Micronesica 40(1/2): 227–232, 2008

First Records of Odonata From the Republic of Nauru

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Abstract—Five species of dragonflies and one damselfly are recorded from Nauru for the first time, and constitute the first records of Odonata from this island republic identified to species. None is endemic; all are widespread in the Indo-Australian region and the islands of the west central Pacific Ocean. *Diplacodes bipunctata* (Brauer) is the most common species throughout the island, but *Ischnura aurora* (Brauer) appears locally abundant, possibly seasonally. Breeding is confirmed for all species.

Introduction

"Dragonflies" have been previously reported from Nauru, but only collectively, as an insect group; no species were identified in these accounts and no locality records for Nauru were given in Lieftinck's (1962) review of the Odonata of Micronesia. Steel (in Froggatt 1910: 410) reported "many dragon-flies" at Buada Lagoon, but apparently did not include odonates in his insect collections. Chapman (1967: 6) alluded to larvae and exuviae of "two species of dragon-flies" found during a survey of mosquitoes in November and December 1966, and Finsch (1881: 245) reported Libellulidae as an important part of the diet of the Nauru Reed-warbler, *Acrocephalus rehsei* (Finsch). Additionally, Kayser (2005—English translation of German text published 1921-1924), writing of Nauruan life during the 1800s and early 1900s, stated that dragonflies were often caught by children using a miniature sling consisting of a coconut leaf fiber with a small stone tied to each end, and that others were reared from "cocoons" [presumably larvae] collected on grasses at the edge of brackish ponds. The present study is based on my observations and specimens that I recently collected, which are reported here as the first records of Odonata from Nauru identified as to species.

Study Area

Nauru (0º 30' S, 166º 56' E) is a small (21 km^2), raised atoll island in the west-central Pacific Ocean, in southeastern Micronesia, approximately 2,100 km northeast of New Guinea. The nearest island is Banaba (Ocean Island), 300 km to the east. A narrow coastal belt about 100 to 300 m wide abuts a scarp that rises approximately 30 to 40 m in most areas to form the edge of a central plateau, with a maximum elevation of 72 m at Command Ridge. Approximately 10,000

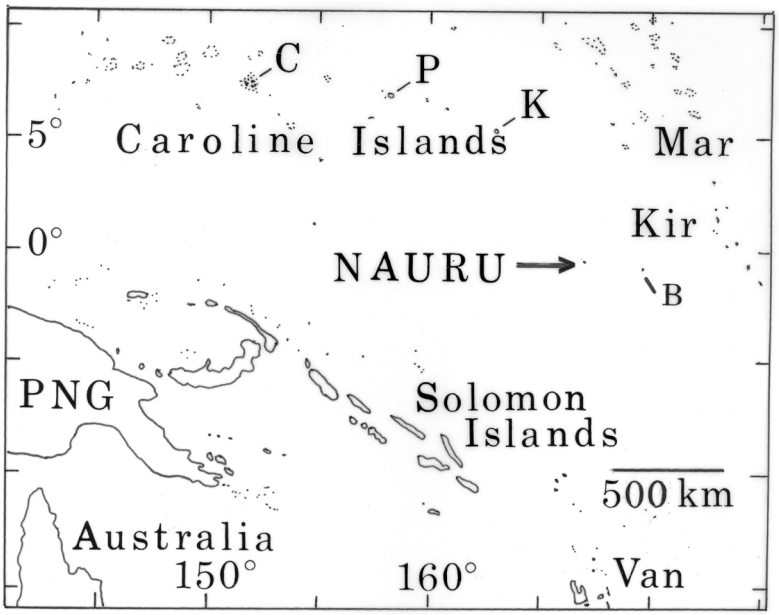

Figure 1: Location map for Nauru and surrounding islands; B = Banaba (Ocean Island), C = Chuuk, K = Kosrae, P = Pohnpei, Kir = Kiribati, Mar = Marshall Islands, Van = Vanuatu, PNG = Papua New Guinea.

islanders reside mainly along the coast and in a small settlement centered about a brackish lake (Buada Lagoon) in a low area in the southwestern part of the plateau. The coastal vegetation consists largely of strand, scrub, scattered coconut trees, and a variety of ornamentals and fruit trees. Much of the original vegetation of the central plateau was stripped away during a century of open cast phosphate mining, but many of the mined areas have since regenerated to scrubland and have small pockets of residual forest dominated by *Calophyllum inophyllum* L. and *Ficus prolixa* J. R. & G. Forster. The most extensive remnant forest areas are on the slopes of the scarp and at its base. More detailed descriptions of the physiognomy and vegetation of Nauru are provided by Manner et al. (1984), Thaman (1992) and Thaman et al. (1994).

The average monthly temperature ranges from 27º to 29º C and the average annual rainfall is 2,098 mm, with the wetter months being December to April. Wind direction is from the west at about 18.5–33.5 km/h during the wet season and from the east at 9.5–18.5 km/h during the May-November dry season. Fresh water habitats and potential breeding sites for odonates are scarce, and largely limited to Buada Lagoon, which is 3–4 ha in area, with an extensive growth of introduced water hyacinth, *Eichhornia crassipes* (Mart.) Solms. There are several smaller brackish ponds at the northern end of the island, as well as rain puddles, open cisterns, and water filled pits and bomb craters throughout the coastal belt.

Methods

I visited Nauru during 12-25 December 2006 and again from 29 March to 5 April 2007 to conduct surveys of birds, reptiles, butterflies, and dragonflies. Thirty nine adult dragonflies of six species were collected with nets, air-dried in envelopes, and deposited in the collections of D. R. Paulson (Seattle, Washington, USA) and G. Theischinger (Grays Point, NSW, Australia). Abundance categories are appraisals based on incidental observations throughout the study period: very common (50 or more encounters per day on most days and under suitable viewing conditions, common (25-50 encounters per day on most days) fairly common (10-25 encounters on most days), and uncommon (fewer than ten encounters per day, and unrecorded on many days).

Species Accounts

Suborder Zygoptera
Family Coenagrionidae

Ischnura aurora (Brauer)

During the December 2006 survey, this species was encountered only in a small patch of grasses and sedges at a rain-flooded section of gravel road near the USP (University of the South Pacific) Nauru campus; two to four were caught with each sweep of the net in a 4 m^2 area. In late March and early April, *I. aurora* was locally common along the shores of several small, brackish ponds at the northern end of the island and very common in dense mats of water hyacinths (*Eichhornia crassipes*) and in marshy vegetation along the shores of Buada Lagoon, where 5-6/m^2 were estimated in an area roughly measuring 10 m x 2 m. The USP campus site was completely dry during the March/April visit; no odonates were observed at that time.

Suborder Anisoptera
Family Aeshnidae

Anax guttatus (Burmeister)

This species was fairly common to common throughout the island during both the December and March/April visits. It was most numerous over open water and regularly, but less frequently, encountered along roads and trails through the scrublands of the central plateau. Small groups of three to five were often seen flying along roadsides at sunrise, before most other species of odonates were active. It was occasionally seen trapped in buildings.

Family Libellulidae

Diplacodes bipunctata (Brauer)

This species was common to very common in open, wet areas throughout the island and less frequently encountered in dry, grassy areas. It was the most abundant odonate on Nauru during both visits, excluding the dense concentration of *Ischnura aurora* along the shore of Buada Lagoon during March/April.

Table 1. List of Odonata collected on Nauru during 12-24 December 2006 and 29 March-5 April 2007, and recorded incidents of breeding.

		Breeding[a]	
Species	Specimens	December	March/April
Ischnura aurora (Brauer)	9♂/3♀	T(4)	T(1)
Anax guttatus (Burmeister)	5♂/2♀	T(1), C(1), O(1)	C(1)
Diplacodes bipunctata (Brauer)	3♂/1♀	T(6), O(3), OT(3)	T(1), C(1), OT(3)
Pantala flavescens (Fabricius)	5♂/5♀	O(1), OT(1)	
Tholymis tillarga (Fabricius)	1♂/1♀	O(1)	
Tramea transmarina Brauer	4♂	O(1)	

[a] C = pair in copula, O = female ovipositing, OT = female ovipositing in tandem with male, T = pair in tandem; numbers in parentheses indicate individuals or pairs of individuals observed.

Pantala flavescens (Fabricius)

This species was uncommon to fairly common, frequently encountered over roadside puddles, and more numerous in December than in March/April, when conditions were much drier. Small aggregations of four or five were occasionally seen patrolling within a small area in vacant lots and over strand vegetation along the beach.

Tholymis tillarga (Fabricius)

This species was fairly common at brackish ponds and most frequently encountered during late afternoon and at dusk, and it was occasionally flushed from trailside vegetation on the central plateau.

Tramea transmarina propinqua Lieftinck.

This species was the least frequently encountered odonate on Nauru; no more than 10-15 were observed in two weeks in December and one week during March/April. All sightings were over open water or very close to water.

Discussion

Small island size, distance from potential source populations, and limited habitat diversity with few potential aquatic breeding sites likely contribute to the meager odonate fauna of Nauru, which consists of a small group of highly vagile species widely distributed among many of the far-flung low-lying coralline islands of the Pacific. The six species recorded on Nauru belong to six of 13 genera that Rowe (2004) reported as including species capable of considerable transoceanic movement, and that are widely dispersed among Pacific Ocean islands. Lieftinck (1962) recorded the same six species, and no others, for the Marshall Islands and Gilbert Islands (now a part of the Republic of Kiribati), an

expanse of several thousand small, low-lying, and water-resource poor atoll islands several hundred to over 1,000 km east and northeast of Nauru.

The effect of distance from potential source populations may be an especially critical factor in accounting for the number of species on these Pacific islands. The number of odonate species tends to diminish progressing eastward from Indo-Australia across Micronesia (Lieftinck 1962, Buden & Paulson 2003, Paulson & Buden 2003, Buden & Paulson 2007). The same six species that are found on Nauru also are the same six (plus one single-island endemic) that make up the odonate fauna of Kosrae (Buden & Paulson 2003), which is the easternmost of the Caroline Islands, and about 800 km northwest of Nauru. Kosrae is considerably larger (109 vs 21 km^2) and higher (630 vs 72 m), and it has much greater variety of habitats, including mangroves, rainforest, cloud forest, numerous fast flowing mountain streams, brackish estuaries, and freshwater swamps. Forest stream habitats on Kosrae seem especially unexploited and underutilized by odonates (Buden & Paulson 2003). Distance from potential source populations and the vagility of the colonists likely contribute to the similarities in the odonate faunas of these two topographically very different islands.

Breeding is documented for all the species recorded on Nauru and is based on observations of pairs in tandem, or in copula, or by females ovipositing (Table 1). Breeding was observed in Buada Lagoon, smaller brackish ponds, rain puddles, and excavated pits. Four of the six species (*Diplacodes bipunctata*, *Pantala flavescens*, *Tholymis tillarga*, and *Tramea transmarina*) were observed ovipositing in the same area of rain-flooded gravel road adjacent to the USP campus in December. This area was completely dry and devoid of any odonate activity when revisited at the end of March. The ability to utilize transient water resources doubtless has contributed to the success of this group of odonates in colonizing small, distant islands, such as Nauru.

Acknowledgments

I thank Günther Theischinger for confirming identifications of sample specimens and Dale Deireragea for his assistance in the field, and I am especially grateful to Alamanda Lauti, Director of University of the South Pacific Nauru Campus for her assistance with travel arrangements, accommodations, and collecting permits and other documents.

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Received 20 July 2007, revised 30 Sep.