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Survey of the Giant Gippsland Earthworm, *Megascolides australis* in areas potentially affected by a realignment of the South Gippsland Highway – Bena to Korumburra

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Abstract

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A survey for the Giant Gippsland Earthworm, *Megascolides australis*, was conducted in an area between Bena and Korumburra, which is the subject of a planning study into possible improvements to the South Gippsland Highway. Assessment of any impacts of road construction on *M. australis* and opportunities for mitigation are discussed.

Giant Gippsland Earthworm populations were recorded in two areas along the proposed route for the realignment of the South Gippsland Highway. Both sites were located on the north side of the highway in Victoria Rail Track land. The first site encompassed an area approximately 200 m long within which eight earthworm sites were located. A juvenile earthworm and three egg cocoons were also recorded within this area. The Narracan Burrowing Crayfish, *Engaeus phyllocercus*, a listed species of burrowing cray also appeared to occur within a creek/soak at this site. The second area was very localised and while one adult Giant Gippsland Earthworm was located, no evidence of any other Gippsland worms was found.

Recommendations for protecting the populations of Giant Earthworms at site one includes carrying out possible improvements to the South Gippsland Highway on the south side of the existing highway for approximately 400 m in the vicinity of the designated earthworm habitat, leaving the north side where the earthworms occur intact.

Introduction

Museum Victoria was contracted by Vic Roads in October 2001 to provide advice on whether the Giant Gippsland Earthworm, *Megascolides australis* will be impacted by potential road works along the South Gippsland Highway between Bena and Korumburra. The Giant Gippsland Earthworm is listed as threatened under Victoria's *Flora and Fauna Guarantee Act (1988)* and the Commonwealth's *Environment Protection and Biodiversity Conservation Act (1999)*. The species has been recorded within the Bena – Korumburra region (Smith and Peterson 1982, Van Praagh 1992, 1994).

Objectives. The aim of the study is to conduct a survey for the Giant Gippsland Earthworm in potential road project sites between Bena and Korumburra, South Gippsland. In addition, to provide advice on whether the Giant Gippsland Earthworm will be affected by road improvements and report on what actions can be undertaken to mitigate any affects on the species.

***Project Outline*.** The specific tasks required of this study are:

- Provide advice on the presence of the Giant Gippsland Earthworm in the bands of interest based on active searches;
- Give locations of where the Giant Gippsland Earthworm is encountered in AMG/Lat, Long coordinates;
- Provide an objective assessment of the potential impacts of the road realignment on any Giant Gippsland Earthworms recorded during the survey;
- Describe any opportunities to avoid or mitigate these potential impacts through design or management;
- Provision of an assessment of the likely resultant level of impacts if mitigation measures are adopted.

Giant Gippsland Earthworm

Significance of the Giant Gippsland Earthworm. The Giant Gippsland Earthworm, one of the largest earthworms in the world, has International, Commonwealth and State conservation significance. It is listed as Vulnerable by the International Union for the Conservation of invertebrates (IUCN) (Wells *et al*. 1983) as well as under the Commonwealth Endangered Species Act. In Victoria it is listed as Vulnerable (CNR 1995) and Threatened (Flora and Fauna Guarantee Scientific Advisory Committee 1991). The species has also been listed on the register of the National Estate (Coy 1991) and is protected under Victoria's *Flora and Fauna Guarantee Act* (1988).

***Distribution*.** The species is endemic to a relatively small area of approximately 40,000 ha of the Bass River Valley in South Gippsland, in a triangle roughly bounded by Loch, Korumburra and Warragul. The species can have a very localised distribution and is very patchy within its range. Sightings are regarded as uncommon and usually confined to within 40 m of stream banks, in particular smaller tributaries of the Bass River, soaks, and wet

south facing hills.

Biology. Much of the biology of *M. australis* remains unknown, reflecting the difficulty in sampling a long lived and fragile subterranean animal. *M. australis* is an hermaphrodite with two individuals required for fertilisation. Breeding activity is evident by a large, swollen clitellum and occurs predominantly in spring and summer (Van Praagh 1996). Large amber coloured egg cocoons ranging in size from 5 to 9 cm are laid in chambers branching from the adult burrow at an average depth of 22 cm (Van Praagh 1994). Only one embryo is found in each egg cocoon, which is thought to take over 12 months to incubate. Although the life span of the species is unknown, field and laboratory studies suggest that it is very long lived, possibly taking up to 5 years to reach reproductive maturity. Field studies show the population consists predominantly of adults at all times of the year (Van Praagh 1994). This suggests a slow growth rate and population turnover, with a low rate of recruitment.

The worms live in complex, permanent burrows that extend to around 1 to 1.5 m in depth. Worms appear to remain underground, feeding on the root material and organic matter ingested in the soil. Occupied burrows are always wet, even in summer, probably aiding the worm in movement and gas exchange. Worms can be locally abundant with a mean density of 2 per m^3 with up to 10 worms per m^3 recorded (Van Praagh 1992, 1994).

Threats to the Species. The Giant Gippsland Earthworm is one of the few species of native earthworms that has persisted in areas converted from native bush to pasture by surviving in pockets of suitable habitat where the affects of cultivation have been less severe (Van Praagh 1994, 1997).

The worm is a subsoil species, lives in a complex burrow system and rarely comes above the surface of the soil. Although the worm is somewhat buffered from environmental stress due to its depth in the soil profile, it exhibits particular life history characteristics which make it vulnerable. For example, the worm is long lived, has a slow growth rate, produces few young and has a poor dispersal ability (Van Praagh 1992, 1994, 1997). These characteristics mean that populations have little ability to recover from any damage since population turnover is so slow. Individuals are extremely fragile and even slight bruising or damage may result in death. The major threats to the species include disturbances to its soil habitat (physical and chemical), soil erosion, compaction, vegetation clearance and, in particular, changes to the water table and altered drainage patterns.

Study Area. South Gippsland Highway – Realignment Bena to Korumburra between 111.5km and 115.2km.
The study area comprises an area of approximately 3.7 km east of Bena consisting primarily of pasture in roadside and railway reserve, and private property.

Methodology

To establish the presence of the Giant Gippsland Earthworm along the routes of the proposed road improvements, a survey of the site was undertaken. This involved:

Identification of suitable habitat. The entire length of the route of the proposed road realignment was assessed to identify areas of suitable earthworm habitat. While precise habitat parameters for the species are unknown, several factors that characterise suitable habitat have been identified (Smith and Peterson 1982, Van Praagh 1994). These include proximity to water, soil moisture and soil type. The earthworm is usually associated with creek banks, in particular smaller tributaries of the Bass River, soaks or wet south facing slopes but is generally absent from areas where there is a high level of waterlogging and compaction. Areas of higher underground water content or seepages can often be observed due to greener patches of pasture often presenting as soaks and areas that have pronounced terracettes (Van Praagh *et al* .2002). These areas were targeted for earthworm sampling.

Detailed surveying of areas of suitable earthworm habitat. Sites identified as suitable habitat within or near the bands of interest were surveyed to establish the presence of the earthworms. The most reliable way of locating the earthworm is by digging and looking for earthworm burrows. This involves digging quadrats of approximately 50 cm x 50 cm to examine the soil for burrows. A wet burrow indicates that the burrow is actively being utilised by a worm. Earthworms can also be detected by a gurgling sound that is made when worms retreat down their wet burrows. Thus presence of the worms can also be established by banging the ground with a spade and listening for gurgles, particularly if the ground is wet.

All records of the Giant Gippsland Earthworm were recorded using AMG coordinates within 5 m of the site.

A field survey for the Giant Gippsland Earthworm was conducted on 16 and 22 of January 2002.

Limitations of study. Due to the large survey area involved, sites of suitable habitat were targeted for sampling. While every effort was made to identify these sites, it is possible that some sites were missed during the survey. For example, *M. australis* sometimes occurs on roadsides where the identification of suitable habitat may not be obvious. It was not possible to sample every section of roadside within the proposed area of road realignment due to time constraints and, in some cases, inaccessibility. However, eroded roadside embankments were examined for burrows where possible.

Results

Small amounts of suitable earthworm habitat were identified along the band of interest realignment between Bena and Korumburra. Most of these sites were on the north side of the South Gippsland Highway in the railway reserve. Very little suitable habitat was identified on the south side of the highway, possibly because these areas were north facing and therefore not as wet. There was only one creek transecting the study area and it occurred on the south side of the highway. Several sites along this creek bank were sampled and although the soil looked relatively suitable, no signs of the earthworm were found.

The Giant Gippsland Earthworm was recorded at two sites within the study area, both on the north side of the South Gippsland Highway in Victoria Rail Track land (Fig 1). Site 1 encompassed an area of approximately 200 m starting east of Bena at 38º 25' 200" 145º 47' 190" and continuing to 38º 25' 274" 145º 47' 308" (towards Korumburra). Worm burrows

were located at 8 sites within this area (Table 1 - sites 1a to 1h). Egg cocoons were found at three of these sites (1b, 1c and 1g) and one juvenile earthworm was found at another (1d). Gurgles were heard at another 3 of the 8 sites. All of the sites except one, showed evidence that worms currently occupied them. This area consisted of pasture and scattered fruit trees (Plate 1a, b).

The last site within the 200 metre area occurred on a large roadside embankment under tall pine trees (*Pinus radiata*). Burrows were confined to the outer edges on the top of the embankment. Further inspection of this embankment from above did not reveal any signs of recent worm activity and it is likely the burrows are old and are no longer occupied by earthworms. A large gully with a small creek within it occurred to the north of this site. A small number of yabby burrows were recorded within the bank and flood bed of this creek. While a specimen of the yabby occupying the burrows could not be obtained, it is likely that they represented burrows of the Narracan Burrowing Crayfish (*Engaeus phyllocercus*).

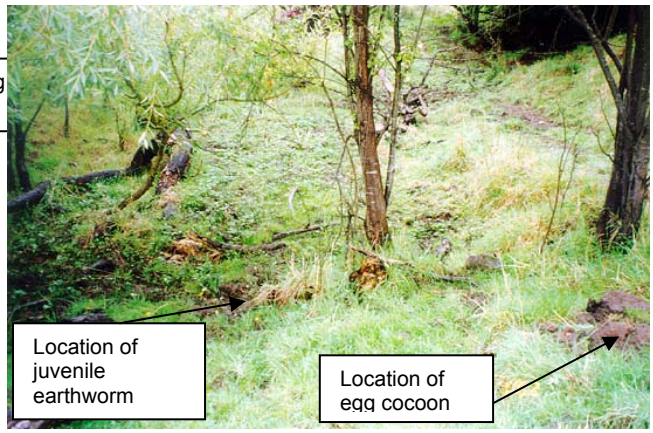
The second site occurred at 38º 25' 565" 145º 47' 861" in Victoria Rail Track land adjacent to a private property access road which continued under a railway bridge (see Fig 1). The site occurred on the edge of a drainage channel or creek, arising from a culvert further up hill towards the railway track. A clump of trees consisting of eucalypts, wattles (Blackwoods and Silver Wattles) and a fruit tree occurred at the site. A very large adult worm was found at a depth of about 10 cm. No other signs of Giant Gippsland Earthworms were found at this site and distribution appeared to be limited to this single site. This site was rather unusual in that it was very rocky.

Table 1 Location of Giant Gippsland Earthworm sites from Bena to Korumburra

Site	Lat	Long	Land	GGE Distribution	GGE ty*	GGE Activity	Habitat
1a	38º 25'	145º 47'	Vic Rail	Found for about 20 m west of	Medium –	None detected obable	Pasture in front of slope g up to rail way track.
1b	38º 25'	145º 47'	"	Found on embankment of hole across to small gully and gentle slope leading to highway	Medium	Egg cocoon ı) and gurgles	Pasture, dock, scattered rees (*Prunus*) and Hazel derris.
1c	38º 25'	145º 47'	"	Found around top edge of gully/soak near cattle track	Medium	Egg Cocoon cm)	Pasture
1d	38º 2"	145º 47'	"	Found at side edge of small soak, a couple of metres from egg cocoon (1c) found.	Medium	Juvenile worm	Pasture, dock and red fruit trees (*Prunus*). pugging at bottom of gully Highway.
1e	38º 25'	145º 47'	"	Gentle slope		Gurgles	Pasture
1f			"	Gentle slope, 8 m east of site		Gurgles	Pasture
1g	38º 25'	145º 47'	"	Confined to corner of ck, adjacent to large pines	Medium	Egg Cocoon urgles	Pasture with old dead ree above site
1h	38º 25'	145º 47'	"	Top of steep roadside nkment, under large Pines	Medium-	No signs of activity.	Embankment with pine
2	38º 25'	145º 47'	"	Confined to a single locality e of creek/ drainage channel.	Low	Large adult (10cm depth)	Creek drainage channel nded by pasture with of trees including large /pts, Blackwood and Silver es.

Plate 1a. Location of a Giant Gippsland Earthworm egg cocoon – site 1b

Plate 1b. Location of juvenile Giant Gippsland Earthworm and egg cocoon – site 1c and d



Discussion

Implications of road construction. Possible improvements to the South Gippsland Highway from Bena to Korumburra could involve major physical disturbance to the soil resulting from large scale soil excavation, removal of rock and soil by machine extraction, compaction and altered soil hydrology.

Potential impacts on M. australis. The impacts of major earthworks such as road making within known *M australis* habitat are discussed by Van Praagh and Hinkley (2000 a b,c and 2001). These include directly killing or injuring earthworms during soil excavation, and indirectly by compacting the soil and altering the soil habitat in particular drainage and moisture regimes. Soil moisture levels are very important in governing earthworm distribution and water balance within burrows is important for worm movement and respiration.

Individuals do not recover if injured and appear to have no capacity to regenerate. The species generally occurs within the top 1m to 1.5 m of soil and egg cocoons are found in the top 40 cm (Van Praagh 1992). Depth of excavation for road works can include the entire area occupied by the worms.

Impact of proposed road realignment on M. australis. One relatively large population of *M. australis* would be affected by the proposed realignment (Table 1 site 1a-1h). The most significant aspect of this population was the number of egg cocoons recorded in addition to a juvenile worm, indicating a healthy, breeding population. Egg cocoons are normally quite difficult to find, as the breeding rate for *M. australis* is so low (0.36 cocoons per adult) (Van Praagh 1994). Young worms were not visible in at least 2 of the eggs found, indicating that they were recently laid. The other was too damaged by digging to make any observations. Lots of gurgles also indicated that an active population occurred within the area. The worms were patchily distributed over the 200 metres although it is apparent that the last site under the large pines no longer supports a Giant Earthworm population. However, the stream in the gully behind this area possibly supports the Narracan Burrowing Crayfish *Engaeus phyllocercus*. This species is listed under Victoria's *Flora and Fauna Guarantee Act* (1988). It is restricted to the Eastern Strzelecki Ranges and occurs from Strzelecki-Ferndale in the west to the Little Morwell River at Darlimurla in the south east. Land For Wildlife Atlas records show the species has been collected as far west as Korumburra, Loch and Warragul although there has been little survey work in this area for the species (Van Praagh and Hinkley 1999).

Road construction through the site 1 area where an active earthworm population occurs would most likely result in the elimination of these local populations by direct effects of road works. Indirect effects such as altered soil hydrology would probably destroy any remaining worms. The life cycle of the species including long life span, low reproductive and recruitment rates, and low dispersal ability make the fragmented populations, as a whole highly vulnerable to catastrophic events (Van Praagh 1992, McCarthy *et al*. 1994).

As only one worm was found at site 2 and distribution appears very limited, the site is not regarded as significant. No evidence of any other Giant Gippsland Earthworms at this site was found.

Impact minimisation. The only guaranteed way of protecting the earthworm colonies at site 1 is to avoid road improvement works on the north side of this 200 m section of the South Gippsland Highway. If possible, any highway improvements should be constructed on the south side commencing at least 100 m west of the start of the earthworm habitat and continue approximately 100 m east of the last locality point, leaving the north section intact.

Recommendations

1 South Gippsland Highway improvements should be made on the south side of the existing highway for at least 400 m starting at approximately 100 m west of 38º 25' 00" 145º 47' 190" and continuing for at least 100 m past 38º 25' 274" 145º 47' 308"
2 Leave at least a 100 m east and west of the designated earthworm habitat (as described above) as a buffer area for the earthworms.
3 Limit any activities close to the buffer zone that may effect the hydrology within the designated earthworm habitat.
4 Avoid any disturbance in the Vic Track railway land on the north side of the highway within this designated Giant Gippsland Earthworm area.
5 Avoid any disturbance of the small creek /soak in the gully

behind the pines at the overpass (38º 25' 274 145º 47' 308") to preserve the probable population of Engaeus phyllocercus. In particular, the natural hydrology of the area must be maintained.

6 Notify Museum Victoria of any Giant Gippsland Earthworms unearthed / exposed during construction. Record the number and location of all Giant Gippsland Earthworms unearthed / exposed.

7 All unharmed Giant Gippsland Earthworms unearthed / exposed during construction must be promptly relocated to a nearby area which will not be impacted upon by the works. Worms shall be placed in a shallow hole and covered with loose moist soil.

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