THE SEASONAL OCCURRENCE OF ODONATA IN THE LIWONDE NATIONAL PARK, MALAŴI

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The Liwonde National Park in Malaŵi was sampled for Odonata species on 32 occasions from October 1975 to June 1977. The principal aims were to record the seasonal distribution and imaginal habitats of the Park's odonate fauna, since little information of this nature has been published for specific areas in Africa and none was available for Malaŵi.

Since the Liwonde National Park has a continental tropical climate with pronounced dry and wet seasons, and a range of habitat types including large and small rivers, swamps, waterholes, grassland, savanna woodland and rocky hills, the seasonal distributions and habitat preferences of Odonata were varied. Sixty-one species of 9 families (33 libellulids, 14 coenagrionids and 14 species distributed amongst the Lestidae, Protoneuridae, Calopterygidae, Chlorocyphidae, Gomphidae, Aeshnidae and Corduliidae) were recorded.

The seasonality of the species was summarized using the following categories: 1. Species flying throughout the year (*e.g. Ischnura senegalensis*). 2. Species occurring through the year but with a dry season break (*e.g. Pantala flavescens*). 3. Species flying for a single period extending into the dry and wet seasons (*e.g. Orthetrum chrysostigma*). 4a. Species flying only in the wet season — long flight period (*e.g. Phaon iridipennis*); 4b. — Short flight period (*e.g. Elattoneura glauca*). 5. Species with very restricted period — dry season only (*e.g. Paragomphus elpidius*). 6. Species with long but irregular flight periods (*e.g. Ceriagrion kordofanicum*). 7. Species with 2 or 3 short, widely separated flight periods (*e.g. Platycypha caligata*).

Of the total of 61 species, 36 were associated with the Shiré River (which connects Lake Malaŵi with the Zambezi River). These "Shiré River" species could be divided into those also found in few other habitats (10 stenovalent species, *e.g. Pseudagrion acaciae*) and those occurring frequently in a large range of habitats (26 euryvalent species, *e.g. Ceriagrion glabrum*). Twenty-five species occurred in habitats other than the Shiré River itself. Most of these were rarities in the Park, but a few (*e.g. Pseudagrion kersteni*) were common or moderately common.

Irregular periods of flooding of the low-lying parts of the Park by closure of the barrage across the Shiré River at Liwonde probably had deleterious effects on many breeding Odonata populations.

Six species were new records for Malawi.

INTRODUCTION

Odonata have not been extensively collected in any part of Malawi and accordingly, the local species are not well known. In 1966 an expedition from the National Museum of Rhodesia visited Malawi and this resulted in the capture of 86 species of Odonata from a total of 113 species then known from the country (PINHEY, 1966). Before this, PINHEY (1961) published Odonata records of several other collectors and this same author revised the Malawi checklist, incorporating many more records (PINHEY, 1979). There do not seem to be any records of Odonata from the Liwonde area prior to the present paper and there are no records of the seasonal distribution and imaginal habitats of the Odonata for any part of Malawi.

The Liwonde National Park (14°42'S-15°3'S; 35°14'E-35°24'E) is Malawi's newest National Park and was not open to the general public when this survey was carried out. Now open to the public, it is expected to make a considerable contribution to Malawi's conservation and tourist programmes. An introductory account of Liwonde National Park including its history, geology, geography, vegetation and fauna has been given by DUDLEY & STEAD (1976). The Liwonde Research Project, which has been organized by the Departments of Biology and Geography & Earth Sciences of the University of Malawi in Zomba, involves an intensive coordinated study of the Park's ecosystem. This work, begun in 1974, aims to develop a system of monitoring the flora and fauna in order to help the Government's Department of National Parks and Wildlife to manage the Park's resources. The Park has a rich herpetological, avian and large mammal fauna, and is easily accessible from the main urban centres in Malawi. The preliminary work carried out includes a survey of plants and animals within the Park, a description of the ecology of the principal plant communities and major mammal species, and an evaluation of the impact of both the larger mammals and Man on the Park's ecosystem. This paper is, therefore, a contribution within the Liwonde Research Project, to the flora and fauna inventory of the Liwonde National Park.

The Liwonde National Park (Fig. 1), comprising about 650 km^2, is situated between Lake Malombe and Liwonde Township near the main Zomba-Lilongwe road. The Park's western boundary incorporates 24 km of the Shiré River which is a tributary of the Zambezi and the largest river in Malawi. The irregular eastern boundary is limited mostly by cultivation situated below the Makongwa escarpment. The Park is generally a flat valley rising only slightly from the Shiré River (472 m above sea level) to the eastern boundary. This part of the great Rift Valley of eastern Africa is punctuated by 3 main groups of inselbergs, of which the southernmost and the largest, Chiunguni, has an elevation of 921 m. The

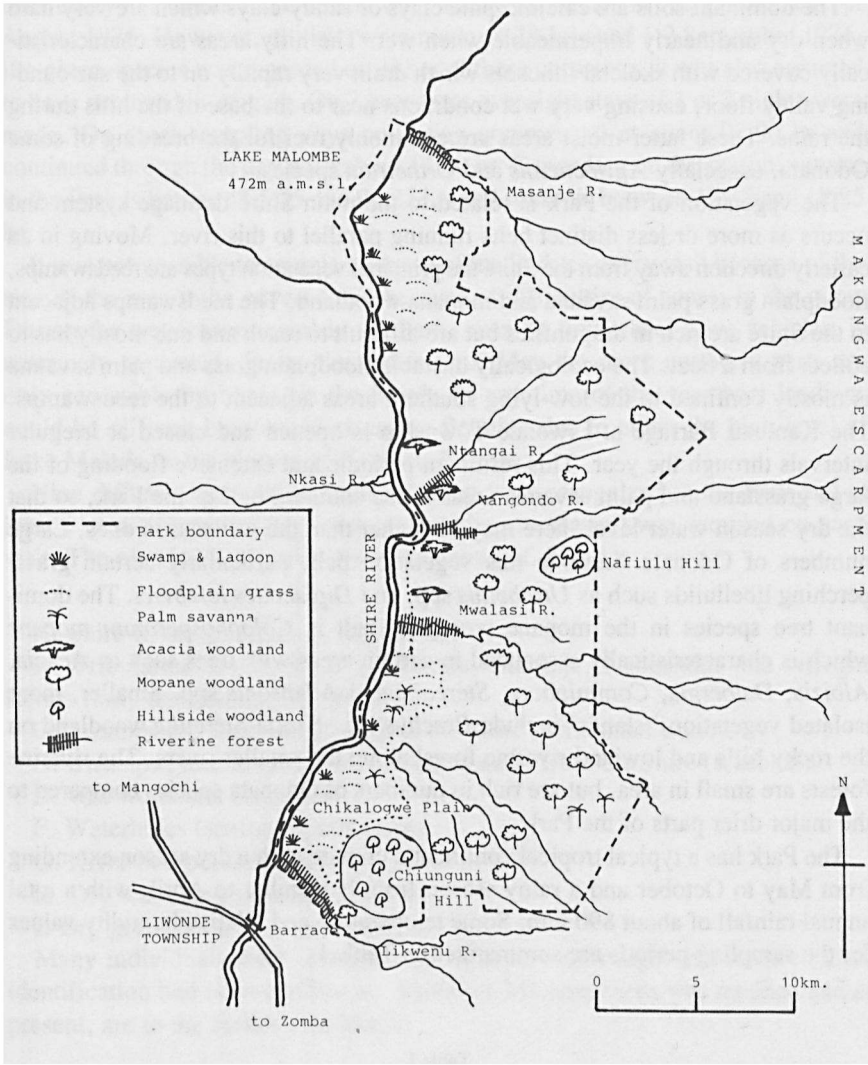

Fig. 1. Principal physical features of Liwonde National Park (omitting the northern extension), 1975-1977.

Shiré River flows south along the western boundary of the Park and receives water from Lake Malawi via Lake Malombe. The Shiré provides the main permanent source of water in the Park during the dry season. The Likwenu River (forming the southern boundary) and the Masanje River (in the north) are permanent, small rivers liable to flash flooding during the rains, each supporting dense riverine vegetation. The other rivers in the Park are generally dry for much of the year, only flowing during the wettest periods. The numerous small waterholes, some of which support small *Lestes* spp. populations, are mostly non-permanent and vary considerably in nature.

The dominant soils are calcimorphic clays or sandy-clays which are very hard when dry and nearly impermeable when wet. The hilly areas are characteristically covered with skeletal lithosols which drain very rapidly on to the surrounding valley floor, causing very wet conditions near to the base of the hills during the rains. These latter moist areas are commonly foci for the breeding of some Odonata, especially *Agriocnemis* and *Orthetrum* species.

The vegetation of the Park is related to the main Shiré drainage system and occurs as more or less distinct belts running parallel to this river. Moving in an easterly direction away from the Shiré the principal vegetation types are reedswamps, floodplain grass/palm savanna and mopane woodland. The reedswamps adjacent to the Shiré are rich in dragonflies but are difficult to reach and one mostly has to collect from a boat. The ecologically unstable floodplain grass and palm savanna is mostly confined to the low-lying southern areas adjacent to the reedswamps. The Kamuzu Barrage at Liwonde Township is opened and closed at irregular intervals through the year. This results in periodic and extensive flooding of the large grassland and palm savanna areas in the southern half of the Park, so that the dry season water levels here may be higher than the wet season ones. Large numbers of Odonata occur in this vegetation belt, particularly certain grass-perching libellulids such as *Urothemis* spp. and *Diplacodes lefebvrei*. The dominant tree species in the mopane woodland belt is *Colophospermum mopane* which is characteristically associated in certain areas with trees such as *Acacia*, *Albizia*, *Dalbergia*, *Commiphora*, *Sterculia* and *Adansonia* spp. Smaller, more isolated vegetation 'islands' include *Brachystegia-Kirkia-Sterculia* woodland on the rocky hills and lowland riverine forest along the smaller rivers. The riverine forests are small in area, but are rich in numbers of Odonata species compared to the major drier parts of the Park.

The Park has a typical tropical continental climate with a dry season extending from May to October and a rainy season from November to April, with a total annual rainfall of about 890 mm. Some temperature and relative humidity values for the sampling periods are summarized in Table I.

Table I

Maximum shade air temperatures (°C) and percent relative humidity, as measured by a whirling hydrometer at the collecting sites. Liwonde National Park, 1975-1977.

	Mean max.	Actual max.	Mean % rel. hum.
Nov-Apr Wet season	31.1°C	38.3°C	57
May-Oct Dry season	27.2°C	32.8°C	40

SAMPLING PROGRAMME

The Park was visited and imaginal Odonata observed and collected on 32 occasions from 19 October 1975 to June 1977. The mean frequency of visits was

once every 2.7 weeks and Odonata were actually collected in every month except August 1976. However, as visits were made on 28 July and 1-2 September 1976, if a given species was recorded on either of these occasions, it was also assumed to have occurred in August. On 3 occasions overnight stays of 1 or 2 nights were made. On most sampling days collecting commenced at about 08:00 hr and continued through the day until about 17:00 hr. Depending on the season, sunrise in the Park is between 05:35 and 06:25 hr; and sunset is between 17:35 and 18:25 hr.

It was not possible to sample all areas of the Park on every visit because of the size of the area to be covered and because of difficulties of access in the rains. During the wet season travel in the Park, even by four-wheel drive vehicles, is extremely restricted. From November until May the more northerly parts are only accessible by boat, via the Shiré. At any time of the year boat landings could be difficult because of extensive flooding due to either the high level of Lake Malaŵi or the closure of Kamuzu Barrage.

Nine different types of dragonfly habitat were recognized in the Park and at least 1 area of each (as appropriate according to season) was sampled on each visit. The nine habitat types were as follows (*ref.* Fig. 1):

A. Shiré River (permanent, large river).

B. Tributaries of the Shiré : Likwenu, Masanje, Nangando, and Ntangai Rivers (only the first 2 are permanent).

C. Swamps and lagoons adjacent to the Shiré (permanent water).

D. Swamps/Palm savanna/wet grassland away from the Shiré (seasonal).

E. Wet woodland (seasonal).

F. Waterholes (seasonal-permanent).

G. River-bed pools (seasonal).

H. Dry woodland savanna (seasonal).

I. Dry grassland savanna (seasonal).

Many individuals were identified on sight or were caught and released after identification had been confirmed. A total of 341 specimens was retained and at present, are in the author's collection.

RESULTS AND DISCUSSION

A total of 61 Odonata species and 9 families was recorded in the Park. Libellulids accounted for over half of this total (33 species) and coenagrionid species numbered 14. The remaining 14 species were distributed amongst the Lestidae, Protoneuridae, Calopterygidae, Chlorocyphidae, Gomphidae, Aeshnidae and Corduliidae (Table II).

Table II records the seasonal occurrence of the species in the Park for the study period 1975-77. An attempt has been made to classify the species according to their seasonality using the following categories:

Table II
Classification and analysis of flight periods.

	J	F	M	A	M	J	J	A	S	O	N	D
GROUP 1 — SPECIES OCCURING THROUGHOUT THE YEAR												
Ceriagrion glabrum (Burmeister) +	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ischnura senegalensis (Rambur) +	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hemistigma albipuncta (Rambur) +	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Brachythemis leucosticta (Burmeister) +	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Crocothemis erythraea (Brulle) +	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Trithemis annulata (Beauvois) +	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
T. arteriosa (Burmeister) +	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Urothemis edwardsi (Selys) +	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
GROUP 2 — SPECIES OCCURRING THROUGHOUT MOST OF THE YEAR BUT WITH A DEFINITE DRY SEASON ABSENCE	J	F	M	A	M	J	J	A	S	O	N	D
Ictinogomphus ferox (Rambur) +	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Chalcostephia flavifrons Kirby +	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Diplacodes lefebvrei (Rambur) +	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓
Rhyothemis semihyalina (Desjardins) +	✓	✓	✓	✓	✓	✓				✓	✓	✓
Pantala flavescens (Fabricius) +	✓	✓	✓	✓	✓	✓					✓	✓
Urothemis assignata (Selys) +	✓	✓	✓	✓	✓	✓				✓	✓	✓
GROUP 3 — SPECIES FLYING FOR SINGLE PERIOD EXTENDING INTO BOTH WET AND DRY SEASONS	J	F	M	A	M	J	J	A	S	O	N	D
Orthetrum chrysostigma (Burmeister) +		✓	✓	✓	✓	✓	✓					
Pseudagrion massaicum Sjöstedt +			✓	✓	✓	✓	✓	✓	✓	✓	✓	
GROUP 4a — SPECIES OCCURRING ONLY IN WET SEASON — LONG FLIGHT PERIOD	J	F	M	A	M	J	J	A	S	O	N	D
Phaon iridipennis (Burmeister) +	✓	✓	✓	✓							✓	✓
GROUP 4b — SPECIES OCCURRING ONLY IN WET SEASON — SHORT FLIGHT PERIOD	J	F	M	A	M	J	J	A	S	O	N	D
Elattoneura glauca (Selys) +	✓	✓	✓									
Anax tristis Hagen	✓		✓									
Anaciaeshna triangulifera McLachlan				✓								
Tetrathemis polleni (Selys)			✓									
**Sympetrum navasi* Lacroix												✓
Orthetrum caffrum (Burmeister)		✓										
O. abbotti Calvert		✓										
Nesciothemis farinosa (Foerster)		✓										

	J	F	M	A	M	J	J	A	S	O	N	D
Trithemis werneri Ris		✓										
Olpogastra fuelleborni Gruenberg			✓	✓								
Tramea basilaris (Beauvois)		✓		✓								
Aethriamanta rezia Kirby		✓										
GROUP 5 — SPECIES WITH VERY RESTRICTED FLYING SEASON — DRY SEASON ONLY												
Enallagma subtile Ris							✓					
**E. elongatum* (Martin)						✓						
Paragomphus elpidius (Ris)					✓							
Trithemis kirbyi ardens Gerstaecker					✓							
Zygonyx torrida (Kirby)					✓							
GROUP 6 — SPECIES WITH LONG, BUT IRREGULAR FLIGHT PERIODS	J	F	M	A	M	J	J	A	S	O	N	D
Ceriagrion kordofanicum Ris		✓		✓	✓	✓	✓			✓	✓	
Pseudagrion acaciae Foerster		✓	✓		✓	✓		✓	✓			
**P. sudanicum rubroviride* Pinhey		✓			✓	✓	✓	✓	✓			✓
P. coelestis Longfield		✓	✓				✓	✓	✓	✓	✓	✓
P. hamoni Fraser		✓	✓	✓	✓		✓	✓	✓			✓
P. kersteni (Gerstaecker)					✓	✓	✓	✓	✓	✓		✓
Agriocnemis exilis Selys		✓	✓	✓		✓		✓	✓			
A. gratiosa Gerstaecker)		✓	✓		✓	✓	✓	✓	✓			✓
Gynacantha manderica Gruenberg			✓				✓	✓	✓			
Anax imperator mauricianusr Rambur	✓	✓	✓	✓		✓				✓	✓	
Orthetrum trinacria (Selys)	✓	✓	✓	✓	✓	✓				✓		
O. brachiale (Beauvois)	✓	✓	✓	✓			✓	✓			✓	
Acisoma panorpiodes ascalaphoides Rambur	✓	✓	✓	✓		✓		✓	✓	✓		✓
Philonomon luminans (Karsch)		✓	✓		✓			✓	✓			
Palpopleura lucia (Drury)		✓	✓	✓	✓	✓		✓	✓	✓		
Brachythemis lacustris (Kirby)		✓	✓			✓		✓	✓			
Olpogastra lugubris Karsch		✓		✓	✓	✓				✓		
GROUP 7 — SPECIES WITH 2 OR 3 SHORT, WIDELY SEPARATED FLIGHT PERIODS	J	F	M	A	M	J	J	A	S	O	N	D
Lestes uncifer Karsch			✓				✓	✓				
**L. ictericus* Gerstaecker			✓				✓	✓		✓		
Pseudagrion sublacteum (Karsch)			✓				✓					
Platycypha caligata (Selys) +		✓								✓		
Hemianax ephippiger (Burmeister)			✓			✓						
Macromia picta Selys		✓					✓					
Orthetrum kalai Longfield					✓						✓	
Crocothemis divisa Baumann		✓					✓	✓				
Palpopleura deceptor (Calvert)				✓					✓			
Tholymis tillarge (Fabricius) +		✓				✓				✓		

* New species for Malawi

\+ Seasonal occurrence reliably indicated.

1. Species flying throughout the year.
2. Species flying throughout most of the year but with a definite dry season absence.
3. Species flying for a single period extending into both wet and dry seasons.
4a. Species flying only in the wet season — long flight period.
4b. Species flying only in the wet season — short flight period.
5. Species with very restricted flying season — dry season only.
6. Species with long but irregular flight periods.
7. Species with two or three short, widely separated flight periods.

It is clear that the validity of these categories is questionable in a number of species, but in other, commoner species, the recorded occurrence patterns represent the norm for this area of Malawi. Where it is considered that a reliable indication of the seasonal occurrence exists such species are marked with a + in Table II.

The 8 group 1 species are all well known for their general abundance throughout the year in many Afrotropical areas, although they seemed to be at their peak in numbers during the rainy season months of December-February. It is not possible to infer anything about their life histories from the existing information. *Ischnura senegalensis* was common in a variety of habitats and was seen on 15 occasions in the Park, occurring in every month; the only previous record from Malawi in 1962 is noted by PINHEY (1979). Presumably, collectors have overlooked this species because it is so ubiquitous.

The 6 species in group 2 all show a break of at least 2 months in the dry season which correlates well with their behavior in other savanna areas of Africa. For example, all these species tended to be absent or scarce as adults during the dry season in the Guinea savanna of Nigeria 1970-73 (unpublished personal observations).

Two species are included in group 3 (*Orthetrum chrysostigma* and *Pseudagrion massaicum*). These species were commonest in the dry season but first appeared in the middle/late rains and *P. massaicum* also flew until November.

The only species assigned to group 4a, *Phaon iridipennis*, was very markedly restricted to the 6 truly wet months of the year. It seems likely that this species had a single generation per year in the Liwonde habitats. However, MARSHALL & GAMBLES (1977) record that imagos of this species are capable of surviving through the dry season away from water in Ghana. The group 4b species (13) were mostly uncommon or rare and their breeding status in the Park is very uncertain. However, the protoneurid, *Elattoneura glauca*, was very common on the Likwenu River during the 3 months January-March, and absent during the rest of the year. This is strongly suggestive of a univoltine life cycle. One species, *Sympetrum navasi*, was a new record for Malawi.

The group 5 species were all recorded only from the dry season and none was common. *Enallagma elongatum* was a new record for Malawi. One male specimen of *Zygonyx torrida*, normally particularly associated with fast running rivers, rapids and waterfalls, was captured in dry mopane woodland in May. None of the usual habitats for this species occur for prolonged periods in the Park.

The 17 species in group 6 all exhibited long, but irregular flight periods. In all these cases there is uncertainty regarding the true significance of the recordings. Several of group 6 (especially *Acisoma panorpoides*, *Pseudagrion coelestis* and *P. hamoni*) may have flown throughout the year but were missed in some months in the sampling programme due to the inaccessibility of the swamp habitats. Some of the species (*e.g. Ceriagrion kordofanicum* and *Pseudagrion sudanicum rubroviride*) may perhaps have a synchronized multivoltine life history similar to that recorded for *P. salisburyense* by CHUTTER (1961). *C. kordofanicum*, *P. sudanicum rubroviride* and *P. coelestis* are new records for Malawi.

Group 7 was characteristic of species having 2 or 3 short, widely separated flight periods. In the case of *Platycypha caligata*, which was common in February and October on the Likwenu River, but was seen in no other month, a

Table III

Species recorded from the Shiré River (36 species). (All the species listed below also occurred away from the Shiré, except *Nesciothemis farinosa* and *Sympetrum navasi*)

Euryvalent species (at least 3 different wet + a dry habitat)		*Stenovalent species* (all only recorded from max. of 2 wet habitats except *B. lacustris* from three)	
Ceriagrion kordofanicum	C	*Phaon iridipennis*	C
C. glabrum	C	*Pseudagrion acaciae*	C
Pseudagrion hamoni	C	*P. sudanicum rubroviride*	C
P. massaicum	C	*P. coelestis*	C
Agriocnemis exilis	C	*Enallagma elongatum*	R
A. gratiosa	C	*Macromia picta*	MC
Ischnura senegalensis	C	*Brachythemis lacustris*	C
Ictinogomphus ferox	C	*Sympetrum navasi*	R
*Anax imperator mauricianus**	C	*Nesciothemis farinosa*	R
Orthetrum brachiale	C	*Olpogastra fuelleborni*	C
O. trinacria	C		
Chalcostephia flavifrons	C		
Acisoma panorpoides ascalaphoides	C		
Palpopleura lucia	C		
Hemistigma albipuncta	C		
Brachythemis leucosticta	C		
Crocothemis erythraea	C		
Diplacodes lefebvrei	C		
Trithemis arteriosa	C		
T. annulata	C		
Rhyothemis semihyalina	C		
Olpogastra lugubris	C		
Tholymis tillarga	MC		
Pantala flavescens	C		
Urothemis assignata	C		
U. edwardsi	C		

* only 2 wet habitats recorded — Shiré and flooded grassland, but presumed to occur in the Shiré swamps and lagoons.

STATUS: C = Common at least during one period in the year; MC = Moderately common sometime during the year; R = Rare, only one or very few individuals seen.

synchronized bivoltine life history is strongly indicated. *Macromia picta* and *Tholymis tillarga*, both moderately common in widely separated months, may have had respectively bi- or trivoltine life histories. Others (*Hemianax ephippiger* and *Crocothemis divisa*), were probably present in small numbers at times other than when they were recorded. *H. ephippiger* was, surprisingly, only seen twice despite the apparent suitability of many habitats. The scarcity of *Lestes* spp. was also surprising in view of the numerous waterholes in the Park. Both *Lestes ictericus* and *uncifer* were breeding in Chiunguni waterhole on 21 March 1977, but that was the only time *Lestes* was seen breeding. *L. ictericus* was a new record for Malaŵi.

Table IV
Species not recorded from the Shiré River (25 species).

Species	Habitats in Liwonde	Status
Lestes uncifer	F & H	R
L. ictericus	F & H	R
Elattoneura glauca	B	C
Pseudagrion kersteni	B, D, E, F, & H	MC
P. sublacteum	B	R
Enallagma subtile	H	R
Platycypha caligata	B	C
Paragomphus elpidius	B & H	R
Gynacantha manderica	E & F	R
Hemianax ephippiger	D & H	R
Anaciaeshna triangulifera	E	R
Anax tristis	D & F	R
Tetrathemis polleni	F	R
Orthetrum chrysostigma	B, D, & H	C
O. caffrum	C	R
O. abbotti	D	R
O. kalai	G	R
Crocothemis divisa	D & H	R
Palpopleura deceptor	F	R
Philonomon luminans	C, D, F & H	MC
*Trithemis werneri**	D, E, & H	R
T. kirbyi ardens	H	R
Tramea basilaris	D	R
Zygonyx torrida	H	R
Aethriamanta rezia	D & E	R

* normally recognized to be a river species.
Status: categories as in Table III
Habitats in Liwonde: refer to text.

It is clear that the mighty Shiré River exerts a major influence on the species composition and on their distribution in the Park (Tables III & IV). Of the 61 species of Odonata recorded, 36 were associated with the Shiré itself. However, only 2 species, *Nesciothemis farinosa* and *Sympetrum navasi*, were seen exclusively at the river, in each case once only. The 36 species associated with the Shiré have been divided into 2 groups: Those flying at at least 3 different types

of water, plus at least 1 dry habitat (euryvalent species); and those species only recorded from a maximum of 2 water habitats and not more than 1 dry area (stenovalent species) (Table III). Table IV lists those species which were not recorded at all from the Shiré. For the commoner species (*Elattoneura glauca, Platycypha caligata, Pseudagrion kersteni, Orthetrum chrysostigma* and *Philonomon luminans*) the typical habitat selected in the Park is well reflected in Table IV. All the remaining species are listed as "rare" and in many of these there is no reliable indication of preferred habitat. However, through experience in other areas, I would not recognize the majority of the Table IV "rare" species as being primarily associated with large rivers, except *Trithemis werneri* and *Zygonyx torrida*. Of the remaining "rare" species the following were recorded in habitats regarded as typical breeding areas: *Lestes uncifer* and *L. ictericus, Anax tristis, Hemianax ephippiger, Gynacantha manderica, Tetrathemis polleni, Palpopleura deceptor*, and *Tramea basilaris*.

The irregular flooding of large low-lying areas in the south of the Park referred to in the Introduction must have had a profound effect on breeding populations of Odonata, as well as on those of many other organisms. The great ecological instability of such areas, being largely unrelated to seasonal water levels, might be expected to have general deleterious effects. The absence of some expected species (such as *Orthetrum icteromelas, Palpopleura jucunda* and some of the gomphids) and the scarceness of others (*Hemianax ephippiger* and *Anax imperator*) might be related to this disturbance of the whole river and floodplain system in the Park.

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