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GONE TODAY, HERE TOMORROW — EXTINCT AQUATIC MACROINVERTEBRATES IN VICTORIA

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Abstract

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Only two aquatic macroinvertebrates have been given the official status of extinct (or presumed extinct) in Victoria. The Dandenong Amphipod *Austrogammarus australis* (Sayce) has been declared presumed extinct under the *Flora and Fauna Guarantee Act* 1988, the Department of Conservation and Natural Resources 1993 threatened fauna list and the Australian National Parks and Wildlife 1990 provisional list of threatened Crustacea species. The Otway Stonefly *Eusthenia nothofagi* Zwick was also listed under the *Flora and Fauna Guarantee Act* 1988 as presumed extinct in May 1991. A subsequent survey for amphipods in the Dandenong Ranges during 1995 has discovered specimens of *A. australis*, but with a very restricted distribution. Another survey, of eustheniid stoneflies in the Otways discovered that the species was common throughout the Otway Ranges. It is in the process of being de-listed. Now there are no officially extinct aquatic macroinvertebrates in Victoria. While this news should be greeted with joy by invertebrate biologists, it calls into question the current conservation status categories and processes when dealing with aquatic macroinvertebrates.

Introduction

As they (whoever they are) say, 'Extinction is forever'. Once extinct, a species cannot be resurrected, unless you believe in the outrageous popular myths propagated in films like 'Jurassic Park', and other fictional accounts of the activities of mad wild-haired scientists posing as biologists and ecologists. While a dictionary definition of the term 'extinct' corresponds with reality (i.e. the last individual of the species is dead), when it comes to more legal and bureaucratic official designations and conservation status lists, a slightly different tack is taken.

In conservation-speak, 'extinct' is generally defined as not having been recorded for a certain length of time. The IUCN (1983) and the CNR (1993) list of threatened Victorian fauna use a period of 50 years, although the CNR updated list (CNR 1995) uses 'taxa that are considered to have occurred in Victoria since European settlement but that have not definitely been recorded in the wild in Victoria in recent decades, and almost certainly no longer occur there'. Under the Victorian *Flora and Fauna Guarantee Act* 1988 (herein called the FFG Act), taxa can be listed as presumed extinct if they have not been recorded for 40 years.

While such conditions may be appropriate for high profile groups with relatively few species that are investigated regularly by a number of searchers (e.g., mammals and birds) or some diverse, colourful or collectable groups of interest to a large number of people (e.g. butterflies), the use of the formal conservation term 'extinct' breaks down for groups that are rarely investigated, including many of the invertebrates.

In invertebrate biology, advances in our knowledge on the distribution, taxonomy and ecology of many invertebrate species are often made by individual workers who, for some reason best known to themselves, become interested or enthusiastic about a particular group of animals. After years of sampling, taxonomic and ecological studies, the individual moves on, leaving the group without a champion. No more studies are conducted with the oft repeated comment 'Oh, don't worry about it, that groups been done'. Quite often, after 40 or 50 years without any sampling, the group is suddenly suitable for declaration as extinct.

This paper presents the results of investigations of two previously presumed extinct taxa that, when someone takes the time and trouble to actually look for them, are raised from the dead.

Dandenong Amphipod
***Austrogammarus australis* (Sayce)**

Austrogammarus australis (Crustacea: Paramelitidae) was originally described as *Gammarus australis* by Sayce in 1901 but placed in a new genus, *Austrogammarus*, erected by Barnard and Karman (1983), along with *Austrogammarus haasei* Sayce. The genus now includes seven species, four of which were first described by Williams and Barnard (1988) (*A. smithi*, *A. saycei*, *A. spinatus* and *A. multispinatus*) and another, *A. telsosetosus*, by Barnard and Williams (1995). *A. smithi* is known only from Tasmania, *A. telsosetosus* occurs only in South Australia, while the other species all appear to be restricted to Melbourne's eastern suburbs including sites around Monbulk, Sassafras, Croydon and Dandenong.

The type locality for *A. australis* was given as Dandenong Creek near Bayswater, but other locations where the species was subsequently located were given as the ambiguous 'a tributary of Monbulk Creek' and 'in a gully halfway to Sassafras'. The last known confirmed record of the species was in 1911. More recent attempts (Williams and Barnard 1988) to collect the species from the presumed type locality were unsuccessful, with the observation that the now modified urban drain nature of parts of Dandenong Creek near Bayswater made the location unsuitable for the species.

On the basis of the time since the last record, the failure to rediscover the species, and modifications to streams around the type locality, the species was classified as 'presumed extinct' by Horwitz (1990) and by the Department of Conservation and Natural Resources (CNR 1993). The species is also listed under the FFG Act as 'presumed extinct'.

In May and June 1995, a survey was conducted to try to confirm or deny the extinct status of the species. A total of 47 sites were surveyed throughout the Dandenong Ranges, and included sites within the Dandenong National Park and Olinda State Forest, as well as creeks from the suburbs of Heathmont, Bayswater, Ferntree Gully, Belgrave, Monbulk, Kallista, Kalorama, Lillydale, Mt Evelyn and Upway. These sites possibly included the type locality and the other original sites, but insufficient information is available to accurately locate these sites. At each site, samples were collected in likely habitats with an FBA net, placed in a sorting tray and all Amphipoda seen in the sample during a period of 0.5 person hours were collected in the field.

A total of 409 individuals of Amphipoda were recorded from 31 out of 47 sites sampled (Fig. 1). All sites containing amphipods were located in the least disturbed higher altitude areas of the study area, with none found at sites in the lower more modified urban sections of streams. In terms of composition, by far the majority of the amphipod fauna of the Dandenong Ranges consisted of members of *Pseudomoera gabrieli* (Eusiridae — 91% of the individuals).

Using the key provided by Horwitz et al. (1995), individuals identified as *Austrogammarus* were located at ten sites (Fig. 1). *Austrogammarus australis*, as described by Williams and Barnard (1988), was recorded at nine of these sites. These were located in the three major catchments draining the Dandenong Ranges (Dandenong Creek, Monbulk Creek and Olinda Creek). Confirmation of the specimens' identity was provided by John Bradbury (University of Adelaide, pers. comm.). All sites were in the headwaters of streams, had generally low levels of modification, with predominantly native riparian vegetation and shaded stream sections, but there was no consistent trends that could be associated with particular in-stream characteristics.

Austrogammarus haasei was located at only two sites (26, 27 in Fig. 1), both in Sherbrooke Creek. At one site on Sherbrooke Creek (27), *A. haasei* was found co-existing with *A. australis*.

While *A. australis* is clearly not extinct, the designation of an alternative formal conservation category is difficult. Categories like Endangered and Vulnerable usually involve some demonstrable decline in abundance and/or range to some undetermined critical level, and some defined threat to their survival (CNR 1995). Such a decision cannot be made with certainty for this species. It has clearly declined in range (the type locality no longer exists) but to what extent is unknown, and whether the decline is continuing is unknown. What the critical level of abundance or distribution, below which it is certain to go extinct (in the real sense of the word) is unknown. Hence, it has been reclassified as Insufficiently Known (taxa suspected to be Rare, Vulnerable or Threatened — CNR 1995).

Of some significance is the situation regarding the other *Austrogammarus* species. Despite Williams and Barnard (1988) not listing any new records for *A. haasei* since the original descrip-

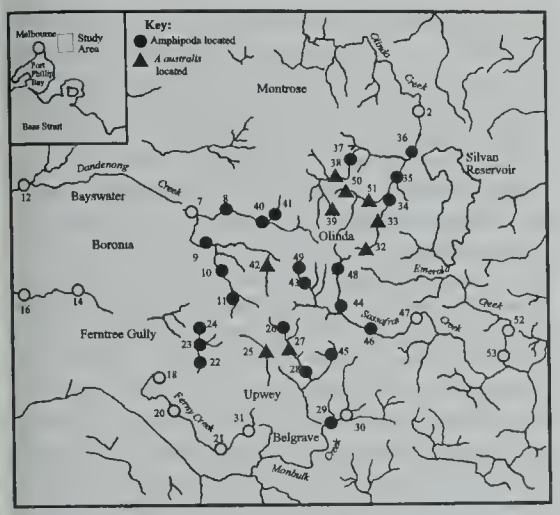

Figure 1. Map showing the distribution of Amphipoda in the Dandenong Ranges. Key: ? — Amphipoda recorded; 1 — *Austrogammarus australis* recorded.

tion (so, like the Dandenong amphipod, it could have been regarded as extinct prior to this study), it has never appeared on any threatened list (CNR 1993, Horwitz 1990). It has a distribution more restricted than *A. australis* and should probably have the same status or greater. How one species of *Austrogammarus* can appear on a formal list, while presumably the same publication used as key evidence also indicates that another species should be worthy of similar status, remains unexplained.

Otway stonefly
Eusthenia nothofagi Zwick

The Otway stonefly, *Eusthenia nothofagi* Zwick, was described on the basis of differences in adult male genitalia from the other species in the genus, *E. venosa* (Tillyard), by Zwick (1979). This decision was based on adult male specimens from a single site held in the Museum of Victoria (collected in January 1932 from Beech Forest). However, without providing any definitive reason, Zwick stated that the two species (*E. venosa* and *E. nothofagi*) do not occur together. This has subsequently been taken to mean that *E. nothofagi* is restricted to the Otway Ranges, while *E. venosa* is widespread throughout the rest of Victoria. Until mid-1991, no additional confirmed records of the species had been noted.

On the basis of the presence of only a single confirmed location, *E. nothofagi* was listed as Endangered, ('taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating') by the International Union for Conservation of Nature and Natural Resources (IUCN 1983 — although note that the 50 years required for extinct status had just expired at the time of publication), and as Endangered by Department of Conservation and Natural Resources (CNR, 1993). The species was listed under the FFG Act in May 1991 as presumed extinct (40 year requirement).

However, in mid-1991, a malc adult stonefly, subsequently identified as *E. nothofagi*, was collected by P. Lilywhite of the Museum of Victoria at Melba Gully State Park, near Lavers Hill. This was the first official record of the taxon since the original specimen from which the species description was made.

Again, a survey was conducted to determine the true distribution of the species. Fifty-two sites were sampled from across the Otway Ranges region, primarily within the forested areas, but extending outwards into the agricultural flats surrounding the ranges (Doeg and Reed 1995). At each site, a total of one person-hour was spent searching in the stream for *Eusthenia* nymphs. All habitat types within the stream (primarily wood debris and stones) were included. Possible habitat elements at each site were lifted and examined by eye for nymphs (this was possible due to the large size of the larvae).

Nymphs of the genus *Eusthenia* were recorded at 19 sites (Fig. 2). These were distributed over a wide area of the Otways, from the Johanna River (at Melba Gully State Park) and Chapple Creek (a tributary of the lower Gellibrand River) in the west, to the Erskine River at Erskine Falls in

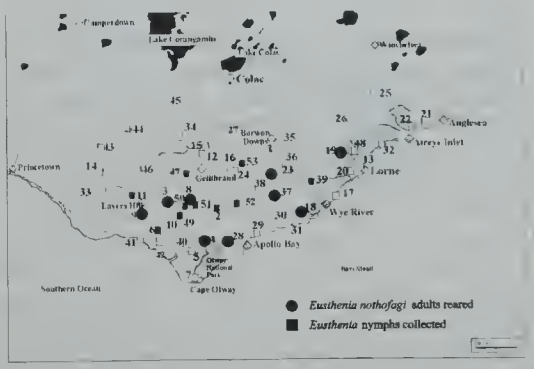

Figure 2. Map showing the distribution of the Otway stonefly in the Otway Ranges.

the east. Sites covered almost the entire range of altitudes found in the Otway Ranges (40–500m ASL). In the majority of cases, sites were located in forested areas (cool temperate rainforest, and wet sclerophyll forest), in State Forest or National Park. Two sites (the Ford and East Barham Rivers) were in areas where agricultural clearing was relatively extensive (although the specific sites were wide streams with abundant local riparian vegetation) and one (the Aire River at the Redwoods) was located primarily in pine forests.

Late instar nymphs were reared through to male *Eusthenia nothofagi* adults from 9 sites, confirming the presence of the species widely distributed throughout the Otway Ranges (Fig. 2). No adults of *Eusthenia venosa* were reared, and it is therefore assumed that, as suggested by Zwick (1979), all *Eusthenia* nymphs represent records for *Eusthenia nothofagi* and that the species is distributed at least from Melba Gully in the west, to Lorne in the east, a distance of some 50–60 km. It seems likely that the species would probably be located within virtually all the catchments between these extremes.

The presence in a large number of catchments, including reserved areas would suggest that the species is in little danger of becoming extinct. On the basis of these data, the species has been removed from the latest CNR threatened fauna list (CNR 1995) and is in the process of being delisted under the FFG Act (Pam Clunie, Flora and Fauna Branch, pers. comm.).

Conclusions

Formal conservation categories present difficulties when dealing with aquatic macroinvertebrates. With the current definitions, it is possible for species to be declared extinct while still thriving in reality. Other categories (Endangered and Vulnerable) require some demonstration of decline which, for many species, probably cannot be definitively established. The original suggestions that the Otway stonefly and the Dandenong amphipod were extinct are products of the lack of comprehensive surveys of each area, and complications in our taxonomic knowledge. Areas are rarely surveyed at the intensity seen in these two studies. Many studies only include a relatively small number of sites within a catchment. While a species with a restricted distribution (like *A. australis*) may be collected at one of these sites, this provides little information on the true distribution of the species. Such data sets will only increase the list of taxa recorded from single sites (and hence suitable for formal conservation status listing). However, many other species with similar restricted distributions may also be missed.

The situation is complicated where taxonomic identification is based on adult features, when the most often collected forms are larvae or nymphs (hence the identity can only be guessed at, but not confirmed). Again, the lack of confirmed published records for these types of taxa will increase the number of species suitable for formal conservation status listing. While such problems are slowly being addressed through increased survey activity and improved taxonomic procedures, it is likely that many more taxa will come under scrutiny for inclusion in such lists (possibly as a product of the perceived conflict between preservation, conservation and development).

Such conflicts may lead to a 'stamp collecting' mentality approach to conservation status. It would be a simple matter to compile a list of invertebrate species described prior to 1945 (50 years ago), scan all the available published literature since then, and create a list of species that can be officially declared extinct. Species more recently described, but only recorded at, say, the type locality would also be eligible for listing as rare, or potentially threatened. Undoubtably, such an approach would generate many taxa suitable for listing. But without an adequate knowledge of the survey effort put into the species, it will virtually impossible to designate the 'correct' conservation status for such species.

Only intensive further work will reveal that some of these easily nominated taxa considered rare are, in fact, common or secure. On the other hand, the number of taxa that will be shown to be rare or threatened will undoubtedly increase (Butcher and Doeg 1995), leading to the question of individual species management. The diversion of time, effort and money into confirming the status and developing management plans for all these potential species would be extensive, but may actually be of little or no value in the 'big picture' effort to conserve macroinvertebrate taxa. Yen and Butcher (1994) suggest that single species conservation may be inappropriate for the majority of invertebrates, but stress the importance of maintaining some type of list of threatened invertebrates because of the importance of listed species as flagship taxa.

Maybe it is time to examine our attitude to the setting of a formal conservation status for indi-

vidual invertebrate taxa. The formal definitions of conservation status categories are clearly inadequate, given the information available for the majority of species, so that any list produced will always be inadequate and sometimes incorrect. Even where distributions are well established, questions of historical decline or potential of extinction are often still unanswered. One option would be to atomatically designate species believed to be worthy of conservation status into the Insufficiently Known category (taxa that are suspected but not definitely known to belong to other categories), until sufficient data to establish a realistic status is collected.

Another option may be to redefine the criteria under which invertebrate species are assigned to each formal category, taking into account the limitations of any data likely to be collected. A final approach may be to determine a system of 'confidence' measures, where species are assigned to the most likely category but is annotated with a measure of the strength of the data used to make the determination.

The problem is to devise a system where the values of a listing process are retained, and where truely rare invertebrate species, like *A. haasei*, are given their full recognition as important species. But a system is needed where the designation to a particular conservation status is defensible, according to sound recognised criteria, but also acknowledging the special nature of invertebrate data for many species.

As an adjunct to the listing process, a concerted effort to control the threatening processes that cause decline in invertebrate biodiversity is vital and may, in the long term, be a more appropriate and, a more successful approach to invertebrate conservation.

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