravel) and fine (dark silt) materials, and the banks were a dark rainforest soil. This stream is a tributary of the Bonang River, which joins the Deddick River, which then joins the Snowy River at McKillop Bridge. The site is located in a State Forest at the base of Brown Mountain at approximately 760 metres altitude near Bonang in East Gippsland, Victoria.

The survey area is bounded on the west by Legges Road and on the east by Errinundra Road. From both these roads the survey site slopes down to the stream at the base. The stream flows roughly from the south to the north through cool temperate rainforest. Dominant overstorey: "Sassafras". *Atherosperma moschatum*, *Elaeocarpus reticulatus*, "Blackwood" *acacia melanoxylon*. Understorey: *Cyathea australis*, *Orearia agrophylla*, *clematis arista*, Mountain corea, *tetrhena juncea*, *Blechnum wattsii*. The most dominant plant is the tree fern *Dicksonia antarctica*. On the Legges Rd side of Brown Mountain creek, tall wet schlerophyll forest with a shrubby small tree understory, dominated by Eucalyptus trees; approximately 20% Errinundra Shining Gum *dentriculata*, 20% Mountain Grey Gum *E. cypellocarpa*, 30% 'Cut Tail' (*Eucalyptus amygdalina*) or (*Eucalyptus fastigata*), and 30% Messmate. On the Errinundra side of Brown mountain creek is tall wet Schlerophyll forest with a shrubby understory.



Figure 1. The unnamed watercourse, tributary Bonang River

2.4 Survey Method

The aquatic survey consisted of a variety of different methods, some of these include:

- Visual observation of crayfish activity. Generally burrowing activity is the most common indication of crayfish activity, although visual observation is also often a useful technique to record the presence of crayfish that are active on the forest floor or stream bed during sampling.
- Visual search for shell fragments and remnants of crayfish. Crayfish moult their shells to grow a new larger shell discarding the old shell, they lose claws due to fighting or claws are left from animal predation. Searching for shell remnants can give a good indication of the species present, the numbers of animals in the population and an indication of the predators in the area feeding on the crayfish as each predator has its own signature re shell remains.
- Trapping crayfish. Most crayfish species can be captured in baited traps. 12 box type collapsible traps were deployed in this survey. These were baited with dog food pellets and set in two transects of six traps. The traps have small (50-60 mm) entrances to prohibit entry of unwanted animals like platypus, water rats, turtles and birds, etc.
- Active netting. Scoop nets were used to scoop the bottom sediments, under logs, through leaf litter, under banks or through reedy sections, etc. This is a particularly important method to detect species that do not respond to baits or traps.
- Structure removal and probing. Crayfish shelter under rocks and logs, etc. and time was allocated to lifting such shelter objects and searching by hand for crayfish. This is another particularly important method to detect species that do not respond to baits or traps.
- Burrow excavation by hand. Most crayfish species construct burrows and thus an integral part of the survey involved careful excavation of burrows by hand to search for crayfish. This is a particularly important method to detect species that do not respond to baits or traps.

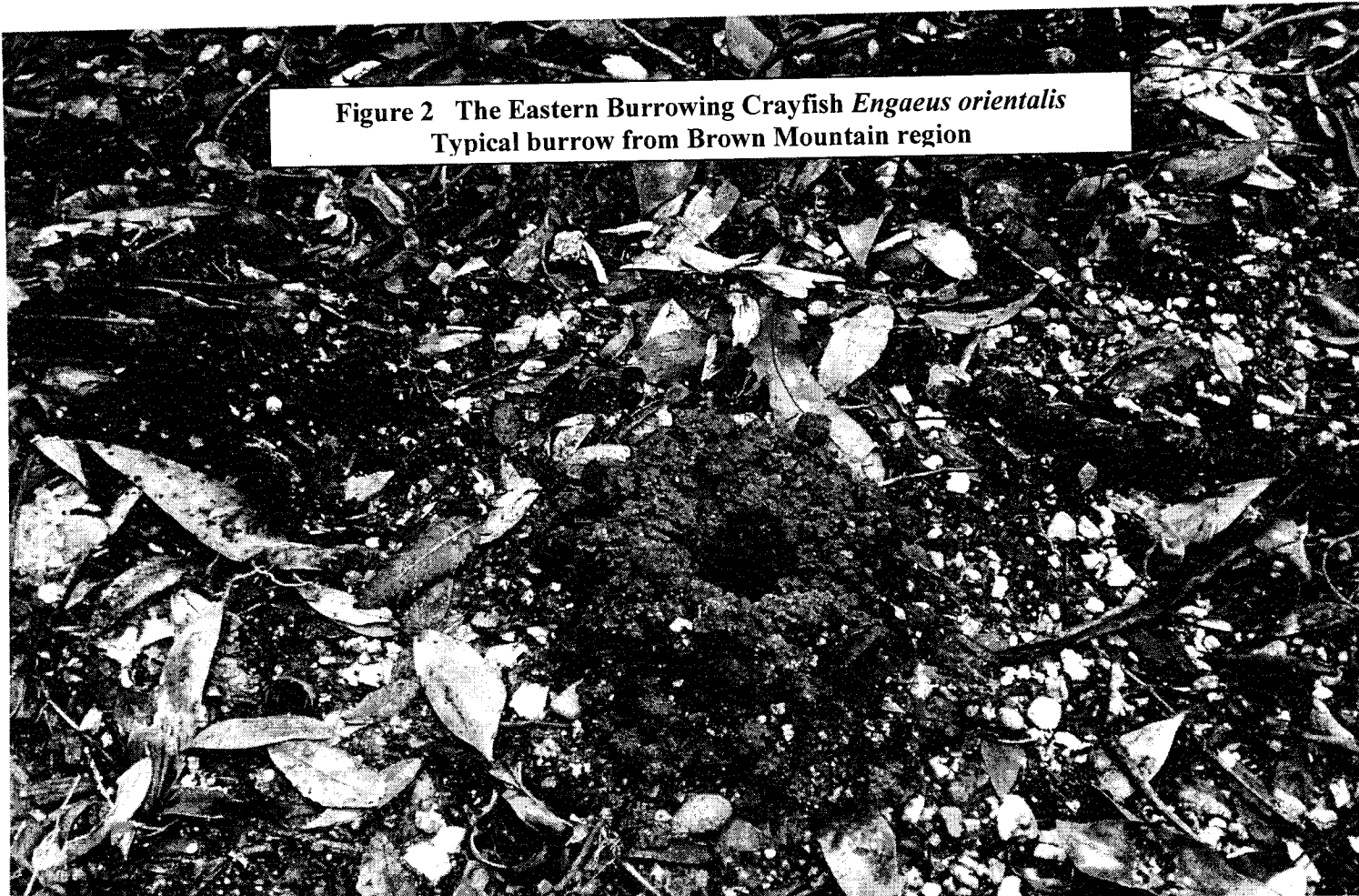
Survey times for the Brown Mountain Region are recorded on page 43. Survey sites via the GPS points are recorded on page 39 to 43.

2.5 Survey Results from Methods

No specimens of *Euastacus diversus* or *Euastacus bidawalus* were collected during the survey. Two crayfish species were collected, *Engaeus orientalis* and an undescribed species of *Euastacus*. This new species will be referred to as *Euastacus* sp. and known as the Brown Mountain taxon.

2.5.1 Visual Survey. The forest floor from the roads to the creek was searched for crayfish activity. There was burrowing activity throughout the site with large funnel type mounds of excavated material indicating the presence of crayfish. These burrows were scattered throughout the forest floor and ranged from the top of the ridges down the slopes to the creek. The numbers of burrows increased as we approached the creek in the moister soil. Investigation of these burrows indicated that they belonged to *Engaeus orientalis*, a terrestrial burrowing crayfish. Figure 2.

**Figure 2 The Eastern Burrowing Crayfish *Engaeus orientalis*
Typical burrow from Brown Mountain region**



The creek is clean, clear, flowing water, providing high visibility for visual surveys. Visual surveys of a large section of the creek over two days only found one crayfish out and about in the creek; this crayfish was captured and vouchered for identification.

2.5.2 Shell Remnants Survey. Despite an intensive search throughout the site there was no indication of any shell fragments. The lack of any remains may be indicative of low population densities of crayfish.

2.5.3 Trap Survey. The two transects of six traps set in separate sections of the creek during the day produced zero results. The traps left overnight were checked the following day and out of 12 traps only one crayfish was captured. This specimen was retained for identification, later being identified as *Euastacus* sp. Figure 4

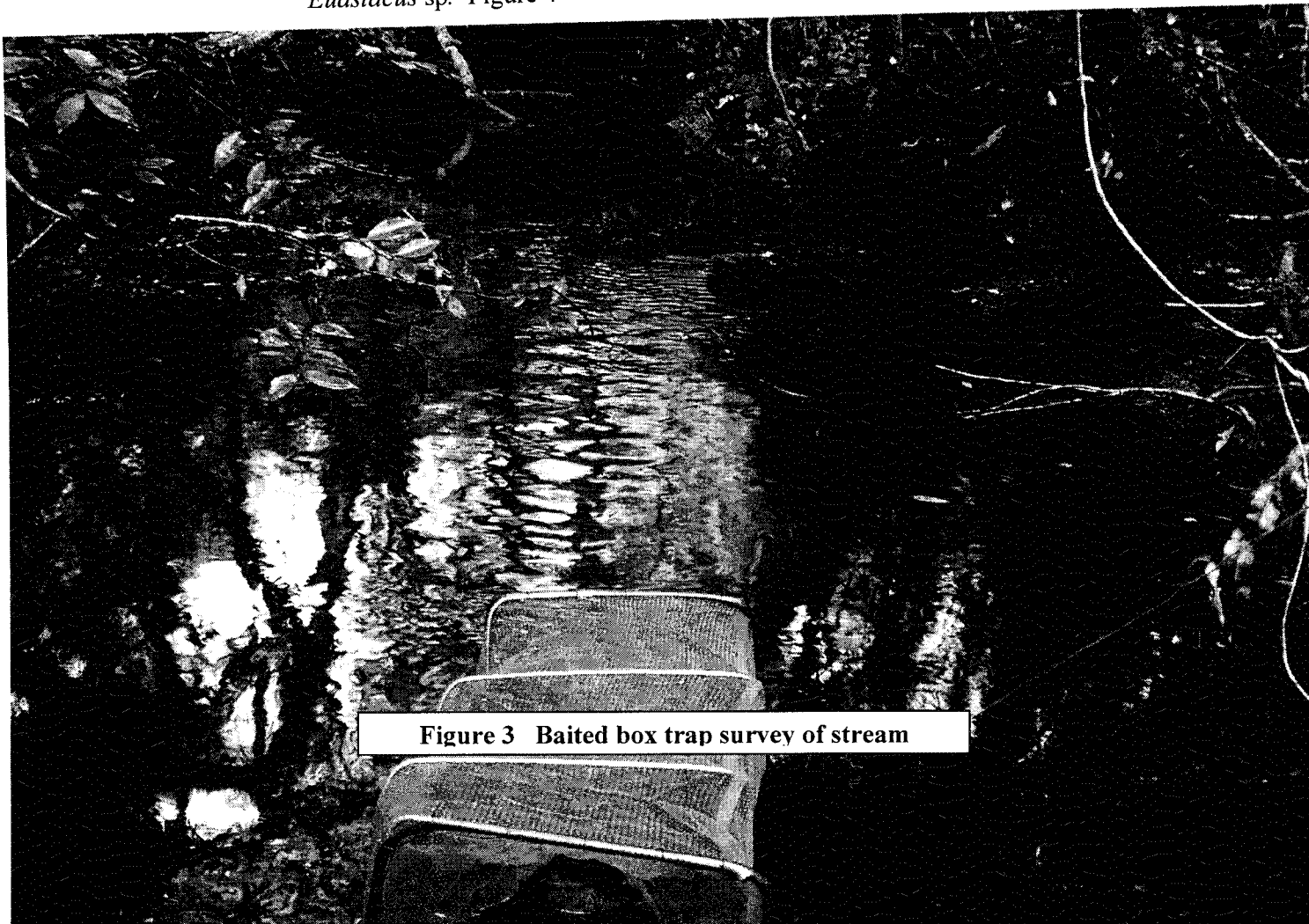


Figure 3 Baited box trap survey of stream

2.5.4 Active netting. No crayfish were captured directly by scoop netting. Scooping under ledges, under logs, through vegetation and scooping the leaf litter was entirely ineffectual.

2.5.5 Structure lifting and probing. This was the most successful method and all specimens of *Euastacus* sp. bar two were captured by this method. In the main survey site all structure was large woody debris, in surrounding creeks outside the Brown Mountain survey area more logs and rocks were available. After lifting structures crayfish were successfully captured by hands or by using a scoop net to scoop the cavity generated by removal of the structure.

2.5.6 Burrow excavation. A large number of burrows and potential burrows were excavated. Those burrows that did yield crayfish were all found to support *Engaeus orientalis* and a number of these animals were collected from the surrounding area.

2.6 Species Identification

Specimens of crayfish captured from the survey site were retained for identification. Specimens were returned to the office at Port Stephens, there they were photographed alive, DNA sampled, euthanized by freezing for 24 hours then vouchered in 70% ethanol.

The collected specimens were then morphologically examined and a record was taken of all morphological characters.

The findings of the morphological assessment confirmed that the burrowing crayfish present is *Engaeus orientalis*.

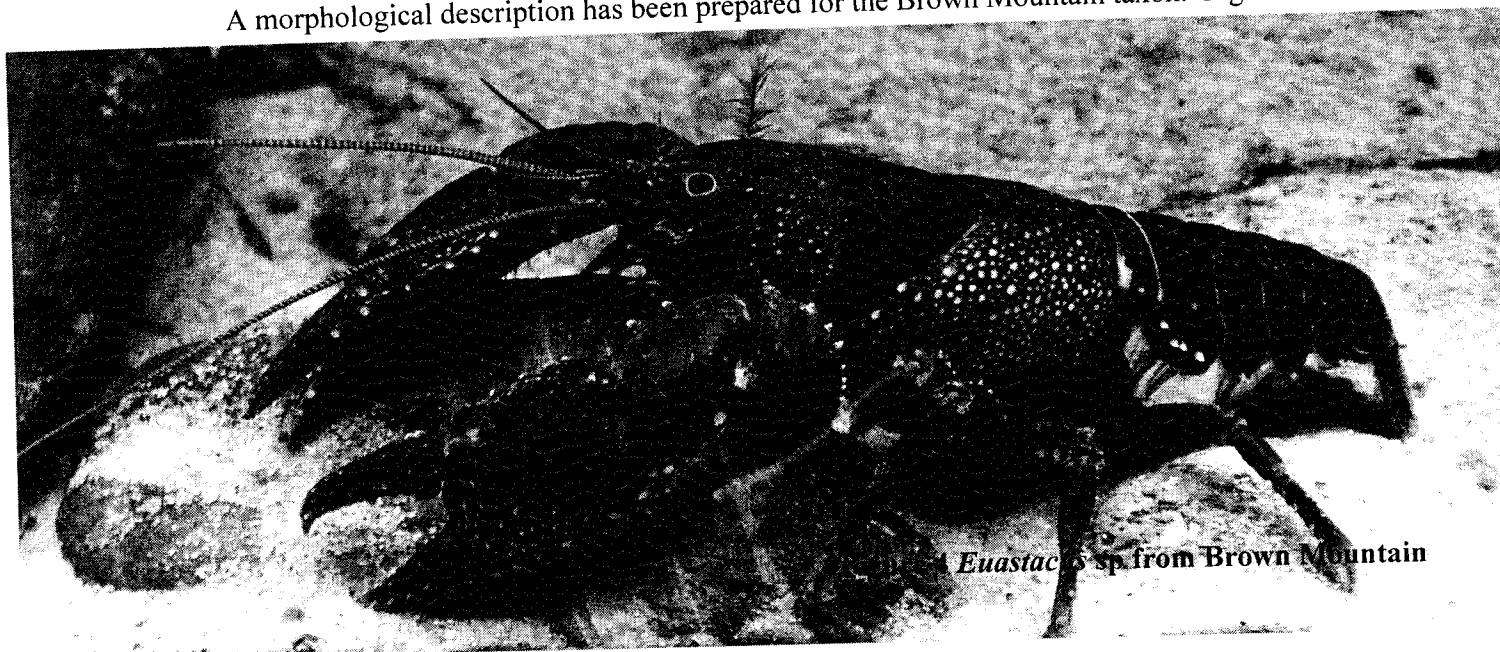
Preliminary examination of the *Euastacus* specimens from Brown Mountain confirmed that they did not conform to the published description of any species. These specimens of *Euastacus* are all considered to be one taxon, and will be referred to throughout this

report as *Euastacus* sp. The taxon is morphologically distinct from *E. diversus*, and appears to most similar to *E. bidawalus*. However, it has several unique morphological features that suggest it may be a new, as yet undescribed species. Genetic samples are currently being analysed, and a description of the taxon has been prepared.

Additional material for all described species of *Euastacus* in eastern Victoria has also been collected in other recent ACP surveys, and this material has also been examined as part of the clarification of the Brown Mountain taxon. In particular, specimens of *E. diversus* and *E. bidawalus* have been collected from several sites, and a thorough redescription of *E. diversus* is currently in preparation. Examination of historic and recent material for all eastern Victorian *Euastacus* species supports the morphological appraisal in the present study, that the Brown Mountain taxon is morphologically distinct.

Samples of genetic material were collected from all specimens captured in the Brown Mountain survey. This material is in storage and is available if required. Genetic material from previous surveys as part of the Australian Crayfish Project have been sent to J Fetzner of the Carnegie Museum of Natural History USA for sequencing and an analysis of *Euastacus* sp. is currently pending. Findings are expected in January, and may be of further interest to stakeholders in the Brown Mountain area.

A morphological description has been prepared for the Brown Mountain taxon. Fig 4.



Euastacus sp. from Brown Mountain

3.0 BROWN MOUNTAIN AQUATIC SURVEY REPORT

3.1 The Regional Crayfish Fauna

There are two other *Euastacus* species recorded from areas nearby the Brown Mountain Forestry Coupes survey area. These are *Euastacus kershawi* and *Euastacus diversus*. These species are known to occur around Goongerah to the south of Brown Mountain. *Euastacus diversus* is known to occur in the Brown Mountain drainage, specifically it is known to occur in Goongerah Creek and Lilly Pilly Creek and their tributaries. Specimens of *Euastacus diversus* have also been collected from Mountain Creek, which starts less than 1 km from the Brown Mountain survey area. Mountain Creek is situated to the west and south of the study area, and is a tributary of the Brodribb River.

Euastacus kershawi is restricted to the main streams habitats, generally from around Goongerah and all the main streams south. *Euastacus kershawi* is a large, spiny and very distinctive crayfish and as such can be easily identified. Only passing reference to this species will be given in this report as it has no relevance.

Another two *Euastacus* species are recorded in East Gippsland. Firstly, is *Euastacus bidawalus* is recorded from drainage systems some 40 km as the crow flies east or south east of Brown Mountain in the lower Bemm River (Lind National Park) and Cann River drainages (Chandlers Creek). It also occurs further east and into south-eastern New South Wales. Secondly, is *Euastacus claytoni* recognized as occurring from the New South Wales Border near Craigie and further north through NSW.

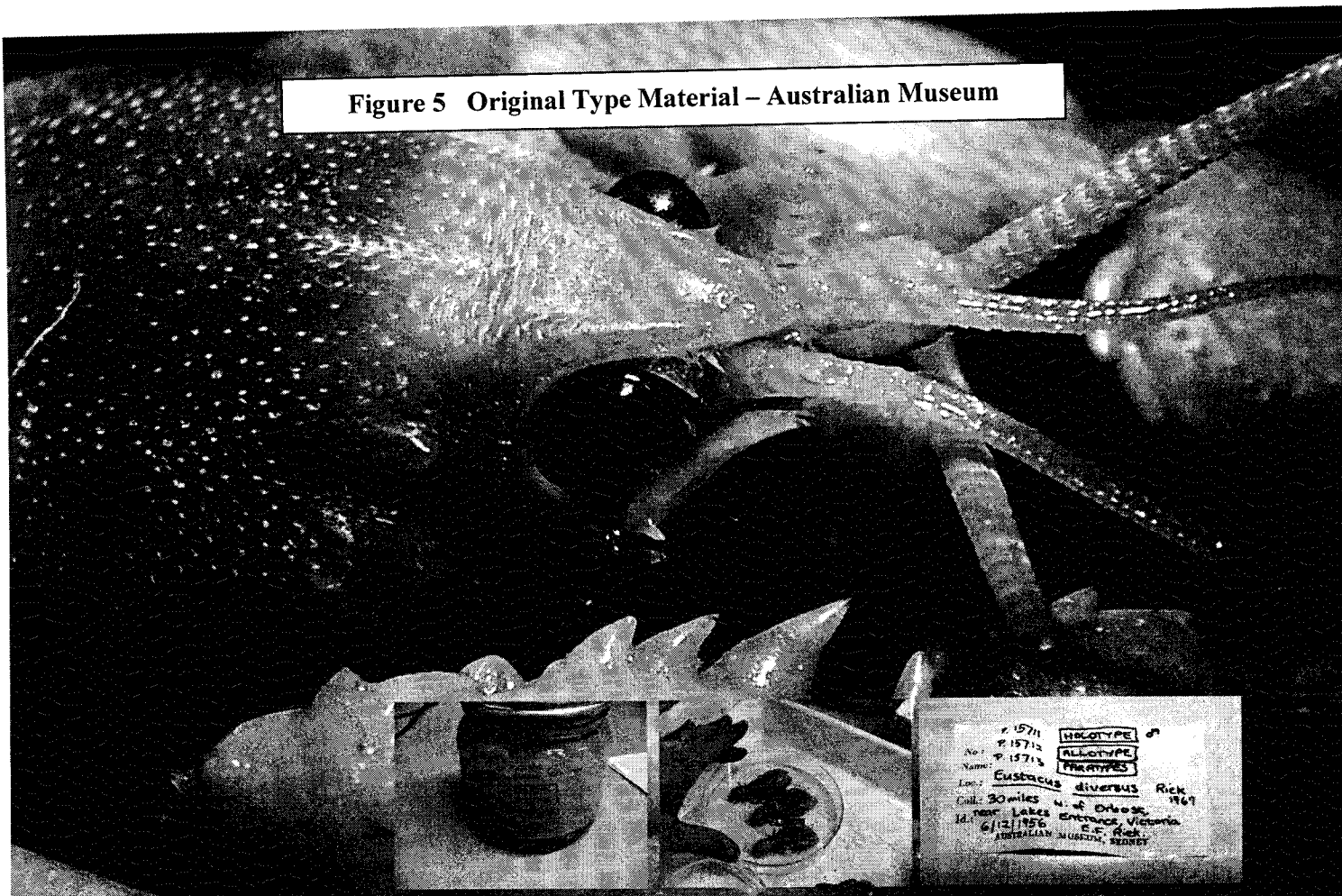
Basic information is provided in the following sections on the two small spiny crayfish that are most relevant to the current report, *Euastacus diversus* and *E. bidawalus*, and on the taxon recorded in the Brown Mountain surveys, *Euastacus* sp. in this study.

3.2 The Orbost Spiny Crayfish *Euastacus diversus*

This is a small crayfish species only reaching max occipital carapace length (OCL) 36.01 mm (ACP Spec 1081). It is found from 250 m a.s.l. to over 1000 m (ACP collection records). It is a creek system crayfish, and a burrowing species that constructs a relatively simple burrow. This is a small species that is not very spiny it and has little capacity to defend itself. It is restricted to near the margins away from the deeper water, likely due to the presence of larger crayfish species and various predators in such areas. In small streams without larger crayfish or predators, the species is less elusive and will openly wander deeper pools. It has been found in low numbers at all sites, and appears to be relatively rare within its native habitat.

The knowledge base on *Euastacus diversus* is extremely poor. Specimens of this species were originally collected from 30 miles north of Orbost by Edgar Riek on the 6th of December 1956. Edgar Riek then described this species in 1969. Since then collection of specimens has been very difficult. In 1986 the then foremost expert on *Euastacus* crayfish Gary Morgan attempted to find new specimens from the type locality but was

Figure 5 Original Type Material – Australian Museum



unsuccessful. He then redescribed the original specimens captured in 1956, held in the Australian Museum.

His redescription published in the memoirs of the Victorian Museum in 1986 represent the latest peer reviewed morphological description on this species. Other scientific papers include; on genetic phylogeny of *Euastacus* (Shull et al), eco-morphological groupings (Coughran), and conservation (O'Brien). In 2003 the Victorian Department of Sustainability & Environment produced an action statement on *Euastacus diversus*, Action Statement No. 128.

To date no females carrying eggs have been captured, although several mature adult females have been captured. This is suggestive of low reproductive rates. Creek surveys have indicated very low population densities and these facts together with its restricted distribution are the reasons for this species to be listed as "threatened" under the FFG Act.

Researchers working on the Australian Crayfish Project have been surveying the East Gippsland region of Victoria since 2006. We are happy to announce that we have successfully located specimens of *Euastacus diversus* from the type locality the original specimens were collected from in 1956. These specimens have been vouchered within the Australian Crayfish Project taxonomic collection, and genetic samples were taken allowing a genetic analysis to be completed for this species. The Australian Crayfish project has collected specimens of *Euastacus diversus* from across its distribution and is currently redescribing this species. Refer AABio Project No: 100016

Euastacus diversus habitat consists of perennial flowing streams from quite large to relatively small streams. Stream water is cool, clear, flowing over a gravel, rock or sandy bed with leaf litter and debris. Streams flow through damp, wet forests or rainforest with tree ferns predominant along the banks. Refer to figure 6 showing typical creek. The estimated distribution of this species is indicated on the map page 37.

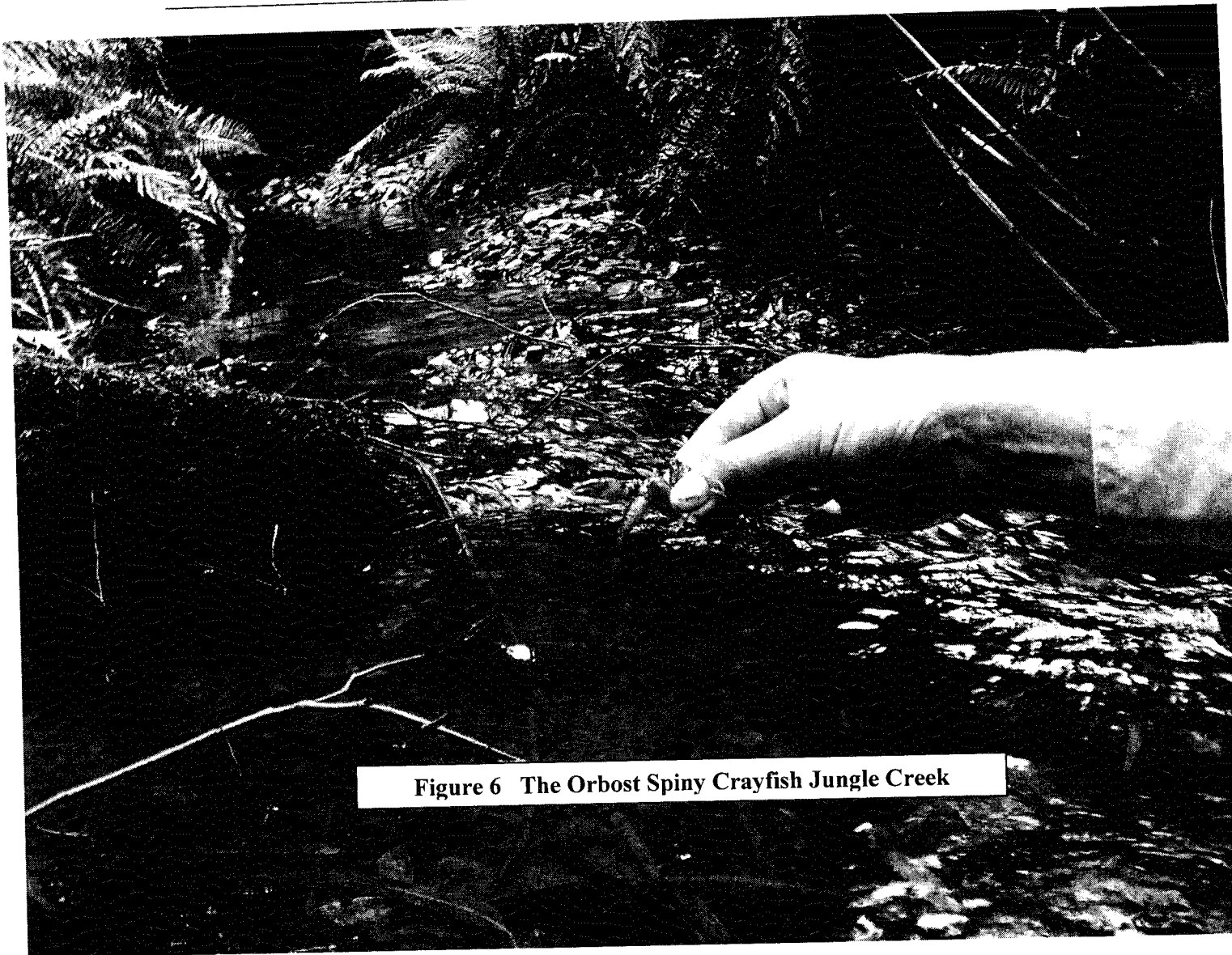


Figure 6 The Orbost Spiny Crayfish Jungle Creek

3.3 The Bidhawal Crayfish *Euastacus bidawalus*

The Bidhawal Crayfish is a larger species reaching a maximum OCL 48 mm. It is a lowland species recorded from 50 m to 450 m a.s.l. Unlike *E. diversus*, it is an extensive burrowing crayfish that constructs a large burrow system extending well up from the stream into the surrounding forest. Additionally, it commonly occurs in areas well away from the stream, and wet damp areas in the adjacent forest floor are readily colonised.

Euastacus bidawalus are a more fecund species and they are quite common within their distribution. Gary Morgan also described *Euastacus bidawalus* from specimens he collected himself and the scientific description as published in the Memoirs of the

Victorian Museum 1986 is the most recent peer reviewed taxonomic account available on this species. The estimated distribution is indicated on the map page 37.

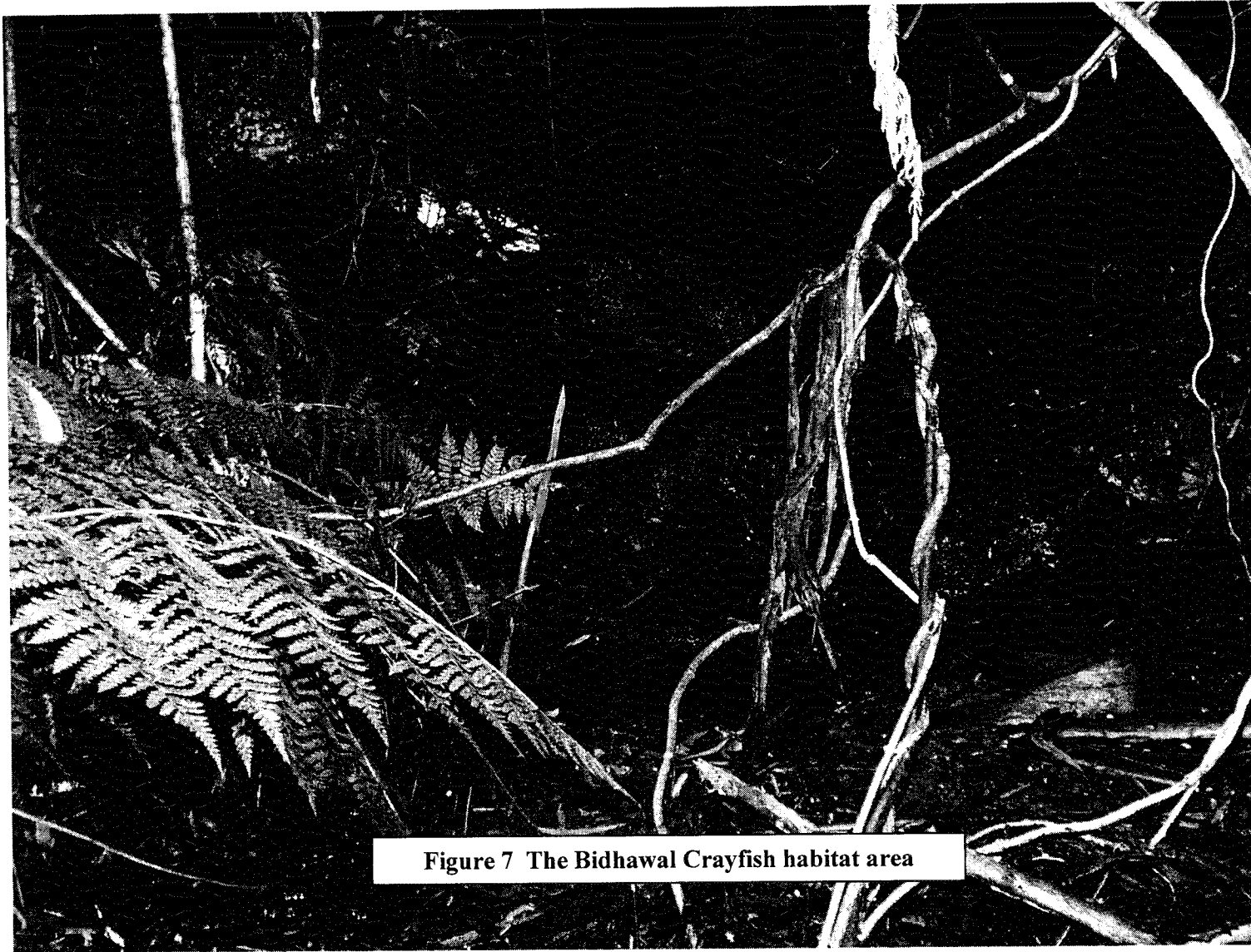


Figure 7 The Bidhawal Crayfish habitat area

3.4 The Bonang Taxon *Euastacus* sp.

This has a maximum OCL of 39.01 mm. It has a severely restricted distribution and a narrow altitudinal range between 700 to 900 m a.s.l. is morphologically most similar to *Euastacus bidawalus* but displays a number of unique traits. Unlike *E. bidawalus*, this is a stream crayfish that does not construct an intricate burrow system. As a stream

crayfish it is much more vulnerable to stream based predators and this may be a factor influencing its restriction to the smaller feeder streams with relatively cold flowing water. The estimated distribution of this species is indicated on the map page 37.

The type locality is a small, un-named, perennial flowing forested stream draining the Errinundra Plateau below Brown Mountain. The watercourse is one to two metres wide, ranges from shallow pools (typically up to ~300 mm deep) to shallow riffle sections typically less than ~50 mm deep. The stream substrate included both coarse (sand/gravel) and fine (dark silt) materials, and the banks were a dark rainforest soil. This stream is a tributary of the Bonang River, which joins the Deddick River, which then joins the Snowy River. The site is located in a State Forest at the base of Brown Mountain at approximately 760 m altitude approximately 6 km south of Bonang in East Gippsland, Victoria. The distribution of this species is only within a small section of stream approximately 2.7 km long. The species does not occur further upstream where the flow becomes intermittent or further downstream where the flow is stronger and the water deeper and full of predatory fish like river blackfish and brown trout.

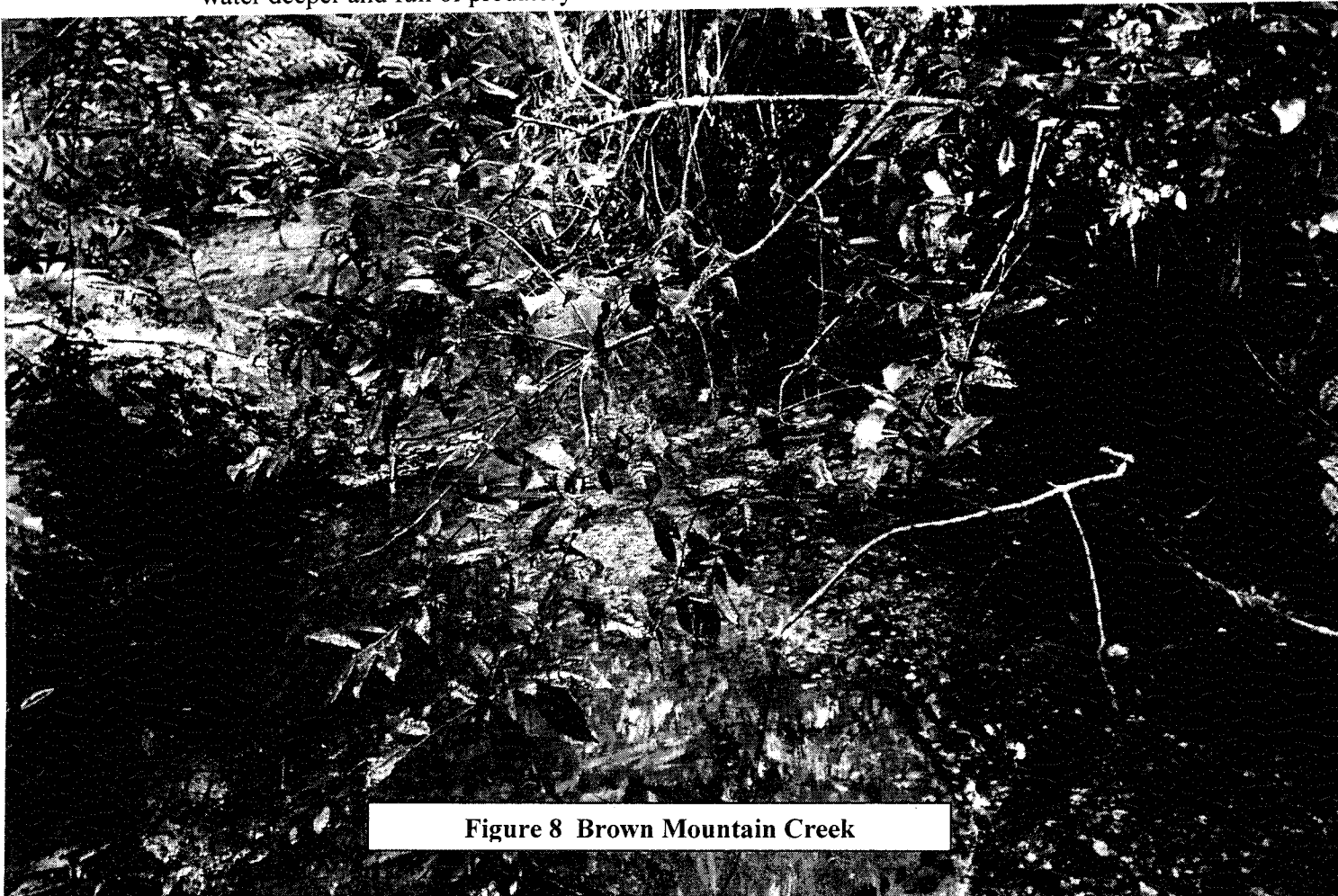
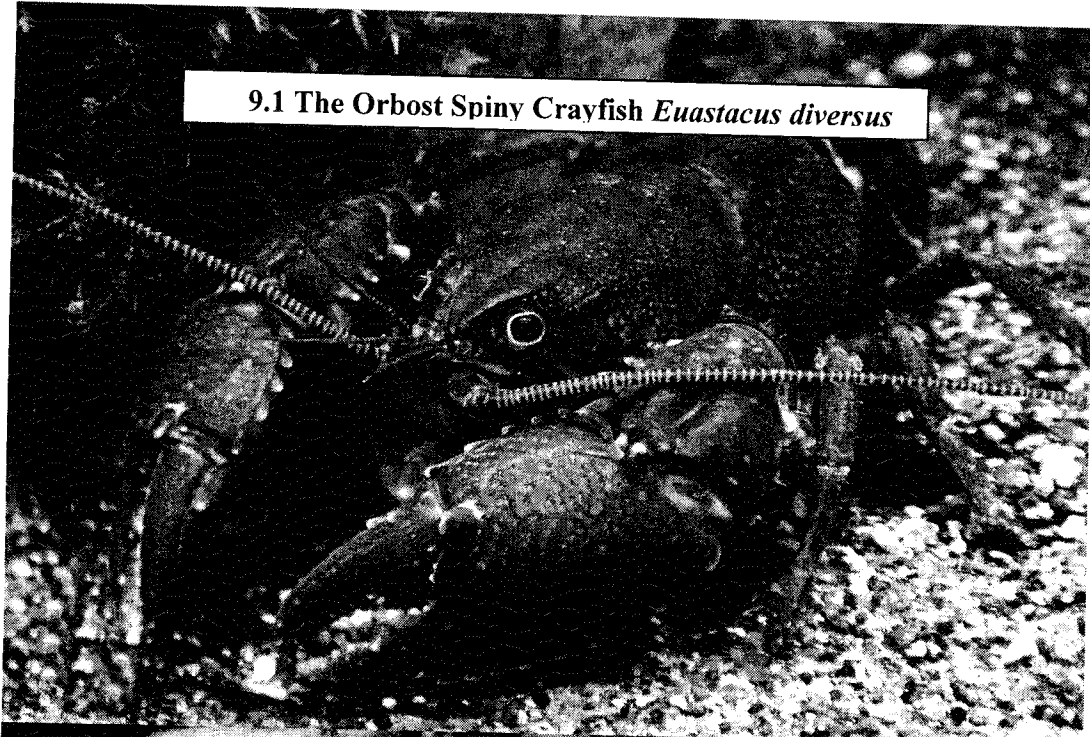


Figure 8 Brown Mountain Creek

9.1 The Orbest Spiny Crayfish *Euastacus diversus*



9.2 The Brown Mountain Spiny Crayfish *Euastacus* sp.

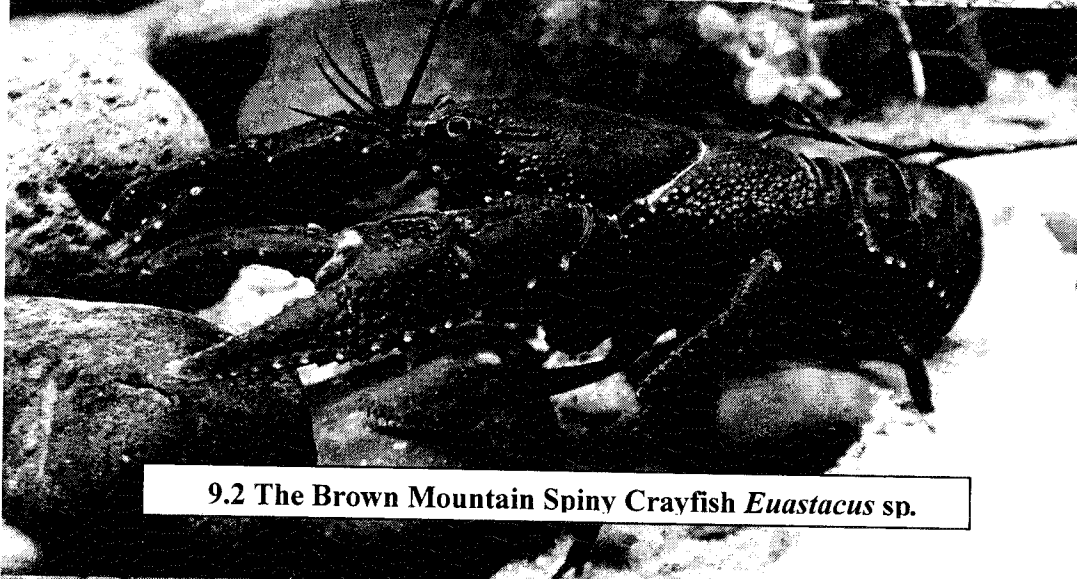


Figure 9

9.3 The Bidhawal Spiny Crayfish *Euastacus bidawalus*



4.0 DISTRIBUTIONS

There are 3 *Euastacus* species of immediate relevance to the Brown Mountain Coupe area. These are *Euastacus bidawalus*, *Euastacus diversus* and *Euastacus* sp. Additionally, there are another two species of *Euastacus* also found near this area, *Euastacus claytoni* & *Euastacus kershawi*. Only *Euastacus* crayfish will be discussed here, though another type of freshwater crayfish *Engaeus orientalis* is found throughout the area, it is an entirely different animal and cannot be confused in any way with *Euastacus* crayfish. The estimated distribution of these species are indicated on the map page 37.

4.1 *Euastacus bidawalus*

As per the latest scientific information – Memoirs of the Museum of Victoria, Volume 47 Numbers 1 and 2, 30th May 1986, Gary Morgan states the distribution to be: Between 150 m and 400 m a.s.l. From near Mt Imlay south of Eden NSW to Lind National Park, 20 km west of Cann River. Refer Figure 9.3.

Surveys as part of the Australian Crayfish Project (ACP) have increased this knowledge base and we believe the species to occur from 50 m to 450 m a.s.l.

Euastacus bidawalus has a more eastern lowland distribution; basically those rivers and streams further east, the lower Bemm, Thurra, Cann, Mueller and Genoa Rivers.

4.2 *Euastacus diversus*

As per the latest scientific information – Memoirs of the Museum of Victoria, Volume 47 Numbers 1 and 2, 30th May 1986, Gary Morgan states the distribution to be 30 miles north of Orbost. Refer to Figure 9.1.

The Victoria Department of Sustainability and Environment in their Action Statement No. 128 indicates the distribution to be: 30 miles north of Orbost, Ferntree Creek, Ellery Creek, Jungle Creek and Lilly Pilly Creek, all part of the Brodribb River catchment. They also indicate that it occur in Yandown Creek in the Queensborough River Catchment. Request was made to DSE in November 2009 to be granted access to examine any specimens related to *Euastacus diversus* and the distributions statements made in the Action Statement 128. To date we have been unable to verify the Yandown Creek statement.

Surveys by the ACP teams have expanded the knowledge base on *Euastacus diversus* and can confirm the following. The Orbost Spiny Crayfish is found in the Brodribb River and its tributaries from 250 m a.s.l. to over 1000 m a.s.l. Known locations include Ellery Creek, BA Creek, Ferntree Creek, Martins Creek, Mountain Creek, Jungle Creeks and Lilly Pilly Creek. It is also suspected to be in tributaries of the Errinundra River, a tributary of the Bemm River.

These rivers and streams run roughly south from the mountains to the sea and involve only 2 upper river catchments – the Brodribb and Bemm.

4.3 *Euastacus* sp.

Surveys of the East Gippsland region of Victoria have identified this species from only three highland locations, all tributaries of the Bonang River. The species has a very limited distribution of between 700 m and 900 m a.s.l. These streams run roughly north to the Bonang River then the Deddick River and finally the Snowy River.

Biological surveys of the unnamed tributary of the Bonang River at the Brown Mountain forestry coupe this species in just a <3 km section of creek running through the Brown Mountain Coupe area. Refer Figure 9.2.

4.4 *Euastacus claytoni*

As per the latest scientific information – Records of the Australian Museum, supplement 23, 7 March 1997. Gary Morgan states the distribution of *Euastacus*

claytoni to be from the Craigie area near the NSW and Victorian border through Nimmitabel to the vicinity of Captains Flat. The ACP has dramatically increased this distribution to well into East Gippsland, to within 10 km of Brown Mountain. However, this species is easily distinguished morphologically from *E. bidawalus*, *E. diversus* and *Euastacus* sp. in that it does not have a male cuticle partition.

4.5 *Euastacus kershawi*

As per the latest scientific information – Memoirs of the Museum of Victoria, Volume 47 Numbers 1 and 2, 30th May 1986, Gary Morgan states the distribution to be from sea level to approximately 250 m in southerly flowing streams of Gippsland. *Euastacus kershawi* is a giant spiny crayfish growing to a very large size; it is also very spiny so easily distinguished from the other less spiny species. ACP survey teams captured both *Euastacus diversus* and *Euastacus kershawi* together at Martins Creek and *E. kershawi* is known to occur in the river at Goongerah some 10 km south of the Brown Mountain survey site.

4.5 The Status of the Knowledge Base

The knowledge base on all these species is limited. I expect the main Victorian Government management agency does not know of the existence of the Bonang crayfish taxon, which is still in the process of being formally described. It does, however, know of the Orbost Spiny Crayfish and acknowledges the deficiency in knowledge of this rare species and recommends several management actions in its Action Statement 128 (2003):

- Systematically survey those streams likely to contain populations of Orbost Spiny Crayfish be carried out.
- Habitat Protection of 100 m buffers for 1 km upstream and downstream of detection sites.
- Preclude the release of non indigenous aquatic species into public waters.
- Monitoring annually at two of the known populations of Orbost Spiny Crayfish.

- Ongoing liaison to ensure officers working in the area are aware of its existence and report suspected records of the species.
- Provide samples of *E. diversus* and *E. bidawalus* to Deakin University in order to undertake a biochemical taxonomic study.

To the best of my knowledge DSE has not conducted systematic surveying or annual monitoring. No new information been added to the knowledge on the biology of the species. It is unclear if samples have been sent to Deakin University or results of that study have been released.

The Australian Crayfish Project has been conducting systematic biological surveys of East Gippsland. Requests for financial assistance to DSE, the East Gippsland Catchment Management Authority, East Gippsland Shire Council and directly to the Premier of Victoria have been unsuccessful. The conservation work identified for this species appears to have received little priority from management agencies. Placing scientists and equipment into remote areas for extended periods of time is an expensive task, further complicated by the fact that every day in the field requires at least two days in the office to examine, record and collate the information gathered. Additionally, preparation of reports or scientific papers embodying the findings requires at least another 100 hours of work.

Despite this lack of support the ACP has slowly progressed and a large amount of new information has been collected and will continue to be collected over the next 10 years.

Biological surveys of East Gippsland lasting 2-7 days per session were conducted by ACP Teams in;

- September 2006
- June 2007
- September 2007
- November 2007
- January 2008
- October 2009
- November 2009

These surveys have gathered much information but surveying will continue over the next few years to gather more. Ultimately, the ACP aims to clarify the taxonomy, distribution and ecology of all the crayfish species in East Gippsland. At this time it appears that we will describe three new *Euastacus* species and redescribe two known *Euastacus* species. Ongoing research into *Engaeus* and *Gramastacus* species also continues throughout East Gippsland. The description of the Bonang taxon is the first instalment of this research and is expected to be published shortly. A redescription of *Euastacus diversus* is scheduled to follow, in early 2010.

5.0 BROWN MOUNTAIN FORESTRY COUPES – INFORMATION REQUESTS

The following information refers directly to the specific information requests from Bleyer Lawyers, as requested Ref: VEB:2009003 dated 26th October 2009. Numbering relates directly to the numbered information requests.

11. *What steps are necessary in order to ascertain whether or not the Orbost Spiny Crayfish is, or is likely to be, present in or near the Brown Mountain Forestry Coupes?*

The specified area would need to be surveyed biologically using both active and passive capture methods to find and identify the crayfish species present. Crayfish specimens would need to be vouchered and used for intensive morphological examination by freshwater crayfish identification experts to confirm the identification the species. Morphological examinations should take into account both the published description of the species and more recent research on the taxonomy of *E. diversus* and other crayfish in East Gippsland. For any survey of *Euastacus* freshwater crayfish or specifically the Orbost Spiny Crayfish a “threatened species” a number of permits from the Governmental management agencies would need to be obtained.

The steps mentioned above have now been completed, as outlined in Section 2.0.

12. *On the basis of a site visit or visits to and surveys of each of the Brown Mountain Forestry Coupes.*

a) *Are Orbost Spiny Crayfish present in any or all of the four Brown Mountain Forestry Coupes? If so, please explain in which of the Brown Mountain Forestry Coupes and explain the reasons for your opinion.*

A biological survey by an ACP survey team consisting of four field workers did not find any evidence of Orbost Spiny Crayfish within the coupe areas.

A different and currently undescribed species of crayfish was found within the general borders of two coupes, specifically in the main water course of coupes 840-502-0015 & 840-502-0019.

b) *If you are unable to form an opinion as to (a), is it likely that the Orbost Spiny Crayfish are present in any or all of the Brown Mtn Coupes etc.*

The surveys for the Orbost Spiny Crayfish have used both active and passive techniques, and searched in both stream and adjacent forest habitats. These thorough surveys have recorded two species of crayfish but have failed to locate any Orbost Spiny Crayfish, suggesting that it is unlikely the Orbost Spiny Crayfish occurs in these particular forest coupes.

The identification of a different, undescribed species of spiny crayfish in these coupe areas also renders it unlikely that the Orbost Spiny Crayfish is present in coupes east of Legges Road since different species of *Euastacus* rarely occur close together

unless they are vastly different in body size and biology. Legges Road can be used as a general divider for this forestry region.

Therefore *Euastacus diversus* appears to be restricted to streams west of Legges Road , and *Euastacus sp.* is restricted to streams to the east of Legges Rd. The coupe area identified as 199192 of the Brown Mountain Land Status and Harvesting History Map falls within Orbost Spiny Crayfish distribution area.

- c) *Are Orbost Spiny Crayfish likely to be using of traversing any or all of the Brown Mountain Coupes?*

The specific knowledge base on *E. diversus* is limited, however, based on our existing knowledge of *Euastacus* generally, we would not expect that the Orbost Spiny Crayfish is traversing any of the Brown Mountain Coupes (east of Legges Road) joining the unnamed tributary of the Bonang River.

13. *With what level of confidence are you able to predict whether or not the species will be present in, likely to be present in, or using or traversing the Brown Mountain Forestry Coupes? What factors, etc influence your level of confidence.*

I am 100% confident that a different species of freshwater crayfish is present in the Brown Mountain Forestry Coupes (840-502-0015 & 840-502-0019) that adjoin the unnamed tributary of the Bonang River. I am also reasonably confident that the Orbost Spiny Crayfish is not present in this unnamed tributary of the Bonang River as surveys failed to locate any specimens despite employing a range of survey techniques that have readily located the species at other sites. In my opinion it is very unlikely to occur with a similar species that has similar biological requirements. That said, the overall knowledge base on both of these species is small; and it is just conceivable that the OSC may be present in the coupes concerned.

14. *Would the logging of any or all of the four Brown Mountain Forestry Coupes have any impact on the Orbost Spiny Crayfish as a species, the local population or individual members of the species? If so, can you estimate what the nature and level of impact will be?*

The Orbost Spiny Crayfish is not within this river system so this species will be unaffected. However, an undescribed species occurs within this river system and this species has a seemingly more restricted distribution than the Orbost Spiny Crayfish. After it is described, this Brown Mountain taxon will require immediate protection under the Flora and Fauna Guarantee Act 1988.

This new species has an extremely restricted distribution and survives at very low population densities in a very fragile environment. I expect that controlled logging would have only limited impact on this species. Uncontrolled logging could be detrimental and has the potential to exterminate the species from this tributary.

This new species is only present in a very small section of stream (between 2 and 2.7 km of stream length). Coupes 840-502-0015 & 840-502-0019 are roughly in the centre of this fragile distribution. There is definitely the potential to eliminate this species from the creek if logging operations disturb the fragile balance in any way. With a small habitat area and small population size, any alteration could rapidly lead to the extinction of the species within that creek.

6.0 POTENTIAL CONSERVATION ISSUES - DISCUSSION

Once described this new species will be recommended for listing under the Flora and Fauna Guarantee Act 1988.

This new species has an extremely restricted distribution, it is only found within the upper catchment in the shallow flowing water. Downstream once the water gets deeper around the 300 mm mark it is not found, upstream once the flow becomes intermittent or ephemeral it is not found. This means in any given creek system only a section from 0.5 to 5 km long may be habitable by this species. Then within this small section it is only found in the deeper pools and only when major predators are not present. Additionally, it is likely that the water needs to be cool. Any alteration to these critical requirements will lead to the demise of this species. This species only seems to utilise the prime habitat areas which are scattered through the creek systems.

This extremely restricted distribution with small overall populations makes this species exceptionally vulnerable to localised environmental disturbances. Logging activities and road construction impacting on the fragile habitat balance could prove disastrous for this species.

Specimens captured in the creek were returned to the laboratory alive to photograph in glass aquaria. At 20°C the crayfish showed signs of stress and started lying on their sides. At 24°C the crayfish rolled onto their backs and I expect would have died. Once the water was cooled to 18°C they showed no sign of any stress and behaved normally. It is hard to accurately determine temperature stresses on crayfish within a short time. Our observations were conducted within the first week of capture so they would have been stressed from capture and placement in a new environment. Stress is accumulative. Perhaps in a natural environment without additional stresses they may better tolerate warmer water and it may need to get a few °C hotter before they expire. At this time I would indicate that the species becomes stressed at 20°C and mortality may occur at 24-26°C. I would recommend to the management agencies as a matter of urgency that they start collecting water temperature data in these Bonang River tributary streams as this new species seems to be far less tolerant of increased water temperatures than the Orbest Spiny Crayfish.

Currently, the streams inhabited by this new crayfish species are sheltered from the sun by a high eucalyptus canopy and a lower soft tree fern (*Dicksonia*

antartica) canopy. This helps ensure they are cool and dark. Logging activities along the creek that removes the canopy and allows sunlight to impact on the water and surrounding land that leads to raising its temperature could be extremely detrimental. This includes the whole habitat area upstream as clearing will raise the temperature of all downstream habitat areas. Clearing is a problem as is fire. Current forestry practices are to clear and burn the coupe. Even if the riparian zone is not cleared it is still vulnerable to fire so extreme caution needs to be instigated with fire management.

An additional threat is the use of fire retardant chemicals to fight bushfires. These chemicals have unknown consequences for all aquatic life in the creek systems.

Any alteration to the water flow is detrimental, anything that increases the flow or reduces the flow will compact the habitat available for the species. Extreme drought could dramatically affect this species as would extended periods of consistent rain.

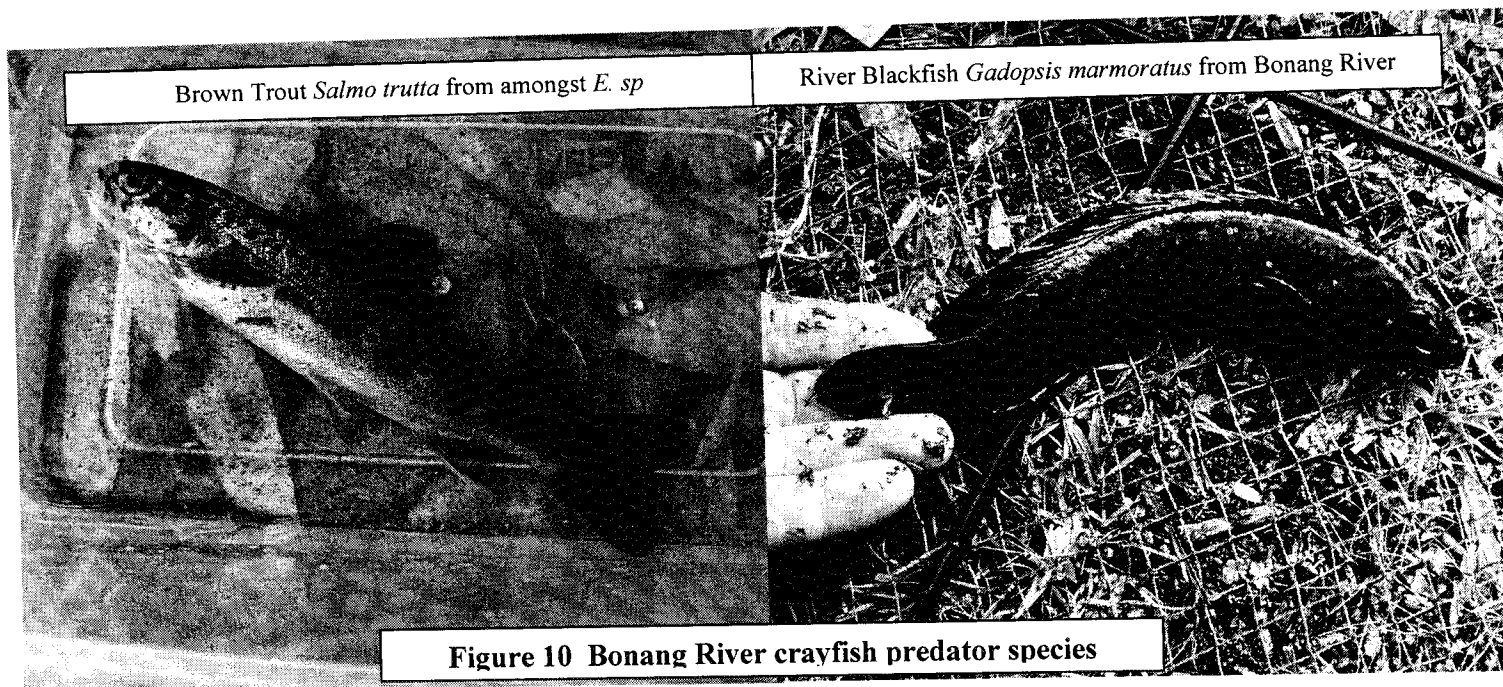
Sediment pulses generated by forestry activities and road construction can have immediate negative effects to this crayfish species. The species only utilises the deeper pools so if these become sedimented then the habitat is lost. Also the structures under which they shelter could be buried under sediment loads.

Sediment loads suspended in the water column are an unknown factor that should also be avoided as a precaution and any disturbance of the surrounding catchment area via logging activities or road construction should be avoided.

Plantation forestry practices like clear felling and planting non native/local species like pines can have unknown consequences for native crayfish species if the chemistry of the runoff water alters.

In stream structure is also critical, the species only inhabits the shallow pools, an increase in flush flow from storm events that leads to a scouring of these pools

making them deeper will be detrimental as such conditions may encourage the establishment of predators.



This new species may currently be under threat by introduced species which use freshwater crayfish as a major food source. Brown trout are an exotic introduced species and this new crayfish species will not have adequate defence mechanisms to deal with new introduced predators. The Bonang taxon does not live in the deeper water downstream where the native predatory fish species River Blackfish live. Brown trout, however, are a species that penetrates further upstream and were captured in amongst *Euastacus* bonang populations. Brown trout therefore constitute a current threat, and may partly account for the apparently low population densities of *Euastacus* sp. observed.

From my observations this small section of creek is critical habitat for this species; it seemingly has nowhere else to go. It is likely it needs perennial flowing water so can't go far upstream as the creek only flows suitably for this <3 km section. It is unlikely to go downstream as the faster flowing deeper water is full of predators waiting to eat it. It seems that despite what occurs this species must stay put, it does not have anywhere to go if conditions change, in periods of stress, this section of stream is it. I feel this section of stream is essential for

its full lifecycle requirements with the total population being born, growing old and dying within this <3 km section of stream.

15. *To the extent that you find there to be an impact by reason of the intended logging operations, will the Orbost Spiny Crayfish recover from that impact and if so over what time would you expect that recovery to occur?*

The Orbost Spiny Crayfish is not present. The Bonang taxon is present. The knowledge base on this species is small, predictions of recovery times or even if recovery is possible cannot be given at this time.

16. You are asked to assume that VicForests will, prior to logging the coupes:

- (a) create a 100m stream side buffer for the stream that runs along the eastern boundary of coupe number 840-502-0015;
- (b) identification of hollow bearing trees

Assuming VicForests adheres to the prescriptions in (a) and (b) above, and assuming logging is carried out in the coupes, would that affect your answers to question 14 and 15 above? If so, in what way?

If a 100m buffer along both sides of the creek is instigated along the full, approximately 3 km section of creek inhabited by this rare, undescribed crayfish species that should in my opinion, based on the current level of knowledge on this species, minimize detrimental effects on this crayfish species.

Continued monitoring of the species and the quality of its habitat (water temperatures, siltation, dissolved oxygen, flow, depth, etc.) would be advisable.

7.0 THE PRECAUTIONARY PRINCIPLE

17. What is your understanding of the precautionary principle?

The Precautionary Principle is where there are threats of serious or irreversible environmental damage to a species or bioregion. Full scientific knowledge may not be currently available but that lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

8.0 CONCLUSION

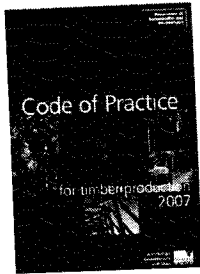
The Orbost Spiny Crayfish is a freshwater crayfish species restricted to two drainage systems with a distribution within these systems from 250m to 1050 m a.s.l. This species is rare with little biological information available on the species. It is referred to as one of Australia's most endangered crayfish by many and the Victorian Department of Sustainability and Environment refers to it as a "*crayfish with one of the most restricted distributions of all Euastacus species*". The Victorian Scientific Advisory Committee determined that the Orbost Spiny Crayfish is:

- significantly prone to future threats which are likely to result in extinction, and
- very rare in terms of abundance and distribution.

The Orbost Spiny Crayfish has been listed as a threatened taxon under the Flora and Fauna Guarantee Act 1988. The DSE in 2003 generated Action Statement No. 128 with 6 Intended Management Actions in an effort to help protect and conserve this rare threatened crayfish species.

Neither the Orbost Spiny Crayfish (*Euastacus diversus*) nor The Bidhawal Crayfish (*Euastacus bidawalus*) was found in the section of creek relevant to the Brown Mountain Forestry Coupes. Only *Engaeus orientalis* and a new species of freshwater crayfish was found, the latter of which seems rarer and with a much smaller distribution than the threatened Orbost Spiny Crayfish. Unfortunately, this new species has been misidentified by the Management Agencies charged with its protection. This reflects the

poor status of the knowledge base for these species in the areas that are currently threatened by significant habitat alteration.



The Victorian Government has created a Code of Practice for timber production 2007. In that Code the then Minister for Water, Environment and Climate Change, John Thwaites, says “the Code supports the Victorian Government’s commitment to managing the multiple roles of our forests and plantations in maintaining our natural heritage, biodiversity, health, wellbeing and prosperity”. Within this Code the first Code Principle states; “*Biological diversity and the ecological characteristics of native flora and fauna within forests are maintained*”.

It seems extraordinary that Forestry operations approved under this Code of Practice can be conducted in areas where the management agencies have no knowledge of the species within these areas. How can the biodiversity of an area be protected or maintained if no one knows what species are there to protect?

Australia has adopted ecologically sustainable development (ESD) as a guiding principle of environmental management. In relation to these coupes a threatened crayfish species *Euastacus diversus* was known to be present in the general area. DSE in their Action Statement No. 128 admits they know little about this species distribution, biology or ecology. When there is insufficient scientific certainty about the impacts of logging projects on these species, a precautionary approach should be taken when approval is given. Mandatory 100 m plus buffer zones along all creeks should be a standard requirement for any logging approval in this East Gippsland region.

Ideally the creeks in the proposed logging area should have been surveyed by suitably qualified and experienced aquatic biological surveyors for all species prior to any issue of permission to conduct logging activities in this area. Appropriate surveys should include both active and passive sampling techniques in order to maximise the likelihood of detecting elusive species. In order to uphold a duty of care for threatened crayfish and the maintenance of biodiversity in East Gippsland, it is recommended that DSE initiate such surveys in similar situations in the future.

The new information arising from the current study on a rare species of freshwater crayfish that we have observed only living in small sections of perennial creeks flowing through publically owned forests in East Gippsland should be immediately utilised by the management agencies. A precautionary approach needs to be taken now to protect and conserve the aquatic biodiversity in these areas. The species and the natural environment in which it lives must be protected.

Declaration

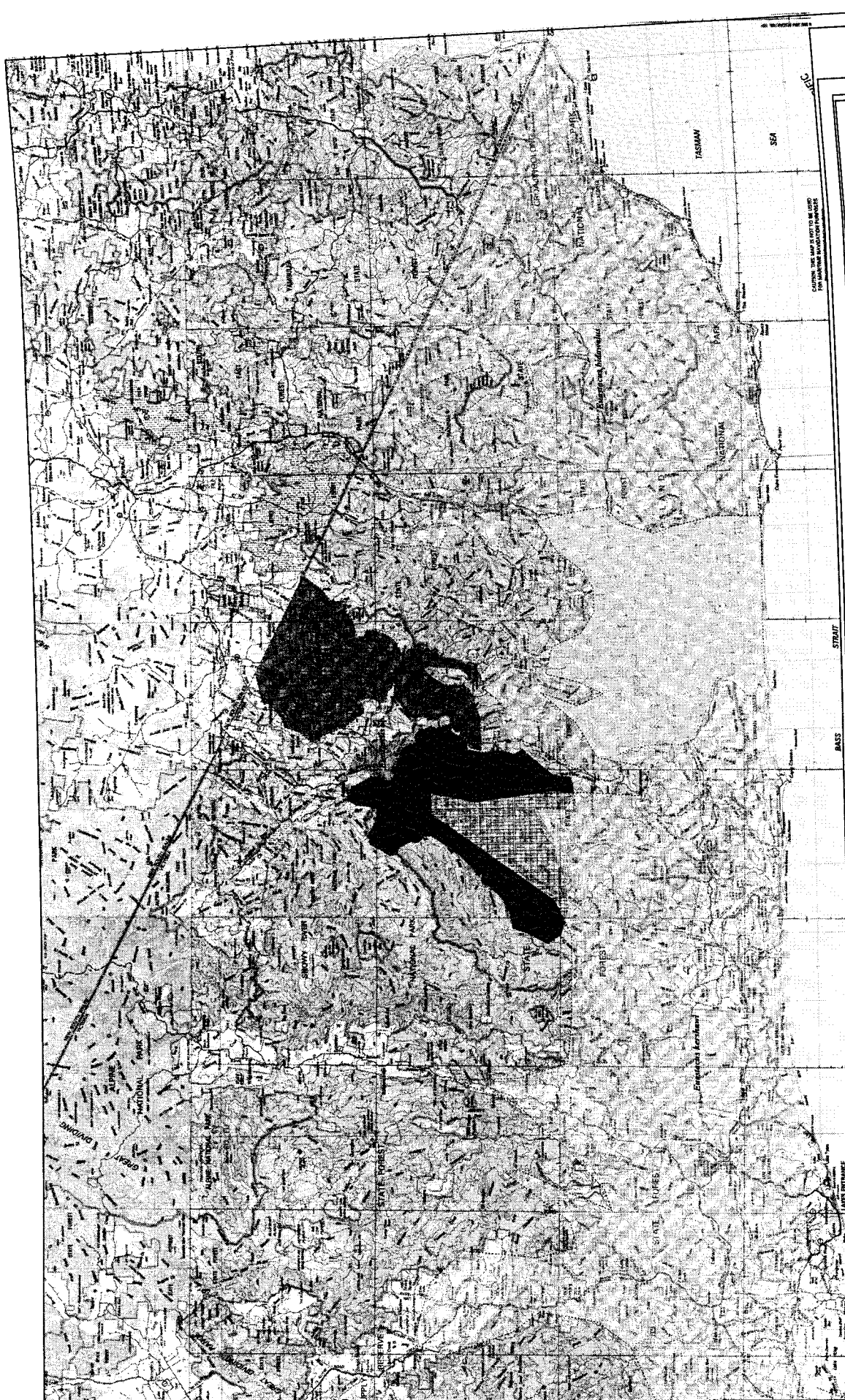
I have made all the enquires which I believe are desirable and appropriate, and no matters of significance which I regard as relevant have, to the knowledge of the expert, been withheld from the court.

Dated:

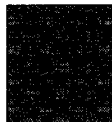
Robert B McCormack
Research & Aquaculture Director
Australian Aquatic Biological Pty Ltd

REFERENCES

- Coughran, J., 2002.** A new species of the freshwater crayfish genus *Euastacus* (Decapoda: Parastacidae) from northeastern New South Wales, Australia. *Records of the Australian Museum* **54**(1): 25–30.
- Coughran, J., 2005.** New crayfishes (Decapoda: Parastacidae: *Euastacus*) from northeastern New South Wales, Australia. *Records of the Australian Museum* **57**(3): 361–374.
- Coughran J., 2008.** Distinct Groups in the Genus *Euastacus*? *Freshwater Crayfish* **16**:123–130.
- Coughran, J. & S. Leckie, 2007.** *Euastacus pilosus* n. sp., a new crayfish from the highland forests of northern New South Wales, Australia. *Fishes of Sahul* **21**(1): 308–316.
- Department of Sustainability and Environment, 2003.** Action Statement, No. **128**, “The Orbost Spiny Cray *Euastacus diversus*”.
- Department of Sustainability and Environment, 2007.** Code of Practice for Timber Production 2007.
- McCormack, R.B. 2008.** The Freshwater Crayfish of New South Wales Australia. Australian Aquatic Biological Pty Ltd., Karuah, NSW.
- McCormack RB and Coughran J (2008).** *Euastacus maccai*, a new freshwater crayfish from New South Wales. *Fishes of Sahul* **22**(4): 471-476.
- Meredith, C., 2009.** Assessment of Critical Habitat for Six Species Under the Flora and Fauna Guarantee Act in the Bonang-Goongerah Area, East Gippsland, Victoria.
- Morgan, G.J., 1986.** Freshwater Crayfish of the Genus *Euastacus* Clark (Decapoda: Parastacidae) from Victoria. *Memoirs of the Museum of Victoria* **47**(1): 1–57.
- Morgan, G.J., 1997.** Freshwater crayfish of the genus *Euastacus* Clark (Decapoda: Parastacidae) from New South Wales, with a key to all species of the genus. *Records of the Australian Museum* (1997) Supplement **23**.
- O'Brien MB 2007.** Freshwater and terrestrial crayfish (Decapoda, Parastacidae) of Victoria, status, conservation, threatening processes and bibliography. *The Victorian Naturalist* **14**(4): 210-229.
- Williams. G. 1990** Invertebrate conservation in: Kennedy, M. (ed). Australia's Endangered Species. Pp: 135-43. Simon and Schuster, Australia.



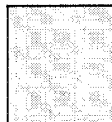
Eusarcus sp.
Brown Mountain
Bonang



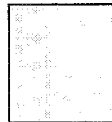
Eusarcus diversus
Orlist Spiny
Crayfish



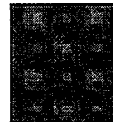
Eusarcus claytoni



Eusarcus hibernalis



Eusarcus kerriani



Eusarcus species
Not Brown Mountain
species

Map:
Location:
GPS:
Datum:

Natmap Raster
East Gippsland Victoria
Top Left 36 7408"S, 147.6637"E
Bottom Left 27 8635"S, 150.0893"E
Deodetic: GDA94
Grid: MGA94

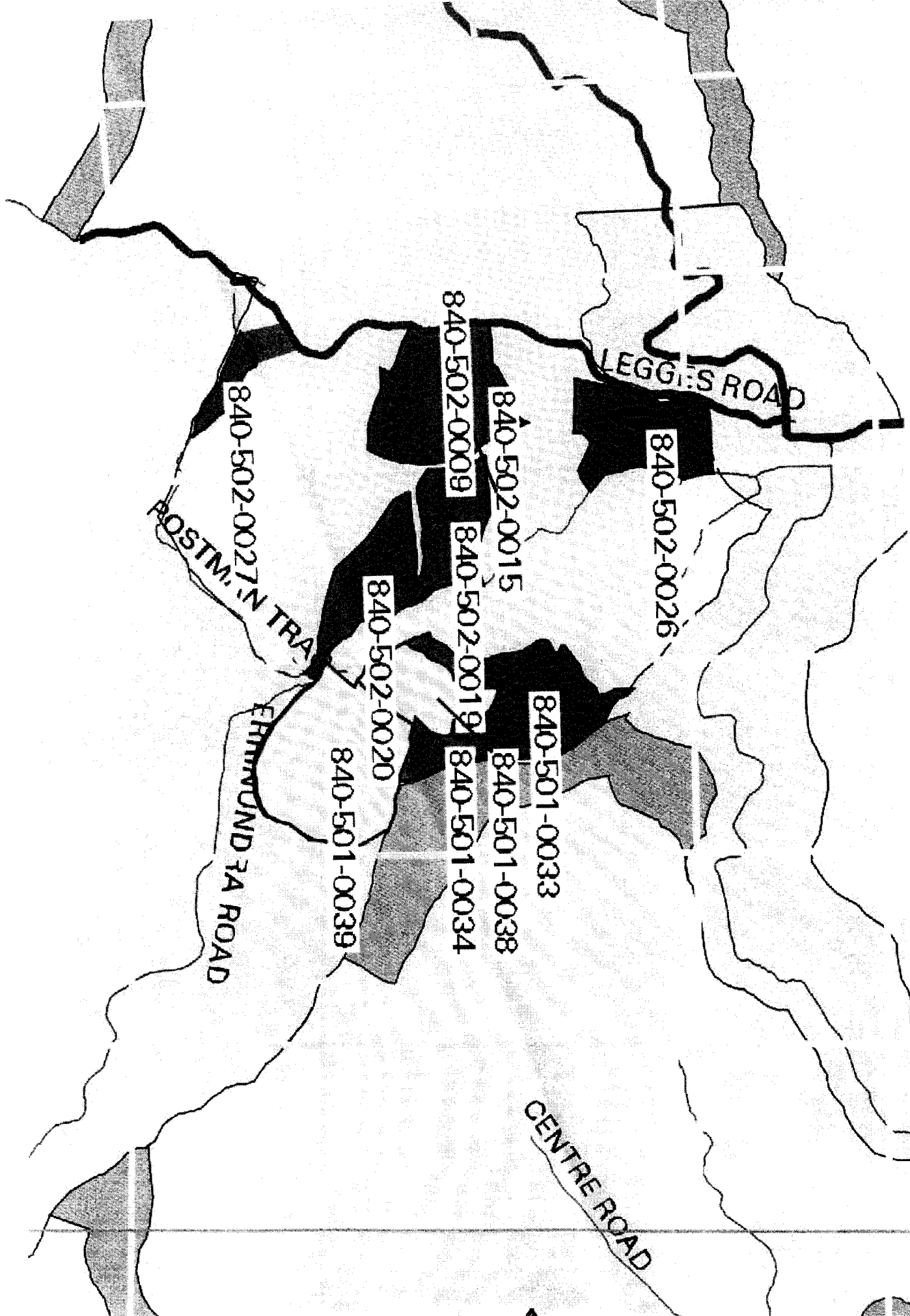
Client: Blyer Lawyers, Lonsdale Street, Melbourne, Vic.
Estimated Crayfish Distributions
East Gippsland
Victoria

AUSTRALIAN
AQUATIC BIOLOGICAL P/L
AQUATIC BIOLOGICAL SURVEY

DATE: 07/12/09

RB McCormack

Page 37 of 47



Map Name	Latitude_longitude		Comment	Symbol
/wpt/name	/wpt/lat	/wpt/lon	/wpt/cmt	/wpt/sym
Yandown Crk	-37.26471	148.9258		Crossed Square
ACP E bonang Result	-37.24643	148.7878	E., bonang-Result Crk-Bonang Rv	Crossed Square
ACP E. div Sassafras	-37.30486	148.8856	E. diversus Erinundra River -Bemm Rv	Crossed Square
ACP E. div Jungle Cr	-37.30383	148.6744	E. diversus- Jungle Ck- Brodribb Rv	Crossed Square
Martins crk	-37.41748	148.603	E. diversus-Martins Crk-Brodribb Rv	Crossed Square
ACP E. divers Lilly	-37.27319	148.7188	E. diversus- Lilly Pilly Crk-Brodribb Rv	Crossed Square
ACP E. div LP Crk	-37.26976	148.7221	E. diversus- Lilly Pilly Crk-Brodribb Rv	Crossed Square
ACP E. div Jungle C1	-37.30284	148.6726	E. diversus- Jungle Ck- Brodribb Rv	Crossed Square
DSE Spec 11 Yandown	-37.26469	148.9257	Queensborough Rv	Hunting/Fishing
Goolengook Rv	-37.48209	148.8636	Bemm Rv	Hunting/Fishing
DSE Spec1	-37.36377	148.7559		Crossed Square
DSE Spec 2	-37.36277	148.7756		Crossed Square
DSE Spec 3	-37.41955	148.6829		Crossed Square
DSE Spec 4	-37.34943	148.7189		Crossed Square
DSE Spec 5	-37.30425	148.6749		Crossed Square
DSE Spec 6	-37.29908	148.7073		Crossed Square
DSE Spec 8	-37.39895	148.5884		Crossed Square
DSE Spec 7	-37.39206	148.5969		Crossed Square
DSE Spec 9	-37.44377	148.5842		Crossed Square
DSE Spec 10	-37.43192	148.5551		Crossed Square
POI362	-37.04772	148.8947		Crossed Square
POI363	-37.04772	148.8947		Box
ACP E. orientalis2	-37.09427	148.726	E. orientalis	Box
ACP E. orientalis1	-37.09383	148.7266	E. orientalis	Crossed Square
ACP E. orientalis	-37.0922	148.7314	E. orientalis	Crossed Square
ACP River Blackfish	-37.15275	148.7241	River Blackfish	Crossed Square
ACP E. orientalis3	-37.29735	148.8413	E. orientalis	Crossed Square
ACP E. orientalis4	-37.30345	148.8346	E. orientalis	Crossed Square
ACP E. orientalis5	-37.3485	148.8406	E. orientalis	Crossed Square
Start Coupe Track	-37.26442	148.768	START-TRACK	Crossed Square
ACP E. div Martins	-37.41733	148.6032	E. diversus-Martins crk- Brodribb Rv	Crossed Square
Base 2	-37.25384	148.7542		Box
Base 3	-37.26222	148.7534		Box

S1-North Limit	-37.25347	148.7562	Survey Site 1	Sight Seeing
S1-South Limit	-37.25453	148.7562	Survey Site 1	Sight Seeing
Trap1	-37.2541	148.7561		Hunting/Fishing
Trap1A	-37.25383	148.7561		Hunting/Fishing
Trap3	-37.25417	148.7561		Hunting/Fishing
Trap4	-37.25423	148.7561		Hunting/Fishing
Trap5	-37.25427	148.7561		Hunting/Fishing
Trap6	-37.25435	148.7562		Hunting/Fishing
Base1	-37.26415	148.7652		Box
S2-North Limit	-37.26046	148.7587	Survey Site 2	Sight Seeing
Trap7	-37.26068	148.7588		Hunting/Fishing
Trap8	-37.26078	148.7588		Hunting/Fishing
Trap9	-37.26097	148.7589		Hunting/Fishing
Trap10	-37.26107	148.759		Hunting/Fishing
Trap11	-37.26118	148.759		Hunting/Fishing
Dry Creek bed	-37.26246	148.7616		Hunting/Fishing
ACP River Blackfish 1	-37.24234	148.7604	River Blackfish	Crossed Square
ACP Brown Trout	-37.24278	148.7606	Brown Trout	Crossed Square
ACP Brown Trout1	-37.24267	148.7581	Brown Trout	Crossed Square
Base2	-37.25399	148.7541		Box
Trap2	-37.25394	148.7562		Hunting/Fishing
ACP E. bonang	-37.28309	148.8076	E bonang-Bonang Rv Picnic Area-Bonang	Crossed Square
ACP E. bonang1	-37.26057	148.7587	E bonang-Brown Mtn Crk-Bonang Rv	Crossed Square
ACP E. bonang2	-37.26092	148.7588	E bonang-Brown Mtn Crk-Bonang Rv	Crossed Square
ACP E bonang	-37.26125	148.7588	E bonang-Brown Mtn Crk-Bonang Rv	Crossed Square
ACP E. bonang3	-37.26144	148.7588	E bonang-Brown Mtn Crk-Bonang Rv	Crossed Square
ACP E. bonang6	-37.26083	148.7588	E bonang-Brown Mtn Crk-Bonang Rv	Crossed Square
ACP B. trout	-37.26074	148.7588	Brown Trout	Crossed Square
S2 South Limit	-37.26166	148.7588	Survey Site 2	Sight Seeing
Trap 12	-37.2613	148.7588		Hunting/Fishing
ACP E. bonang4	-37.25361	148.7562	E bonang-Brown Mtn Crk-Bonang Rv	Crossed Square
ACP E. bonang5	-37.25411	148.7561	E bonang-Brown Mtn Crk-Bonang Rv	Crossed Square
ACP E. div Martins1	-37.44956	148.5784	E. diversus-Martins crk- Brodribb Rv	Crossed Square
ACP E. oriet Martins	-37.45081	148.5795	E. orientalis-Martins crk- Brodribb Rv	Crossed Square
ACP E. div Mar3	-37.45781	148.5824	E. diversus-Martins crk- Brodribb Rv	Crossed Square
ACP E. div Martins1B	-37.45356	148.5817	E. diversus-Martins crk- Brodribb Rv	Crossed Square