Survey Standard: Spiny Crayfish, *Euastacus* spp. (including the Orbost Spiny Crayfish)

1 Purpose

This document outlines the standards required for surveying fauna species listed under the *Flora and Fauna Guarantee Act* 1988 (FFG Act). These standards detail acceptable survey methods and the minimum survey effort to determine the likelihood of the species' presence or absence at a site. They also detail appropriate record keeping and reporting standards.

There are two main purposes of these standards.

1. To document the information required to determine if a record is valid – i.e. determining presence only. The standards provide the information that is required to enable an assessment to be made as to whether a record can be accepted as a valid record. All records, irrespective of how they are obtained, need to adhere to these standards.
2. To document the information required for surveys that aim to determine both presence and absence – i.e. outlining the acceptable level of survey effort required to provisionally infer absence if a species is not detected during a survey. These minimum standards are required to be met by any organisation/group undertaking a presence/absence survey.

Executing and reporting a survey to these standards will support the Department of Sustainability and Environment (DSE) to make an assessment of the validity of a claim to species presence or absence at a site. Subject to DSE approval, alternative survey methods may be applied where the proponent provides an evidence-based rationale for the approach and a detailed description of the survey technique(s) and where the standards are considered to exceed those set out below. Alternatively, rather than undertaking surveys where optimal detection methods and certainty levels are unknown, a habitat-based approach could be taken, whereby the species is assumed to be present if the area provides suitable habitat.

These standards should be read in conjunction with the Action Statement for these species. In the context of timber harvesting operations they should be read in conjunction with the Code of Practice for Timber Harvesting and Forest Management Plans. As further information about the species and survey techniques becomes available, these standards will be reviewed and updated. Additional information that would allow greater certainty in these standards and associated surveys is provided in Appendix 1.

2 Introduction

The Orbost Spiny Crayfish *Euastacus diversus* is one of a group of seven spiny crayfish (genus *Euastacus*) known from East Gippsland. Most species have a restricted distribution and are poorly known. The Orbost Spiny Crayfish (OSC) and the Alpine Spiny Crayfish (ASC) are listed under the *Flora and Fauna Guarantee Act* and each have an FFG action statement (Murray 2003, van Praagh 2003). Three other species are also considered threatened and are listed as Vulnerable on the DSE Advisory List of Threatened Invertebrate Fauna in Victoria (2009).

Spiny crayfish can be difficult to identify as many species are morphologically similar. One grouping consists of the OSC, East Gippsland Spiny Crayfish (EGSC) and the newly

identified Bonang Spiny Crayfish (BSC). Considering the morphological similarity of these taxa, this group is here termed the East Gippsland Spiny Cray Group (EGSCGroup), and specialist skills are required to accurately identify member taxa.

There are many issues in common between these spiny crayfish, and as similar survey techniques are required, survey standards for all seven species are combined in this document.

Further information on the taxonomy, habitat requirements, identification and status are provided in Appendix 1.

3 Requirements to demonstrate presence

Traditional sampling methods for spiny crayfish include the passive techniques of hoop nets or bait traps and the active techniques of electrofishing, dipnetting or collecting by hand. Hoop nets and bait traps require animals to move to the device and remain there.

The most effective approach to sampling freshwater crayfish from a biodiversity perspective (maximising the recording of species diversity at a site) is to incorporate a range of passive and active techniques, i.e. electrofishing, collecting by hand (with dipnetting), and setting bait traps. This is particularly pertinent in systems where crayfish abundances may be low and distributions fragmented.

3.1 Acceptable records

The following types of records are considered acceptable as positive evidence of the occurrence of *Euastacus* spp. at a site:

1. High resolution (1.5 MB or greater), clear, digital images of adult male specimens (if no males found, females will suffice). Clear images of the following features are required:
   - Chelae – ventral, dorsal and side surfaces, including apical spines on propodus and dactylus.
   - Merus – dorsal and ventral surfaces.
   - Thorax – dorsal and side surfaces.
   - Abdomen – dorsal and side surfaces.
   - Dorsal surface of telson.
   - Male cuticle partition area.

2. Voucher specimens of adult crays (Note: males are required, but where males are absent, adult females will suffice). For each vouchered individual, one pleiopod to be placed into 100% ethanol for future genetic analysis and the specimen fixed in a 10% formalin solution with 5% glycerol. If formalin fixation is not possible, an alternative method is to preserve the entire specimen in 100% ethanol, though this renders the specimen quite stiff and appendages easily break. All vouchers specimens to include a label stating waterbody name, decimal latitude and longitude of collection, collector name, date of collection and collection method.

3.2 Required expertise and reporting standards

Surveys conducted for *Euastacus* spp. should be undertaken by wildlife biologists experienced in this group and properly and thoroughly documented, to allow subjective assessment of their adequacy.

Previous expertise is required in the targeted collection of spiny crayfish by the survey methods indicated above, particularly collecting by hand or dipnet. Previous experience in collecting spiny crayfish during standard electrofishing surveys for fish should not be considered as meeting this requirement, as crayfish are not specifically targeted during this operation, but does demonstrate a certain level of skill with one sampling technique.

Extensive knowledge of the characters used in the taxonomy of crayfish of the genus *Euastacus* is vital to confidently undertake identification (i.e. Morgan 1983, 1986, 1997, McCormack and Coughran 2008). Many of these characters are small and not easily discernible, and vary in shape and size. Whilst there is a reasonably high level of certainty of correct identification of some species outside the EGSCGroup if the key provided in the Appendix is used during field identification, the level of certainty is significantly increased if experts undertake identification and keep voucher specimens for later verification, or digital images of sufficient quality are taken from a number of individuals. Vouchering or digital images, and examination by experts is critical for the correct identification of taxa in the EGSCGroup.

The following data are required to support record of a spiny crayfish:

- name and contact details of the observer (including indicating that they will make themselves available to escort an independent validator to the site if required);
- permit details of the surveyors where required (i.e. a research permit under the FFG Act, a research permit under the National Parks Act if working within a Park and consent from DSE Land and Fire Division if working in State Forest);
- stream name
- description of location of sampling reach
- decimal latitude and longitude of start of reach
- date of record
- water quality parameters (electrical conductivity, water temperature, pH, dissolved oxygen (mg/L and % saturation), turbidity (NTU))
- stream average width, average depth, maximum depth
- predominant substrate (i.e. bedrock, boulder, cobble, pebble, gravel, sand, silt, clay)
- gear type and number.

For each gear type used at a site:

- Duration of gear use (minutes) (also record date and time of set and pull for nets)
- Length of survey (for electrofishing)

For each piece of each gear type used at a site:

- Crayfish species collected
- Species and number of other fauna collected or seen.

For each individual crayfish collected at a site

- species

- OCL (mm)
- Sex (male, female or juvenile (when no gonopodia are visible))
- Record if any females are in berry
- Weight (to an accuracy of 1 g).

4 Requirements to demonstrate presence/absence

4.1 Survey effort

The probability of detecting species of spiny crayfish using any survey method is unknown. In these situations greater survey effort (time and gear types) over a greater survey area would be required to increase the likelihood of detecting individuals. The following sampling methodology is, however, considered an improvement on previous sampling methods employed for spiny crayfish. Whilst there is still a level of uncertainty that crayfish may be missed if they are present, the detailed level of survey effort reduces this to acceptable levels.

Based on previous data and experience with sampling species of *Euastacus* (Morgan 1983, 1986, 1997, McCormack 2009, Raadik unpublished data), the following detailed survey methods are proposed to maximise the detection of spiny crayfish in streams within, abutting or downstream of timber harvesting operations.

Site-based sampling requirements

For each sampling site (i.e. 500 m reach) undertake:

Visual observation/search (along whole reach):

- for signs of crayfish burrowing activity
- for exoskeleton remnants (i.e. from moult or predation).

Electrofishing (200 m section)

- single pass, electrofish all habitat types, including undercut banks, instream habitat.
- sample along both edges and the middle of the stream, targeting habitat patches, backwater pools, etc.
- minimum time of 40 minutes elapsed time for streams <4 m average width, 60 minutes >4 m average width.

Physical search (300 m section – separate to the electrofished section):

- collecting by hand, looking under structure (rocks, logs, undercut banks, inside timber)
- burrow excavation (only required if burrows detected but crays not collected by other techniques).
- minimum effort of 40 minutes per person x 2 people.

Trapping (where no, or only a few (i.e. <3) crayfish are collected):

- 12 box-type bait traps (baited with dog food pellets and meat), set for a minimum 8 hours over night and set in two transects of 6 traps each.
- Set in appropriate habitat (i.e. pools).

- Set traps after completing electrofishing or physical search and away from where animals are released from other techniques.

Spatial-scale sampling requirements:

For streams <4 m average width:

- and <3 km in length undertake sampling at a minimum of three (3) sites and sample to the top of the catchment leaving a distance of 200 m between sites.
- and >3 km in length undertake sampling at a minimum of five (5) sites and sample to the top of the catchment leaving a minimum distance of 300 m between sites.

For streams >4 m in average width:

- undertake sampling at a minimum of six (6) sites leaving a minimum distance of 400 m between sites.

Issues with detectability using these gear types are as follows:

- Hoop nets and bait traps: some species and size classes do not respond well to bait traps.
- Single-pass electrofishing, undertaken to a standard less than that outlined above, provides a poor indication of cray abundance and detectability is affected by water turbidity and moderate to high density of instream structure.
- Dipnetting: difficult to physically get net into some habitat areas due to abundance of structure.
- Collecting by hand: time consuming.

All techniques are also compromised when freshwater crayfish abundances are low and individuals are either widely or patchily distributed, as can occur in the EGSCGroup. Sampling efficiency, and detectability, can be improved by using a combination of gear types, sampling over appropriate spatial scales, and increasing the amount of time spent sampling.

4.2 Survey area

Given the unidirectional flow of watercourses, potential impacts on aquatic environments will also extend in a downstream direction, outside of the immediate area of impact. Therefore it is required that if no spiny crayfish are recorded from watercourses within or immediately abutting a proposed harvesting coupe, that sampling continue downstream along the main channel for a distance of 4 km. This distance has been selected as tributary inflows at a greater distance will be sufficient to ameliorate sedimentation impacts. If spiny crayfish are recorded in this downstream reach, this should be treated the same as recording crayfish from within the coupe and prescriptions to protect riparian habitat applied to the banks of all watercourses within or abutting the coupe.

4.3 Timing considerations

Activity patterns of spiny crayfish to changes in seasonal temperatures is poorly known. Sampling should be conducted when environmental conditions are most conducive to effective capture. Therefore periods of high or turbid river flows should be avoided. Crayfish are more active a night and therefore trapping operations should not be restricted to daylight hours.

4.4 Expertise required and reporting standards for presence/absence surveys

As outlined earlier, surveys conducted for *Euastacus* spp. should be undertaken by wildlife biologists experienced in this group and properly and thoroughly documented, to allow subjective assessment of their adequacy.

All of the data outlined in section 3.2 for presence surveys should also be recorded for presence/absence surveys. In addition, the information below should be recorded for presence/absence surveys.

- Dates and survey effort (as outlined in section 3.2) for all surveys, including those that did not detect the species.
- Species and number of other fauna collected or seen.

5 Appendix

5.1 Ecological Information

Currently six species of spiny freshwater crayfish (genus *Euastacus*) are found in the rivers of coastal eastern Gippsland extending from the Mitchell River system eastward to the border with New South Wales. All are also found in the East Gippsland region (between the Buchan/Snowy River system and the NSW border). Recently, additional work on the taxonomy of the spiny crayfish in the East Gippsland region has identified an additional, new species, with possibly another taxon (*Euastacus yanga*) considered an unresolved species complex. The distribution of these taxa within this region is relatively poorly known.

Consequently the species currently known from the region are:

Gippsland Spiny Crayfish	*Euastacus kershawi*	(GSC)
Bidhawal or East Gippsland Spiny Crayfish	*Euastacus bidawalus*	(EGSC)
Alpine Spiny Crayfish	*Euastacus crassus*	(ASC)
Claytons Spiny Crayfish	*Euastacus claytoni*	(CSC)
Variable Spiny Crayfish	*Euastacus yanga*	(VSC)
Orbost Spiny Crayfish	*Euastacus diversus*	(OSC)
Bonang Spiny Crayfish	*Euastacus* sp. 1	(BSC)

GSC has a relatively wide distribution, is reasonably abundant, and is also found elsewhere in Victoria (Morgan 1986). The distribution of the other species are more restricted, with many occupying small, discrete distributions in small to medium sized, forested streams. Many are also considered threatened (see below). Relatively little is known about the biology/ecology of many of these species, though they are all restricted to freshwater streams, do not undergo long distance migrations, sometimes leave the water and move about on land in the moist riparian zone, and undertake their entire life-cycle in the creeks/rivers in which they are found. Consequently they are susceptible to impacts which affect the riparian corridor along streams or alter streamflow or water quality.

Spiny crayfish can be difficult to identify as many species are morphologically similar. One particular grouping consists of the OSC, EGSC and the newly identified BSC. The taxonomy of the first two species is being revised, and the third taxon has been identified as

distinct and is in the process of being formally described (Rob McCormack, pers. comm. 2009). Considering the morphological similarity of these taxa, this group is here termed the East Gippsland Spiny Cray Group (EGSCGroup), and specialist skills are required to accurately identify member taxa. This group also contains two of the most restricted spiny crayfish species in Victoria (OSC, BSC), restricted to small streams in forested catchments in which timber harvesting is conducted, and therefore has significance.

Primary areas of importance for the rarer members of the EGSCGroup (BSC and OSC) are the upper reaches of the northern flowing Bonang, Delegate and Queensborough River systems, and the southern Brodribb, Goolengook, and Errinundra River systems and the Goongerah Creek system. Other areas adjacent to these regions may also prove to be important. The more widespread EGSC is found in the lower elevation areas of the Bemm, Thurra, Mueller and Genoa River systems.

ASC, CSC and the VSC are also found in restricted ranges in small forested catchments subject to timber harvesting, and along with the EGSCGroup, are important aquatic taxa to manage with respect to potential harvesting impacts. In contrast, GSC are generally found in more lowland, larger systems, and less prone to potential harvesting impacts.

ASC is primarily found at higher elevation sites in the upper reaches of the Buchan, Snowy and Deddick River systems, CSC is restricted to the Bendoc/Queensborough/Back system (and possibly the Delegate system), and the VSC to the Genoa/Wallagaraugh system.

5.2 Status

The OSC and ASC are listed under the Victoria *Flora and Fauna Guarantee Act* and each have an FFG action statement (Murray 2003, van Praagh 2003). CSC, EGSC and VSC are also considered threatened and are listed as Vulnerable on the DSE Advisory List of Threatened Invertebrate Fauna in Victoria (2009). EGSC, CSC, ASC and OSC are considered Endangered when assessed against the IUCN Red List criteria (Coughran and Furse 2010), but are not as yet formally listed.

The distribution of the BSC has been defined as smaller than that of the OSC (McCormack 2009), and consequently this species is considered to be at least as threatened as the OSC.

5.3 Identification issues

The identification of freshwater spiny crayfish involves the presence/absence, distribution, abundance and size of many small morphological characters on the exoskeleton of mature males, and morphologically similar taxa (i.e. the EGSCGroup) require a high degree of taxonomic expertise to differentiate.

In general, a small subset of morphological characters can be used to provide a coarse initial field identification, and provides relatively robust identification of a number of taxa, though these should be checked by detailed reference to published descriptions (i.e. Morgan 1986, 1997). Three characters are important at this stage (Note: males are required):

- Presence/absence of Telsonic Surface Spines (TSS)
- Presence/absence of Male Cuticle Partition (MCP)
- Number of Mesal Carpal Spines (MCS)

Unique combinations of these characters, including supposedly distinct distributions, provide the following identifications in this region of Victoria:

1	TSS present…….……2	
	TSS absent…….……..3	
2	MCP present…….……..*Euastacus kershawi*	
	MCP absent…….*Euastacus yanga*	
3	MCP present…….…….EGSCGroup	
	MCP absent……..…..…….4	
4	Three large MCS…….……..*Euastacus crassus*	
	One large and two small MCS……..……..*Euastacus claytoni*	

Extensive knowledge of the characters used in the taxonomy of crayfish of the genus *Euastacus* is required to confidently undertake identification (i.e. Morgan 1983, 1986, 1997, McCormack and Coughran 2008). Detailed examination of voucher specimens is also required to confirm or complete identifications (except for GSC) and this usually requires the aid of a dissecting microscope or a X5 illuminated magnifier to clearly discern the presence/absence of small spines or tubercles.

6 References

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