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FINAL DETERMINATION

Austropetalia tonyana - Alpine Redspot Dragonfly as a Vulnerable Species

The Fisheries Scientific Committee, established under Part 7A of the *Fisheries Management Act 1994* (the Act), has made a final determination to list *Austropetalia tonyana* - the Alpine Redspot Dragonfly, as a VULNERABLE SPECIES in Part 1 of Schedule 5 of the Act.

The listing of Vulnerable Species is provided for by Part 7A, Division 2 of the Act.

The Fisheries Scientific Committee, with reference to the criteria relevant to this species, prescribed by Part 16, Division 1 of the *Fisheries Management (General) Regulation 2010* (the Regulation) has found that:

Background

1) *Austropetalia tonyana* Theischinger, 1995 - Alpine Redspot Dragonfly (family Austropetaliidae [Odonata, Anisoptera]) is a valid, recognised taxon and is a species as defined in the Act. The species was also described by Carle (1996) as *Austropetalia victoriae*; however this is regarded as a junior synonym (Lohmann 1996; Theischinger 2002).

2) *Austropetalia tonyana* is one of three species in the genus *Austropetalia* which is probably confined to south-eastern Australia. The other species are *Austropetalia annaliese* (Theischinger 2013) and *Austropetalia patricia* (Tillyard 1910), commonly known as the Waterfall Redspot Dragonfly.

3) The species in the genus *Austropetalia* are very similar in morphology. Whilst the 32-35 mm long larvae of *A. tonyana* and *A. patricia* are similar in appearance (Theischinger and Hawking 2006, Theischinger 2013), they can be identified by differences in the size and direction of the lateral abdominal lobes on segments 5-8 (Theischinger and Tang 2013). Adult female *A. tonyana* can be distinguished from *A. patricia* by the lack of pigmentation along the subcostal crossveins between the primaries on the wing membrane (Hawking and Theischinger 2004, Theischinger and Hawking 2006) and from *A. annaliese* by less extensive pale/yellow patches on labrum and abdominal segment 10 and by the paler and shorter pterostigma (Theischinger 2013).

4) Dragonflies are hemimetabolous (*i.e.*, undergoing a metamorphosis without a pupal stage). *A. tonyana* has three developmental stages – egg, nymph and adult – with the first two stages being aquatic (Theischinger and Hawking 2006).

5) *Austropetalia tonyana* is thought to be restricted to higher altitudinal montane areas of 600 – 1,800m that occur south of 35^{o}S and is considered a habitat-specialised species (Theischinger and Hawking 2006, Theischinger and Endersby 2009, Theischinger and Tang 2013). The species has probably extremely specific habitat requirements in that the nymphs are only known to occur amongst rocks, logs and moss in the spray zone of waterfalls (Gunther Theischinger, personal communication). Adults perch in a territorial area within the waterfall splash zone and vibrate their wings to generate heat between

rapid foraging sorties. Their flight period is thought to occur between October and January (http://www.ecology-solutions.com.au/vic_dragonflies/A_tonyana.htm).

Criteria – reduction in abundance, geographic distribution or genetic diversity (Regulation clause 271)

1) *Austropetalia tonyana* is a rare species. In total, there are only 31 recordings of *A. tonyana* in Australia since the 1950s, with only seven of these in New South Wales (Alexander Bush, Macquarie University, unpublished data). In addition, expeditions targeting aquatic macroinvertebrates conducted by the NSW Office of Environment and Heritage (formerly the Department of Environment and Conservation) and by Gunther Theischinger have resulted in several sightings (*i.e.*, specimens not collected) of *A. tonyana* in 2005, and the collection of adults of both sexes in the NSW part of the Snowy Mountains. Sightings and collections have usually been made in the months of October, November and December.

2) *Austropetalia tonyana* is a habitat specialist. As far as is known, this habitat specialisation leads to a very restricted geographic distribution. The specific habitats occupied by *A. tonyana* (the splash zone of waterfalls occurring within the altitude zone occupied by the species) are themselves uncommon and discontinuous, with this habitat modelled to decline in the near future (see Criteria – threatening processes, points 1-4).

3) There are conservation concerns for *A. tonyana* in analogous habitat in areas within Victoria near the New South Wales border. As a result, *A. tonyana* is listed as *Near Threatened* under Victorian legislation, *Flora and Fauna Guarantee Act 1988* (FFG). Globally, concerns for odonates are also registered through the establishment of dragonfly sanctuaries by the British Dragonfly Association and the creation of the Odonata Specialist Group for the World Conservation Union (IUCN) (Lemelin 2009).

4) Based on the documented rarity, the high degree of habitat specialisation and the threatening processes listed under Criteria - Regulation clause 272, the Fisheries Scientific Committee has found that it can be inferred or reasonably suspected that *A. tonyana* faces a high risk of extinction in New South Wales in the medium-term future.

Criteria – threatening processes (Regulation clause 272)

1) Threats to the continued survival of *A. tonyana* are difficult to assess due to the rarity of the species. In general, species of Odonata with specialised habitat preferences, such as *A. tonyana*, are highly sensitive to habitat disturbance and disappear following modifications to habitat (Clausnitzer 2003).

2) Species distributions of dragonflies are highly sensitive to modifications in habitat due to climatic change (Bush *et al.* 2013). The habitat of *A. tonyana*, which consists of splash zones below waterfalls in montane areas, faces a high likelihood of modification and reduction in area in the medium-term future due to climate change. Projected warming at higher altitudes in south-eastern Australia is predicted to cause (amongst other changes) reductions in precipitation of 5 - 10% (A1F1 Model) and evapotranspiration of ~10% (A1F1 Model) by 2070 (CSIRO 2007). Such climatic changes will result in longer dry spells when the area of splash zones below waterfalls will contract, interspersed with heavier precipitation events, particularly during summer and autumn, which may either scour habitats occupied by eggs and or small nymphs, or smother them in sediment.

Models predict that a 5% change in evapotranspiration in the Upper Murray catchment following bushfire would result in a 20% change in runoff (Marcar *et al.* 2006). Snow cover in the alpine region due to anthropogenic climate change is also expected to decline by 30 - 93% (depending on the model used) by 2050 (Hennessy *et al.* 2003, Nicholls 2005), substantially reducing snowmelt flow volumes during spring.

3) Models run in 2013 have been used to predict the environmental suitability of landscapes for *A. tonyana,* based on two emissions scenarios, RCP6 and RCP85, equivalent to a mean global temperature increase of 3.0 ^{o}C and 4.9^{o}C and using all known sightings/collections. Predictions of habitat suitability in both scenarios showed that approximately 71-77% of suitable area would be lost from the current species range for *A. tonyana* (Alexander Bush, unpublished data).

4) Catchment scale anthropogenic threats to the degradation of *A. tonyana* habitat include reduced stream flow associated with forestry development and stochastic extreme events such as fire (CSIRO 2007). Moreover, burnt catchments along with the predicted increasing intensity of rainfall will move greater sediment loads into the streams (Carey *et al.* 2003, Lyon and O'Connor 2008) thus further reducing the quality of the waterfall splash zones.

5) The capture of wild Odonata by humans for collection and rearing, commonly known as 'dragon-hunting' (Keith 2005) is increasing in popularity in many countries (Lemelin 2009). Amateur collectors can place increasing pressure on rare species of insects, including dragonflies (Morris and Cheesman 2012). Although the extent of human collection of this species is unknown, collection of Odonata by hobbyists does occur in montane areas in New South Wales (Gunther Theischinger, personal communication).

6) Existing reserve systems or other forms of refuge within the geographic distribution of the species do not adequately protect them from the range of threatening processes described above.

Conclusion pursuant to section 220F(4) of the Act

In the opinion of the Fisheries Scientific Committee:

(a) *Austropetalia tonyana*, the Alpine Redspot Dragonfly, is facing a high risk of extinction in New South Wales in the medium-term future, as determined in accordance with the criteria prescribed by the Regulation as discussed above, and

(b) It is not eligible to be listed as an endangered or critically endangered species.

The species is eligible to be listed as a VULNERABLE SPECIES.

Sources and Links

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