

Action Statement

Flora and Fauna Guarantee Act 1988

No. 184

Glenelg Spiny Crayfish *Euastacus bispinosus* Murray Spiny Crayfish *Euastacus armatus*

Description and Distribution

Australia has a diverse crayfish fauna with over 100 species in 10 genera. Crayfish belonging to the genus *Euastacus* are known as Spiny Crayfish and belong to the Family Parastacidae. The genus *Euastacus* Clarke 1936 is found exclusively in eastern Australia with 41 species recognised (Morgan 1997). Ten *Euastacus* or spiny crayfish are known from Victoria. As the name suggests, the genus is characterised by the presence of heavy claws or chelae and spiny appearance (Zeidler 1982). This includes lateral spines, tubercles, and setal bumps on the abdomen. Species can be identified by the number and position of these spines.

Despite the diversity of crayfish in Australia, very little is known about the biology and life history of the group, apart from observations in taxonomic reviews (Merrick 1993; Morgan 1986, 1997). Detailed studies are confined to a few species that are significant in recreational fisheries or have commercial culture potential eg. *Cherax* species (Merrick and Lambert 1991).

Most of the *Euastacus* group have restricted distributions in the headwaters of streams along the east and south coast of Australia (Horwitz 1990). They generally inhabit flowing aerated, cooler streams, usually in hilly or mountainous country. A few occupy lakes and impoundments and occur in the more turbid and slower flowing waters of the Murray River System.

Many members of the group have restricted distributions and may be geographically isolated. This, in combination with habitat modification and pressures from recreational fishing means that many of Australia's freshwater crayfish are rare.

Thirty-three species of Australian Freshwater crayfish are considered threatened, though few are recognised by State agencies (Horwitz 1995) while fourteen species of *Euastacus* have been reported as requiring conservation attention (Horwitz 1995).

Both spiny crayfish addressed in this Action Statement, *Euastacus bispinosus* and *E. armatus*, are large spiny crayfish and form the basis of a recreational fishery. All species have suffered declines in abundance and size throughout their range, with *E. armatus*, the largest of the spiny crays, being the most notable example. Of the three species, *E. bispinosus* is thought to be the least abundant and has therefore been subject to more stringent fishing regulations (Barker 1990).

Life History and Ecology

Spiny crayfish are very slow growing and can take up to 9 years to reach breeding maturity (Honan and Mitchell 1995b, Turvey and Merrick 1997). Large specimens of *Euastacus spinifer* (160 mm carapace length [CL]) can weigh up to 1.8 kg and have been estimated to be up to 40 years old (Turvey and Merrick 1997). Similar findings for other *Euastacus* such as *E. armatus* and *E. bispinosus* have been recorded (Geddes 1990, Honan and Mitchell 1995b).

Mating activity between mature crayfish occurs from May onwards each year, following which females carry eggs under the tail. The eggs hatch from October onwards, depending on seasonal conditions and the species. The dependent juvenile crayfish are carried

beneath the tail for some weeks or months after hatching. The yolk of the egg is retained by the young hatchlings as a yolk sac supplying food during early growth. Once the yolk sac has been completely absorbed, the young disperse to fend for themselves.

Freshwater crayfish are bottom-dwelling opportunistic scavengers. Their diet consists largely of plant debris with the prime nutrient source considered to be micro-organisms and fungi that colonise on the detritus (Hogger 1998, Turvey and Merrick 1997). Most are moderate burrowers, but many find refuge under rock ledges and amongst submerged tree roots (Zeidler 1982).

Spiny crayfish activity is related to water temperature, with most activity recorded between 8oC and 19oC (Barker 1990).

Declines and Threats

Habitat alteration and destruction is widely recognised as one of the most significant causes of aquatic species decline (Koehn and O'Connor 1990, Campbell and Doeg 1989). Species with limited distributions and fragmented populations, combined with biological features which contribute to low recruitment rates, are particularly vulnerable to localised environmental disturbances. Major threats to Spiny Crayfish include habitat modification and manipulation of waterways resulting in reduced water quality and habitat fragmentation and pressure from over fishing. Predation by introduced fish such as trout may also be a threat.

Riparian vegetation is important for bank stabilisation, as a filter for contaminants, in particular sediment and as a source of organic debris which provides energy in addition to instream habitat (Koehn and O'Connor 1990). Removal or modification of this vegetation has serious consequence for the water quality and hence habitat quality of waterways. Light intensity and stream temperatures may also be altered by removal of shade sources, particularly in summer.

Impacts associated with stock and supply of water for domestic and irrigation uses are considered threatening processes. This includes siltation, alteration of flows through irrigation and weir construction, and loss of aquatic plants through turbidity.

Desnagging and clearing streams decreases the habitat available to crayfish by removing shelter and protective areas for juvenile crayfish to develop. Sediment deposition in streams may also be detrimental to young crayfish as it coats the substrata and fills interstitial spaces. These areas may be of value in protecting juvenile crayfish from predators.

The Murray River

Subject of extensive desnagging and salinity problems.

The Glenelg River

The Glenelg River catchment has been extensively cleared or modified and sedimentation occurs throughout the system (Mitchell 1990). The construction of the Rocklands Reservoir is thought to have resulted in the local extinction of the species, which were recorded from the site prior to the establishment of the dam (Horwitz 1990). *E. bispinosus* prefers streams with well vegetated, shaded banks with an abundance of woody debris (Morgan 1983). Clearly, the loss of riparian vegetation represents a significant threat to the species.

Over-fishing

Over-fishing has contributed to the decline of many native aquatic species such as Macquarie Perch (*Maccullochella macquariensis*) (Cadwallader 1978; Harris and Rowland 1996) and Murray Cod (*Maccullochella peelii peelii*) (Rowland 1989; Jackson *et al.* 1994). Over-fishing has been recognised as a threatening process for the Murray Spiny Crayfish (*E. armatus*) in NSW (Geddes, 1990), ACT (Lintermans and Rutzou 1991) and South Australia (Horwitz 1990a, Lintermans and Rutzou 1991, Lintermans 1998) and the Giant Tasmanian Lobster (*Astacopsis gouldi*) (Horwitz 1994).

Concern for spiny crays in the 1980s arose from anecdotal reports by anglers that crayfish sizes and abundance had decreased markedly over time (Horwitz 1990b). While fishing regulations were in place, prior to 1989 there was no size limit on spiny freshwater crayfish and anglers were permitted to retain all size of crayfish captured.

There is little data available which examines the response of crayfish to over fishing. Morey (1987, 1998) examined the success of fishing restrictions on Gippsland Spiny Crayfish *E. kershawi* by investigating the catch and growth rates of the species in open (no catch restrictions) and closed waters of the Bunyip and La Trobe River systems respectively. Overall, there was no significant difference between the catch rates of crayfish from closed waters compared with open waters, nor were any differences in growth rates found. Morey (1998) concluded that illegal fishing during the closure accounted for similarities in catch numbers between open and closed waters. This is supported by the finding that very low catch rates were observed at sites that were easily accessible such as picnic sites, roadsides and bridges. Fish monitoring programs in the Murrumbidgee River in the mid 1990s after recreational fishing in the ACT was closed in 1991, indicated that there was some recovery of *E. armatus* (ACT Government 1998).

Data now available on the biology several larger *Euastacus* species indicate that these crayfish have similar life cycles including slow growth rate and late maturation, long life span, and low fecundity with annual breeding (Honan and Mitchell 1995a,b,c; Morey 1998). These characteristics make them vulnerable to over-exploitation by fishing, heightened when combined with the stresses of fragmented populations, habitat loss and degradation (Horwitz 1990a). For example, the Glenelg Spiny Cray species is slow growing and may take up to 12 years to reach reproductive maturity. It is long lived, reproduces annually, has a low dispersal rate and is found in low densities (Honan and Mitchell 1995a,b,c). Morey (1998) recorded a growth rate of 7mm per year for *E. kershawi*. If too many larger individuals are removed by excessive fishing, the smaller, non-reproductive individuals cannot replace the older crayfish resulting in a population decline and decline in overall size range (Horwitz 1990, Lintermans & Rutzou 1991). If individuals are taken before reaching sexual maturity, they will not have been able to contribute to the population's fecundity.

Although it is illegal to take berried females, the handling of berried females is liable to result in damage and a decreased number of eggs and larvae reaching juvenile status (Horwitz 1990). Honan and Mitchell (1995a) found that breeding female Glenelg Spiny Crayfish are not 'trap shy' as is the case with many other species, and are therefore susceptible to being caught while in berry.

Prior to 1989 there was no size limit on spiny crayfish and anglers were permitted to retain all sizes of crayfish captured. Considerable variation in size at maturity of the same species from different localities means that uniform size regulations are difficult to formulate. For example, Hoey (1989) found that female *E. bispinosus* mature at 90 mm OCL in comparison to the species in NSW. Therefore the minimum 80mm OCL size restriction in NSW is inappropriate for this species in Victoria as it would allow females to be caught before being able to breed.

Translocation and predation

Horwitz (1990b,c) considered introduction and translocation of exotic and native species as a potential threatening process due to competition, predation and the spread of parasites and disease. Apparently all parastacid crayfish are susceptible to the crayfish plague (Horwitz 1990a) and possibly other diseases.

The relatively sedentary nature of *Euastacus* makes the species susceptible to local predation (Merrick 1997). Introduced Brown Trout (*Salmo gairdneri*)

and Rainbow trout (*Onchorhynchus mykiss*) are known predators of crustaceans and have been implicated as threats to some freshwater crayfish species. Eels are also known predators of crayfish (Merrick 1995).

Euastacus have been recorded as the preferred diet of foxes in some areas (Green and Osborne 1994) and thus fox predation may represent a threat to the species in areas where foxes are prevalent.

Existing Conservation Measures

Controls over fishing

- The Flora and Fauna Guarantee (Taking or Keeping of Spiny Freshwater Crayfish) Order 1/2003 has established a range of conditions and limitations on recreational fishing for spiny freshwater crayfish, including bag limits, possession limits, size limits, gear restrictions and, in the case of the Murray Spiny Crayfish, a closed season commencing on 1 September each year and concluding on 30 April of the following year.
- Commercial fishing for spiny freshwater crayfish is not generally permitted.
- These restrictions are consistent with those applying in New South Wales, which facilitates enforcement and avoids an increase in fishing pressure on Victorian populations during the NSW closed season.
- Fishing for spiny freshwater crayfish in Waranga Reservoir has been prohibited until water levels improve significantly.

Surveys & Monitoring

- Taxonomic reviews of all *Euastacus* species by Morgan (1986, 1997) and Horwitz (1990a) have included some biological and ecological data and provide comprehensive locality data.
- Fish surveys of the East Gippsland Region have included surveys of the Decapod fauna since 1990 (Raadik 1992a, 1992b, 1995). This has included information on the Gippsland Spiny Cray.

Research

- Honan and Mitchell (1995a,b,c) examined growth, reproductive biology, catch rate characteristics and management of *E. bispinosus* in a river and creek of the Glenelg River system in south western Victoria.
- Honan (1998) investigated aspects of egg attachment, embryology and development of juvenile stages of *E. bispinosus* from south-west Victoria.
- Morey (1987, 1988) investigated growth, catch rates and biology of *E. kershawi* and examined

the impacts on the species of closing the LaTrobe River system to fishing.

- No known research of *E. armatus* in Victoria. However, several studies interstate have examined the conservation status of the species eg Geddes 1990, Lintermans and Rutzou 1991, Maloney 1997).
- Geddes et al. 1993 investigated the feasibility of re-establishing the Murray Spiny Crayfish in the lower River Murray in South Australia where it is thought to be extinct.

Conservation and Management Information

- Horwitz (1990b, 1995) has reviewed the conservation status of Australian Freshwater crayfish and discussed threatening processes.
- Surveys have been undertaken in SA, Victoria (?), NSW and the ACT to determine the conservation status of the Murray Spiny Crayfish (Lintermans and Rutzou 1991, Lintermans 1998, ACT Government 1999). An Action Plan for the species in the ACT has been prepared and published (ACT Government 1990).

Habitat Protection

Designation of National Parks, various types of Reserves, Reference Areas and water supply catchments through the distributional range of the species may have indirectly contributed to the protection of the spiny crayfish.

Glenelg Spiny Crayfish

- Discovery Bay Coastal Park
- Lower Glenelg National Park
- Grampians National Park

Murray Spiny Crayfish

- Mount Samaria State Park
- Alpine National Park
- Mount Buffalo National Park
- The corridors of the Yarra and Goulburn (below Lake Eildon) are Heritage River areas (LCC 1991).
- River Zone - upper Goulburn, Murrindindi and La Trobe (Acheron, Toorong and Snobs Ck) are identified as River Zone (LCC 1994). The corridor protected along these rivers and streams extends between 100 m and 300 m from each bank. These special zones may include *Euastacus* in parts of their range.

Forest Management

- Forest Management Plans and associated comprehensive adequate and representative reserve systems contribute to the management of these species on public land. The Code of Forest Practice for Timber Production (1996)

provides for the protection of riparian zones in both State and private forests through management of buffer and filter strips along waterways.

Major Conservation Objectives

Long-term objectives

To guarantee that *E. bispinosus* and *E. armatus* can survive, flourish and retain their potential for evolutionary development in the wild.

Objectives of this Action Statement

1. Improve understanding of the distribution and abundance of Murray and Glenelg Spiny Crayfish.
2. Protect the instream and riparian habitat of known populations of Murray and Glenelg Spiny Crayfish.
3. Develop a population model for Murray and Glenelg Spiny Crayfish to assist in determining sustainable levels of recreational fishing.
4. Improve the understanding of the biology and ecology of the species as the basis for managing its habitat.
5. Increase public awareness, particularly that of recreational fishers, of the value of conserving these species and their habitat.

Intended Management Action

The intended management actions listed below are further elaborated in DSE's Actions for Biodiversity Conservation (ABC) system. Detailed information about the actions and locations, including priorities, is held in this system and will be provided annually to land managers and other authorities.

(Note: Although not included as a specific action to be undertaken, the protection, enhancement and restoration of riparian and instream habitats of Murray and Glenelg Spiny Crayfish is proceeding via the implementation of a variety strategies, plans and processes, including the Victorian River Health Strategy, Regional Catchment Strategies and Regional Vegetation Plans.)

Systematic Surveys

1. Survey the streams in those catchments most likely to contain populations of Murray and Glenelg Spiny Crayfish in order to determine the distribution and abundance of the species. Information collected will include in-stream and riparian habitat data.

Responsibility: Department of Sustainability and Environment, Department of Primary Industries

Population modelling and monitoring

2. Develop a population model for each species.

Responsibility: Department of Sustainability and Environment, Department of Primary Industries

3. Undertake periodic monitoring to refine and validate the population models.

Responsibility: Department of Sustainability and Environment, Department of Primary Industries

Angling

4. Apply restrictions on angling, based on information arising from the population models and associated monitoring, using the **Flora and Fauna Guarantee Act 1988** and the Fisheries Regulations, to ensure that angling poses no significant threat to Murray and Glenelg Spiny Crayfish populations across their geographic ranges.

Responsibility: Department of Sustainability and Environment, Department of Primary Industries

Community awareness

5. Undertake a program of community awareness specifically targeting anglers to explain the biology and ecology of Murray and Glenelg Spiny Crayfish and the reasons for the restrictions on angling.

Responsibility: Department of Sustainability and Environment, Department of Primary Industries

Research

6. Encourage, facilitate and support research into the biology and conservation of Murray and Glenelg Spiny Crayfish in the following areas:

- Determine ecological requirements (including the feeding habits) and tolerances. This information is necessary to determine critical habitat parameters (eg. Seasonal use of microhabitats, temperature requirements, oxygen tolerances).
- The effects of habitat modification on Murray and Glenelg Spiny Crayfish
- Investigate the genetic diversity of populations of *E. bispinosus* at the Grampians National Park and Glenelg River
- Investigate the impacts of introduced fish species such as trout (*S. trutta*, *O. mykiss*) on Murray and Glenelg Spiny Crayfish.

Responsibility: Department of Sustainability and Environment, Department of Primary Industries

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Further information can be obtained from Department of Sustainability and Environment Customer Service Centre on 136 186.

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This Action Statement has been prepared under section 19 of the Flora and Fauna Guarantee Act 1988 under delegation from Professor Lyndsay Neilson, Secretary, Department of Sustainability and Environment, September 2003.

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Published by the Department of Sustainability and Environment, Victoria. 8 Nicholson Street, East Melbourne, Victoria 3002 Australia

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ISSN 1448-9902

Additional information - Glenelg Spiny Crayfish *Euastacus bispinosus*

Description

Abdominal spines, when present are dark brown or black, sometimes blueish or cream. There are 2-8 (usually 3-5 dorsal thoracic spines per side), generally rounded or flat. Three to eight (usually 4-6) large to medium size spines occur on the telson. Well developed teeth on chelae of specimens over 60 mm OCL. Distinguished from other *Euastacus* species by the shape of the thoracic spines (medium-large, rounded or flat) and abdominal spines, and the abdominal boss, which is well developed but not distinctly U-shaped. It is one of the largest of the freshwater crayfish with individuals up to 130 mm OCL and 1.1 kg in weight recorded.



Distribution

E. bispinosus is a lowland dwelling spiny crayfish. It inhabits the Glenelg River and its tributaries in western Victoria and the Grampians. Its range extends up to 320 m above sea level but probably reaches higher elevations in the Grampians. There are only 17 records of the taxon in the Atlas of Victorian Wildlife (NRE 2000) and there have been few records of *E. bispinosus* for Victoria in the last 10 years. Recently, Raadik et al. (2001) recorded the Glenelg Spiny Crayfish at four sites in the Glenelg River basin, collecting a total of 79 individuals.

Glenelg Spiny Crayfish *Euastacus bispinosus*
(Photo: Ian McCann)



Distribution in Victoria
NRE (2002)

The species is also present in Ewens Ponds south of Mt Gambier, South Australia, where it is found in many drains running through what was previously a great peat swamp (Morgan 1986, Honan and Mitchell 1995a).

Habitat

The species usually occurs in low level streams with riparian vegetation including *Eucalyptus* and *Leptospermum* species, and bracken, with wet sclerophyll forest and pine plantations in some areas. In the Grampians, it most commonly occurs at sites in sheltered valleys, bordered by heath with ferns and vines. (Morgan 1986).

Protected in SA but not in Victoria.

Biology

E. bispinosus is one of the few *Euastacus* species, apart from *E. armatus*, that has been the subject of some investigations including reproductive cycles, growth and management (Hoey, 1990, Honan and Mitchell 1995a, b, c, Honan 1998). *E. bispinosus* is slow growing and takes around 8-11 years (85 mm OCL) to reach reproductive maturity and may take up to 26 years to reach the maximum recorded size (Honan and Mitchell 1995c). Females breed once a year (May -June) for up to 14 years and have relatively few large eggs (63 -812), which are carried under the tail for up to seven months before hatching and juvenile release in October and December (Honan and Mitchell 1995c). Population density is considered low and estimated at one Victorian site to be one crayfish for every 2-5 metres of bank (Honan and Mitchell 1995a). Local population sizes are relatively small (Honan and Mitchell 1995).

This species is considered to be one of the most vulnerable of the three larger crayfish to recreational fishing (NRE Fisheries Notes 1998).

Current Conservation Status

CNR 1995.....insufficiently known

IUCN.....Vulnerable A1ade

The Glenelg Spiny Crayfish has been listed as a threatened taxon under the Flora and Fauna Guarantee Act 1988. The Glenelg Spiny Crayfish is considered threatened because of its relatively restricted distribution, decline in range and population numbers (Horwitz 1990) and limited number of Victorian records in the past ten years. Possible threats resulting from habitat modification include clearing, loss of riparian vegetation and agriculture (Yen and Butcher 1997). The species is also exposed to modifications associated with stock and supply of water for domestic and irrigation uses. *E. bispinosus* is likely to have been affected by in-stream alterations on the Glenelg River system such as de-snagging, culverts, weirs and river regulation. Recreational fishing has also been identified as a threatening process.

In its final recommendations the Scientific Advisory Committee (SAC 2001) determined that the Glenelg Spiny Crayfish is:

- Significantly prone to future threats which are likely to result in extinction, and
- Very rare in terms of abundance or distribution.

Ecological issues specific to the taxon

The Glenelg Spiny Crayfish has many life cycle characteristics that make it highly vulnerable to exploitation (Honan and Mitchell 1995a,c). The species is slow growing compared to many other spiny crays and may take up to 12 years to reach reproductive maturity. It is long lived, reproduces annually, has a low dispersal rate and is found in low densities (Honan and Mitchell a,b,c). If too many larger individuals are removed, the smaller, non-reproductive individuals cannot replace the older crayfish resulting in a population decline (Horwitz 1990, Lintermans & Rutzou 1991).

Honan and Mitchell (1995a) also found that breeding females are not 'trap shy' as is the case with many other species, and are therefore susceptible to being caught by fishers while in berry. Although it is illegal to take berried females, the trauma of capture and release through incorrect handling can damage the eggs (Horwitz 1990).

The Glenelg River system has been extensively cleared and siltation occurs throughout the river system.

Additional information - Murray Spiny Crayfish *Euastacus armatus*

Description

The dorsal carapace colour varies from dark or medium green or brown, sometimes with a blue tinge. Adults average 20-30 cm in total length and are characterised by large white claws and ornately spined abdomen. The abdominal segments are laterally slightly tinged blue/green with the abdominal spines pale orange, cream or white. The claws of smaller individuals are mottled green and yellow rather than white.

Large thoracic spines distributed in 1 or 2 irregular rows, usually pale at tips or all white. General tubercles, cream or pale brown, large or medium sized on large animals, moderately distributed or sparse. 1-9 spines on telson (rarely absent). Chelae with well developed teeth on most specimens.

Female maturity occurs from OCLs of 40 to 100 mm and very large specimens can be immature (Morgan 1986).

Distribution

Euastacus armatus is the most widespread member of *Euastacus*. It is one of the largest of the Australian Crustaceans with a maximum OCL of 146 mm and reported to be the second largest in the world weighing up to 3 kg (Geddes 1990).

The species has a broad distribution in Eastern Australia and is believed to have occupied the broadest range of the family. While most spiny crays are restricted to the cooler, montane habitats, the distribution of the Murray Spiny Crayfish extends into the warmer lower parts of the Murray Darling Basin (Morgan 1986). The species used to occupy a range of some 800km east-west and approximately 450 km north-south including most of the Murray River and its tributaries (with the exception of the Darling) flowing through central and southern NSW, Victoria. It is unclear whether the species still exists in South Australia. It is also found in the Murrumbidgee, Cotters and Paddys Rivers of the ACT.

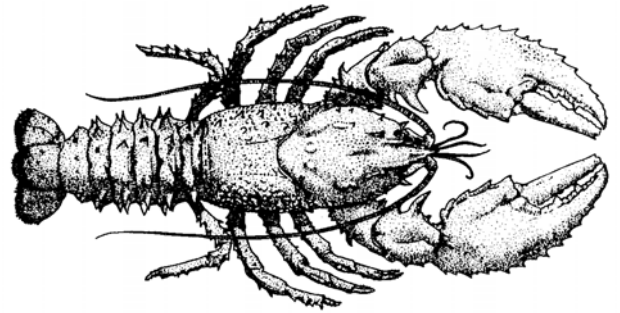
E. armatus was once abundant along most of the Murray River until the mid 1950s. Only occasional catches were recorded from 1956 to mid 1960s, after which there are no reliable records due to the cessation of potting for crayfish. The species has virtually disappeared from the Murray downstream of Mildura and are rare in some NSW rivers such as the Edwards, Wakool and Neimur Rivers where it was once abundant (Geddes 1990).

The species is now thought to be rare below Mildura, and has suffered a major reduction across its range (Horwitz 1990; Geddes, 1990, Lintermans and Rutzou 1991).

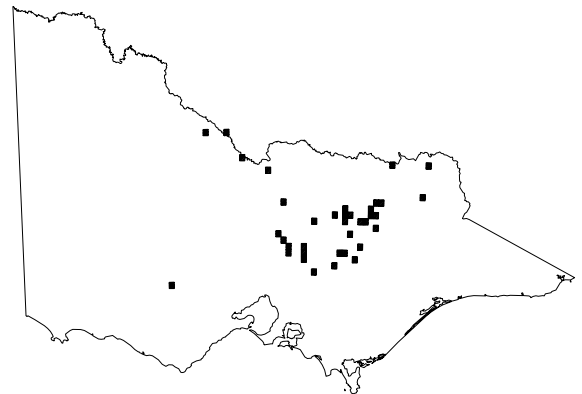
Recently, Raadik *et al.* (2001) recorded the Murray Spiny Crayfish at 39 sites in the five most north-eastern river basins in the Murray-Darling Drainage basins (1,2,3,4 & 5).

Habitat

E. armatus inhabits large and small streams in a variety of habitats including cleared pasture and dry wet sclerophyll forest at altitudes close to sea level to over 700 m (Morgan 1986, Horwitz 1990). The species



Murray Spiny Crayfish *Euastacus armatus*
(source: Williams 1980)



Distribution in Victoria NRE (2002)

prefers faster flowing cool water habitats of main river channels, with soft banks into which they can dig burrows (Horwitz 1990, ACT Government 1999). Where soft banks are not available, the species uses the interstitial spaces between boulders and cobbles on the river bed for shelter (ACT Government 1999).

Biology

The biology of this species is better known than many others due to studies in the ACT where concern over the species conservation status has been apparent for some time.

Murray Spiny Crayfish are slow growing and do not reach sexual maturity until they are quite large (15 to 20 cm) and between 6-9 years old (Lintermans & Rutzou, ACT government 1999). Individuals previously caught from the Murray have been estimated at 20-50 years old. However, pressures from the fishing industry make it unlikely that individuals now live this long (Geddes 1990). Females breed once a year in late Autumn and lay between 500 and 1000 eggs, although fecundity is low (Morgan 1986, Lintermans & Rutzou 1991, ACT Government 1999). Eggs are carried under the tail throughout winter and hatch in spring or summer. The young remain under the tail for another four weeks and moult twice before leaving the female (Horwitz 1990, Geddes 1990, Lintermans & Rutzou 1991, ACT Government 1999).

E. armatus is active throughout the cooler months, from May until October when the water temperatures are below 20°C.

Conservation Status

CNR 1995.....insufficiently known.

IUCN.....vulnerable A1ade

The Murray Spiny Crayfish has been listed as a threatened taxon under the **Flora and Fauna Guarantee Act 1998**. The Murray Spiny Crayfish is considered threatened because of its exposure to immediate threats including overfishing and habitat modification to a large part of its range and egg predation by introduced trout (Horwitz 1990, Yen and Butcher 1997). There has been a documented decline of the species in other States (Geddes 1990) and records of the species support the premise that there has been a reduction in the range of the species within Victoria (Horwitz 1995).

The species is protected in all other states in which it occurs. ACT - Vulnerable *Nature Conservation Act 1980*), NSW Indeterminate (Klippel 1992), South Australia - Endangered (Glover 1987).

Ecological issues specific to the taxon

E. armatus are exposed to a number of threats associated with stock and supply of water for domestic use and irrigation uses. It is likely to have been severely affected by in-stream alterations on the Murray and other river systems such as desnagging, culverts, weirs and river regulation. The construction of the Hume Dam in particular has probably had a severe impact on the species.

Some of the decline of the Murray Spiny Crayfish is clearly related to overfishing. Geddes (1990) suggests that even a moderate fishing removes the largest individuals and therefore reduces the average size of crayfish in the population. No data is available regarding the size of Murray Spiny Crayfish caught in Victoria. However, in NSW the average size of crayfish caught in the 1980s was less than 200g. This is a remarkable decrease in the size of crayfish existing before the waters were fished when individuals were estimated to be up to 50 years old. Since the crayfish do not reach sexual maturity until they are around 250g (6-9 years old), the survival of the species is clearly threatened.