

## **Further knowledge of the colonisation of the South Island, New Zealand by *Hemicordulia australiae* (Odonata: Corduliidae)**

**Milen Marinov**

University of Canterbury, Christchurch ([mg\\_marinov@yahoo.com](mailto:mg_marinov@yahoo.com))

### **Abstract**

Information on *Hemicordulia australiae* from New Zealand is summarised with emphasis on its colonisation over South Island. The first records on possibly breeding individuals from Canterbury plains are also presented.

### **Introduction**

Armstrong (1978) gives details on the observed colonisation of *Hemicordulia australiae* (Rambur, 1842) over the New Zealand's North and South Islands. Some important extracts from this work are given below. The author erroneously considers Rambur (1842) as the first publication giving data on *H. australiae* on the New Zealand's main islands. In his description of the species Rambur (1842) states: "Collection de M. Marchal, et indiquée de la Nouvelle-Holande." The similarity in name may have misled Armstrong (1978) with its close association with New Zealand. However it was the French name for Australia between 1644 and 1824, when the continent became "Australie" (P. Jourde, pers. comm.). Tillyard (1926), who reports the species as "occasionally taken in New Zealand", was the first to publish information on *H. australiae* in New Zealand. The species had been collected earlier, but publication was after this date. Hudson (1950) reports on a single specimen taken at Lake Horowhenua on February 17<sup>th</sup>, 1901.

Apparently *H. australiae* was not established around the country until the mid-thirties when Armstrong (1978) gives evidence for the first breeding populations. It is not accounted in earlier detailed studies by Hutton (1899) and Hudson (1904). Note that the later author does not report on it even though he already had one specimen (given above) prior to publishing his paper in 1904. Tillyard (1920) made collections throughout hot springs in relation to trout food. He did not find *H. australiae* in spite of the fact that the species is known for its preference for warm waters. Armstrong (1978)

reports on *H. australiae* replacing native populations of *Procordulia grayi* and Moore (1989) has seen males patrolling over streams in which the water was too hot to touch.

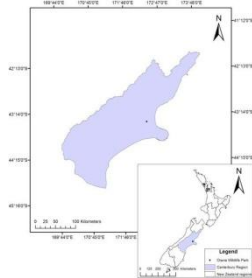
The most significant evidence for the right time of colonisation comes again from Armstrong (1978). Although he had intensively sampled within a certain region for the period 1926-1931 he saw *H. australiae* for the first time at the end of that period. It was not until 1934 that he noted the first breeding colony. Ten years later the species had spread over large area throughout the North Island and was consequently reported by several different authors (Forsyth 1975, 1978; Winterbourn M., Lewis M. 1975; Forsyth & Mackenzie 1981; Prestidge 1979; Winstanley 1980b, 1982, 1983; Chapman 1982; Rowe 1987).

*H. australiae* became established for the first time on the South Island in 1958 around Farewell Cape (Armstrong 1978). In 1962 it was confirmed for Dobson and apparently had already colonised rivers along the West coast. Armstrong does not give any further information for the eastern part of the South Island. Scarce information is presented in other odonatological studies performed over large regions of the island. It is not found by Crumpton (1977) in spite of a detailed search performed over 43 sites throughout Canterbury and Westland (both original and published data). Deacon (1978) followed the seasonal dynamic of Odonata in Lake Sarah, Canterbury, but did not establish the presence of *H. australiae* there. However, Deacon (1979) reports on the species as rarely seen, with a single observation made by F. Kramer from Mid Canterbury (place not specified) on 7<sup>th</sup> February 1979. *H. australiae* is reported for the same region later on by Rowe (1987). It is not reported by Haacks & Lehmann (2001) who have sampled throughout the whole New Zealand. The most recent information about the species from the South Island is dated nearly 20 years ago. Rowe (1987) gave a species distribution map for the whole country and refers to South Island's populations as highly unstable. He also presents the first data for the Canterbury region which is based on isolated individuals only. Moore (1989) found it at one place in the South Island – Lake Brunner, Westland.

The present paper contains the first evidence of a possible breeding population within Canterbury Plains, South Island, New Zealand.

### **Material and Methods**

*Hemicordulia australiae* was observed at Orana Wildlife Park, Christchurch, Canterbury region (43°28'00.8''S; 172°27'27.2''E; 60 m a.s.l.) (Fig. 1). The area was visited on a weekly basis over the period November, 2007 – January, 2008, in relation to the Kea's captivity behaviour programme initiated by the Park Directorate. Odonata observations were made on the imago only, as these insects were not the prime survey object. *H. australiae* imagines were encountered on two days only: 26<sup>th</sup> and 29<sup>th</sup> January. The wetlands visited encompassed a variety of types: mostly permanent bodies (lakes and channels) with still to slow moving waters not shaded by the surrounding trees (fig. 2); the last were represented by *Racosperma longifolium* (Andrews) C.Mart., *R. dealbatum* (Link) Pedley, *Eucalyptus botryoides* Sm.; banks were overgrown with herbs, e.g. *Medicago lupulina* L., *Rumex* sp. and small tufts of *Phormium* sp. *H. australiae* males were observed patrolling mainly over waters with hard cobbles/pebbled bottom (Udden-Wentworth scale, Wentworth 1922) with a well-developed vegetation mat of *Miriophyllum* sp. as well as other dead plant remains of both terrestrial and water origin. Dead tree branches were present at some ends of the channels.



**Figure 1.** Location of Orana Wildlife Park, Christchurch – a possible breeding area for *Hemicordulia australiae* within the Canterbury region, New Zealand.

## Results

*Hemicordulia australiae* encountered during the observation period were mainly male (fig. 3). They appeared to be active around the hottest part of

the day – noon and early afternoon. While patrolling, they chiefly chose the edge of the wetland and flew about 15-20 cm above the water surface.



**Figure 2.** Water margin patrolled by males *Hemicordulia australiae* in Orana Wildlife Park, Christchurch.

Hover stops were quite often and took place normally in sheltered areas – dead tree branches where the individuals were better protected. They, however, could often be performed over vegetation-free sites. Those were randomly chosen and individuals stayed less time in the air there.



**Figure 3.** Male *Hemicordulia australiae*

Away from the water male *H. australiae* use stronger flight and high speed manoeuvres, which often took them near the tree top lines. Group flights of 5-6 individuals were also observed there, mostly in the shadow of the trees, but also over sunny areas.

Only one female (involved in a copulation wheel) was detected for certain. The mating pair perched on tree twigs about 3-4 m from the water and at nearly 6-7 m above the ground. The copulation duration was not recorded as the initial pair formation was not observed. Another possible *H. australiae* mating pair is reported here. It was observed on 13<sup>th</sup> January 2008 perched on flax at about 1 m height. This was not identified with certainty since it was on the opposite shore from the observation point, too far away for clear view of diagnostic features.

Other Odonata species observed during the above mentioned period include: *Xanthocnemis zealandica*, *Austrolestes colenisonis*, *Adversaeschna brevistyla* and *Procordulia smithii*.

## Discussion

*Hemicordulia australiae* is described from Australia (Rambur 1842) and is known as a ubiquitous species that might migrate in swarms (O'Farrell 1970). That may be why it is confirmed for many regions mainly along the whole Eastern shore as well as South-Western Australia and Tasmania (Theischinger & Hawking 2006). It was reported for the first time outside the continent from the Kermadec Islands (Tillyard 1912) and subsequently confirmed as permanently established there by Armstrong (1973) and Watt (1975). The species occurs also on Norfolk Island (Tillyard 1917; Kimmins 1941; Hawkins 1943; Holloway 1977; Wise 1980; Winstanley, Brock 1983), Lord Howe Island (Tillyard 1926), Vanuatu (Kimmins 1958), Mayor Island (Winstanley 1983) and as far north as the Lesser Sunda Islands (Lieftinck 1953). However, the presence of *H. australiae* was not established during entomological investigations on other neighbouring islands, such as New Caledonia and the Loyalty Islands (Kimmins 1953; Lieftinck 1975; Winstanley 1984) and the Fiji archipelago (Evenhius & Polhemus 2007). It is not found on New Zealand's Chatham Islands (Hutton 1898; Macfarlane 1979) and perhaps it will be difficult for the species to become established there. *H. australiae* is well known for its

preference towards warm water temperature (Armstrong 1978) and possibly will hardly survive the climatic situation typical of the island, which Rutledge (1992) identifies as cool, cloudy and windswept, with a temperature range between about 5°C in the winter and 18°C in the summer.

All this data shows *H. australiae* to be a widely distributed species across the australasian region. Prior to Tillyard (1912) the species was considered as non-migratory and had not been recorded outside the Australian continent. That led to the assumption of a possible late Miocene land connection between the Kermadec islands and Australia via New Caledonia. However, the observed species' radiation throughout the region (Lieftinck 1953) suggests that this assumption is not necessary. *H. australiae* is also considered to be self-introduced to the New Zealand main islands (Winstanley 1980a). As discussed in the Introduction, colonisation over this country coincides with a general trend of spreading throughout the australasian region seen elsewhere. Kimmins (1936), for example, did not find it among the material collected from Vanuatu, but discovered it in later collections from the same place (Kimmins 1958). *H. australiae* is a conspicuous species and easily recognisable in flight (Armstrong 1958) due to its habit of frequent hovering that allows the observer to see the characteristic abdominal pattern. That is why it should have been definitely recorded during faunistic samples if present within the investigated area.

*H. australiae*'s invasion of New Zealand is moving from north to south. It has taken 20 or more years for the species to reach the South Island and occupy its West coast. Colonisation further south is going slower for two main reasons: 1.) *H. australiae* is adapted to warmer weather conditions; 2.) the Southern Alps make a difficult, but not impossible, to overcome barrier. Occasional records are found stored at Lincoln University's Entomological Museum – three teneral males collected on 19<sup>th</sup> December 1985 on snow at 2300 m a.s.l. on Mt. Ruapehu, North Island (Emberson, R. M. & P. Syrett leg.). This is so far the highest known elevation from which the species is recorded, and it shows that *H. australiae* could well fly at such high altitudes to reach new territories. This insect has also been reported from the Briar's Cave's entrance (150yds), near Waitanguru, North Island (May 1963). Two individuals were collected on 1<sup>st</sup> January 1961 and the species is referred to as being troglaxene. Those records are indicative that although the species prefers warmer environment for

breeding it could be tolerant to cooler conditions, which perhaps helps it during the dispersal throughout the Pacific.

Along the eastern part of the South Island, *H. australiae* has been identified as possibly breeding, some 50 years after arrival and nearly 20 years since it started to invade Canterbury plains. Previous odonatological investigations within this area reveal it from two places only (Rowe 1987). It is still not regularly encountered, according to the most recent hydrobiological investigations performed on both main islands (Wissinger et al. 2006; Collier & Lill 2008).

The present paper only refers to *H. australiae* as possibly breeding in the Canterbury region. The observations made are of typical reproductive behaviour, as described previously by Armstrong (1958) and Rowe (1987). They do not, however, provide the ultimate exuviae, teneral or final-stadium larvae that would confirm the insect to be autochthonous. Further investigations are required to confirm *H. australiae* as permanently established for the Canterbury plains. These would also establish the southernmost limits of the species. So far in New Zealand, *H. australiae* reaches the same southern latitude as in Tasmania (Allbrook, 1979). The Canterbury plains, however, provide opportunities for further southward expansion and the species could well become established in the Otago region as well.

### **Acknowledgements**

My sincere thanks to all who helped me during the preparation of the paper with advice, plant identification and literature: Hamish Greig, Hamish Maule, Ian Endersby, John Marris, Jon Harding, Jon Sullivan, Martin Schorr, Mary Beech, Philippe Jourde, Richard Rowe, Vincent Kalkman. My special gratitude is to Orana Wildlife Park Directorate for giving me permission to work on its territory.

### **References**

- Allbrook P. 1979. *Tasmanian Odonata*. Hobart, Fauna of Tasmania Committee, University of Tasmania.
- Armstrong J. 1958. The breeding habits of the Corduliidae (Odonata) in the Taupo district of New Zealand. *Transactions of the Royal Society of New Zealand* 85(2): 275-282.

- Armstrong J. 1973. Odonata of the Kermadec Islands. *New Zealand Entomologist* 5(3): 277-283.
- Armstrong J. 1978. Colonisation of New Zealand by *Hemicordulia australiae*, with Notes on its Displacement of the Indigenous *Procordulia grayi* (Odonata : Corduliidae). *New Zealand Entomologist* 6(4): 381-384.
- Chapman M. 1982. The fauna of peaty lakes in the Waikato Valley. *New Zealand Entomologist* 7(3): 283-286.
- Collier K., Lill A. 2008. Spatial patterns in the composition of shallow-water macroinvertebrate communities of a large New Zealand river. *New Zealand Journal of Marine and Freshwater Research*, Vol. 42: 129–141.
- Crumpton W. 1977. Notes on occurrence of Odonata in Canterbury and Westland (New Zealand). *New Zealand Entomologist* 6(3): 302-304.
- Deacon K. 1978. Seasonality in New Zealand Dragonflies. *New Zealand Entomologist* 6(4): 359-360.
- Deacon K. 1979. The seasonality of four Odonata species from mid Canterbury, South Island, New Zealand. *Unpublished Ph.D. Thesis, University of Canterbury, Christchurch*: 209 pp.
- Evenhuis N., Polhemus D. 2007. Checklist of Odonata of Fiji. *Bishop Museum Technical Report* 35(15): available at: <http://hbs.bishopmuseum.org/fiji/checklists/odonata.html>.
- Forsyth D. 1975. The benthic fauna. in Jolly V. & J. Brown (Eds) *New Zealand lakes*. Auckland University Press, Auckland: 388 pp.
- Forsyth D. 1978. Benthic macroinvertebrates in seven New Zealand lakes. *New Zealand Journal of Marine and Freshwater Research* 12(1): 41-49.

- Forsyth D. & A. Mackenzie 1981. Limnology of Opal Lake. *New Zealand Journal of Marine and Freshwater Research* 15(3): 279-283.
- Haacks M, Lehmann A. 2001. Some observations on dragonflies (Insecta: Odonata) throughout New Zealand. *The Weta* 24(1): 13-17.
- Hawkins C. 1943. The insects of Norfolk Island, including a preliminary report on a recent collection. *Annals and Magazine of Natural History, London* (11)9: 865-902.
- Holloway J. 1977. *The Lepidoptera of Norfolk Island, their biogeography and ecology*. Series Entomologica 13, Junk. The Hague.
- Hudson G. 1904. *New Zealand Neuroptera. A popular introduction to the life-histories and habits of may-flies, dragon-flies, caddis-flies and allied insects inhabiting New Zealand. Including notes on their relation to angling*. West, Newman and Co., London.
- Hudson G. 1950. *Fragments of New Zealand entomology. - a popular account of all New Zealand cicadas. The natural history of the New Zealand glow-worm. A second supplement to the butterflies and moths of New Zealand and notes on many other native insects*. Ferguson & Osborn Ltd., Wellington.
- Hutton F. 1898. On a collection of insects from the Chatham Islands with descriptions of three new species. *Transactions and Proceeding of the New Zealand Institute* 30: 155-160.
- Hutton F. 1899. The Neuroptera of New Zealand. *Transactions of the New Zealand Institute* 31: 208-249.
- Kimmins D. 1936. Odonata, Ephemeroptera, and Neuroptera of the New Hebrides and Banks Island. *Annals and Magazine of Natural History* (10)18: 68-88.
- Kimmins D. 1941. Notes on the Odonata and Neuroptera of Norfolk Island. *Entomologist's Monthly Magazine* 77: 134-136.

- Kimmins D. 1953. Miss L. E. Cheeseman's expedition to New Caledonia, 1949. Orders Odonata, Ephemeroptera, Neuroptera and Trichoptera. *Ann. Mag. Nat. Hist.* (12) 6: 241-257.
- Kimmins D. 1958. Miss L. E. Cheeseman's expedition to New Hebrides 1955. Orders Odonata, Neuroptera, and Trichoptera. *Bulletin of the British Museum (Natural History). Entomology* 6: 239-250.
- Lieftinck M. 1953. Odonata of the island of Sumba with a survey of the dragonfly fauna of the Lesser Sunda Islands. *Verhandlungen der Naturforschenden Gesellschaft in Basel* 64: 118-228.
- Lieftinck M. 1975. The dragonflies (Odonata) of New Caledonia and the Loyalty Islands. Part 1. Imagines. *Cah. O. R. S. T. O. M., ser. Hydrobiol.* 9(3): 127-166.
- Macfarlane R. 1979. Notes on insects of the Chatham Islands. *New Zealand Entomologist* 7(1): 64-70.
- May B. 1963. New Zealand cave fauna -2 The limestone caves between Port Waikato and Piopio districts. *Transactions of the Royal Society of New Zealand* 3(19): 181-204.
- Moore N. 1989. A visitor's observations on the dragonflies of New Zealand and their conservation. *New Zealand Entomologist* 12(1): 5-13.
- O'Farrell A. 1970. Odonata (Dragonflies and Damselflies). In: *The insects of Australia: a Textbook for Students and Research Workers*. Melbourne University Press. Sponsored by the Division of Entomology Commonwealth Scientific and Industrial Research Organisation Canberra.
- Prestidge R. 1979: Ingestion and assimilation efficiency of *Aeshna brevistyla* and *Hemicordulia australiae* larvae (Odonata). *New Zealand Journal of Marine and Freshwater Research* 13(1): 193-199.

- Rambur M. 1842. Histoire Naturelle des Insectes. Néuroptères. Roret, Paris.
- Rowe R. [with contributions by Corbet P., Winstanley W.] 1987: *The dragonflies of New Zealand*. Auckland University Press.
- Rutledge M. 1992. Survey on Chatham island indigenous freshwater fish, November 1989. Department of Conservation.
- Theischinger G., Hawking J. 2006. *The complete field guide to Dragonflies of Australia*. CSIRO Publishing.
- Tillyard R. 1912. Notes on some dragon-flies from the Kermadec Islands. *Transactions and Proceeding of the New Zealand Institute* 44: 126-127.
- Tillyard R. 1917. Odonata, Plannipennia, and Trichoptera from Lord Howe and Norfolk Islands. *Proceedings of the Linnean Society of New South Wales* 42: 529-544.
- Tillyard R. 1920. Report on the neuropteroid insects of the Hot Springs Region, N.Z., in relation to the problem of trout food. *Proceedings of the Linnean Society of New South Wales* 45 (2): 205-213.
- Tillyard R. 1926. *The insects of Australia and New Zealand*. Sydney, Angus & Robertson.
- Watt J. 1975. A General Introduction to terrestrial Arthropoda of the Kermadec Islands. *New Zealand Entomologist* 6(1): 32-45.
- Wentworth C. 1922. A scale of grade and class terms for clastic sediments. *Journal of Geology* V. 30: 377-392.
- Winstanley W. 1980a. A preliminary account of the habitat of *Antipodochlora braueri* (Odonata: Corduliidae) in New Zealand. *New Zealand Entomologist* 7(2): 141-148.

- Winstanley W. 1980b. Odonata in the Urewera National Park. *New Zealand Entomologist* 7(2): 148-149.
- Winstanley W. 1982. Some insects in the Rangitoto Range, New Zealand. *New Zealand Entomologist* 7(3): 323-324.
- Winstanley W. 1983. Notes on *Hemicordulia australiae* (Odonata: Corduliidae) from the New Zealand region. *New Zealand Entomologist* 7(4): 457-460.
- Winstanley W. 1984. Odonata from New Caledonia. *The Weta* 7(1): 8.
- Winstanley W, Brock R. 1983. Some Odonata from Norfolk Island. *New Zealand Entomologist* 7(4): 455-457.
- Winterbourn M., Lewis M. 1975. Littoral fauna pp 271-280. In: Jolly, V. & J. Brown, (Eds) *New Zealand lakes*. Auckland University Press, Auckland: 388 pp.
- Wise K. 1980. Records of South Pacific Dragonflies (Hexapoda: Odonata). *Records of the Auckland Institute and Museum* 17: 175-178.
- Wissinger S., McIntosh A., Greig H. 2006. Impacts of introduced brown and rainbow trout on benthic invertebrate communities in shallow New Zealand lakes. *Freshwater Biology* 51, 2009–2028.