Dragonflies and Damselflies (Odonata) of the Atewa Range, Ghana

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Chapter 4

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SUMMARY

Odonata were surveyed during a Rapid Assessment Program (RAP) survey of the Atewa Range Forest Reserve in Ghana. A total of 72 species were found in the streams and rivers that have their headwaters within the reserve (and associated standing water habitats), although only 31 (43%) were found strictly within the reserve's boundaries. Eight species were recorded in Ghana for the first time, of which six (75%) were recorded inside the reserve. Of these, *Atoconeura luxata* is the most significant discovery because: (1) it had not been described at the time and material taken during the RAP was included in its recently published description; (2) it is the only regionally threatened odonate found, being Red-listed as Vulnerable in western Africa; and (3) it confirms the nationally unique 'montane' character of the site. The results indicate a healthy watershed in the forest reserve and the surrounding area, with limited pollution and streambed erosion. This is confirmed by the presence of forest species even in more disturbed landscapes. If forest cover and natural stream morphology are retained, the present dragonfly fauna is expected to persist. However, if development activities were to entail the removal of vegetation or mineral deposits from the range, its capacity to store, buffer and filter rainwater would be seriously compromised, jeopardizing the reliable discharge of freshwater into the region's rivers; an essential resource for millions of Ghanaians and a rich biodiversity.

INTRODUCTION

Odonata (dragonflies and damselflies) are receiving increasing attention from scientists and the public. These graceful, colorful creatures are the quintessence of freshwater health. Due to their attractive appearance, dragonflies and damselflies can function as guardians of the watershed. They can be flagships for conservation, not only of water-rich habitats such as wetlands and rainforests, but also for habitats where water is scarce and, therefore, especially vital to the survival of life. Their sensitivity to structural habitat quality (e.g., forest cover, water clarity) and amphibious habits make Odonata well suited for evaluating environmental change in the long term (biogeography, climatology) and in the short term (conservation biology), both above and below the water surface (Corbet 1999).

Odonata larvae are excellent indicators of the structure and quality of aquatic habitats (e.g., water, vegetation, substrate), while adult Odonata exhibit high sensitivity with regards to the structure of their terrestrial habitats (e.g., degree of shading). As a consequence, Odonata show strong responses to habitat changes, such as those related to deforestation and erosion. Ubiquitous species prevail in disturbed or temporary waters, while habitats like pristine streams and swamp forests harbor a wealth of the more vulnerable and localized species. Different ecological requirements are linked to different dispersal capacities. Species with narrow niches disperse poorly, while pioneers of temporary habitats (often created by disturbance) are excellent colonizers. For this reason, Odonata have a potential use in the evaluation of habitat connectivity (Clausnitzer 2003, Dijkstra and Lempert 2003).

Odonata possess characteristics distinct from those of relatively well-studied taxonomic groups like plants, birds, mammals and butterflies. Therefore, their study supplements knowl-

edge obtained from these better-known groups. There are also practical advantages to Odonata as environmental monitors. Aquatic habitats, the focal point of their life histories, are easy to locate, and their diurnal activity and high densities make Odonata easy to study. The number of dragonfly species occurring in Africa is manageable, their taxonomy is fairly well resolved, and identification is relatively straightforward. Considering the ever-changing nature of the African landscape, be it under human, geological or climatic influence, the study of African Odonata constitutes an exciting challenge, as knowledge of their geography, ecology and phylogeny helps us understand the past and future of a rapidly changing continent.

This was the third African RAP survey to include Odonata. The previous ones, at Lokutu in Democratic Republic of Congo (Dijkstra 2007a) and at several forests in Liberia (Dijkstra 2007b) showed that it is possible to obtain a fair picture of the local diversity within a short period of time: a rich Odonata fauna probably represents high overall aquatic biodiversity. The results of odonate surveys may contrast sharply with the impoverished and imperiled fauna and flora indicated for the other taxonomic groups studied on any particular RAP survey. Because of their 'information rich' potential, Odonata might be placed more at the forefront of RAP surveys and conservation policy. The group is very 'RAPable' and is complementary to traditional RAP taxa, such as large mammals. Particularly in forest and freshwater ecosystems, an emphasis on odonate research seems beneficial as a baseline for biodiversity and watershed conservation. Sampling these charismatic insects can demonstrate whether present and future conservation actions are protecting freshwater biodiversity. Moreover, the interpretation of survey results has recently been facilitated by the inclusion of Odonata in IUCN's assessment of freshwater biodiversity in western Africa, which summarizes the distribution, habitat, threats and taxonomy of all species.

The Odonata of the Upper Guinean forest have been fairly well studied. Landmark papers appeared on Sierra Leone (Carfì and D'Andrea 1994), Ghana (O'Neill and Paulson 2001), the Guinean side of Mt. Nimba (Legrand 2003), Taï Forest in Côte d'Ivoire (Legrand and Couturier 1985) and Liberia (Lempert 1988). The earliest mention in the odonatological literature of material from present-day Ghana is the holotype of *Phyllomacromia sophia* from Cape Coast Castle in 1871. Karsch (1893) treated material from the area Adeli around Bismarckburg, in what was then German Togo. This area now lies partly within the borders of Ghana's Kyabobo National Park, as well as in present-day Togo. Lacroix (1921) described *Tetrathemis godiardi* from Koforidua and later (1924) listed *Cyanothemis simpsoni* and *Orthetrum microstigma* from there. Neville (1960) produced a list of 34 species, collected principally in the Bobiri Forest Reserve. His paper also includes the first behavioral information on Ghanaian Odonata. Pinhey (1962) reported on a small collection from the Prah-Annam Forest Reserve. Marshall and Gambles (1977) recorded 46 species from Mole National Park. D'Andrea and Carfì (1994) added a few scattered records. The most substantial contribution to the odonatology of Ghana was by O'Neill and Paulson (2001), who recorded 71 species, 24 of them new national records, based on material collected in 1997 from widespread localities. These authors were also the first to draw up a complete list of the Ghanaian Odonata, including 123 species. More Ghanaian records were obtained by H.A. Olsvik in February-April and October-November 1993 and by the present author in April-May 2000. This yielded many new records and also provided the necessity to reconsider some species previously listed for Ghana. Although the new national list is, as yet, unpublished, it includes 177 species (see Appendix 3). Judging by data from neighboring countries, about another 50 species may be discovered in Ghana (Dijkstra and Clausnitzer 2006). Lempert's (1988) Liberian data were analyzed combined with the author's data from Ghana (Dijkstra and Lempert 2003). This analysis describes the composition of odonate assemblages in running waters in the Upper Guinean rainforest. As running forest waters harbor the larger part of the region's odonate diversity, particularly of range-restricted species, this baseline is an important tool in the interpretation of the data from the present survey.

METHODS

Adult and larval Odonata were observed and caught with a hand net during daylight at freshwater habitats in the Atewa Range Forest Reserve (Atewa) and at habitats outside the reserve that receive their water from it (Table 4.1). Details of

Table 4.1. Odonata study sites in the Atewa area, Ghana.
ARFR: Atewa Range Forest Reserve

	Location	Coordinates	Altitude (m)
OnO	Obeng-ne-obeng stream in ARFR	6.23429°N 0.56755°W	640
Ade	Adensu stream in ARFR	not obtained	about 600
Swp	Two swamps in ARFR	6.24227°N 0.55684°W 6.22373°N 0.57911°W	800 750
For	Other sites (pools, roadsides) in ARFR	various	600-800
Wan	Wankobi stream and Asikam Gold Mine	6.20170°N 0.53658°W	290
Den	Densu River at Odumase-Okanta bridge	6.08699°N 0.53047°W	230
Bir	Birim River at Bunso waterworks	6.26594°N 0.47070°W	210
Aye	Ayensu River at Anum-Apapem	6.01225°N 0.60923°W	220

their ecology and behavior were noted. Identifications were made using Clausnitzer and Dijkstra (in prep.) and additional literature; taxonomy follows Dijkstra and Clausnitzer (in prep.). Collected specimens were deposited in the collection of the National Museum of Natural History (Leiden, The Netherlands).

RESULTS

A total of 72 species of Odonata were found, while the author had previously obtained records of six additional species from the area (Appendix 3). Thus 65% of the about 120 odonate species expected to occur in Atewa and its direct surroundings were found. Only 31 species were found strictly within the reserve's boundaries. However, the sampling of sites outside the reserve is relevant because those sites are part of the same freshwater system, depending on the situation upstream (i.e. within the reserve). Moreover, many habitat types are more accessible just outside the reserve's limits than within them. None of the recorded species are presently listed as globally threatened. Unlike the Odonata of northern, eastern and southern Africa, those of central and western Africa were not assessed for the 2006 Red List, as data were relatively limited and fragmented (Dijkstra and Vick 2004). However, the author has recently collated and assessed these data, and a preliminary Red-Listing has been made. One recorded species is regionally threatened (see below).

Eight species were recorded in Ghana for the first time, at least six of which are forest-dependent and at least six occur exclusively in running water. While only 43% of the recorded species were found strictly within the reserve's boundaries, three-quarters (six species) of the novelties originate from inside the reserve and five even from a single site, Obeng-ne-obeng stream:

1. *Africallagma vaginale* inhabits rainforest swamps. Previously known from Uganda south to northern Zambia, the present record thus represents a remarkable range extension.

2. A single female pertains to the genus *Onychogomphus*, which was previously unknown from Ghana. The specimen recalls *O. styx*, but the taxonomy of the genus is problematic and a definitive identification cannot be made at present.

3. *Paragomphus serrulatus* (also known by the synonyms *P. bredoi* and *P. xanthus*) inhabits open rivers from northeastern Democratic Republic of Congo to western Africa, having been reported from Sierra Leone, Liberia, Côte d'Ivoire, Togo, Benin and Nigeria.

4. A single female probably pertains to *Phyllogomphus moundi*. A male collected by the author in the Volta Region shortly after the RAP survey confirmed the presence of this species in Ghana. It was already known from Togo, Nigeria and Guinea.

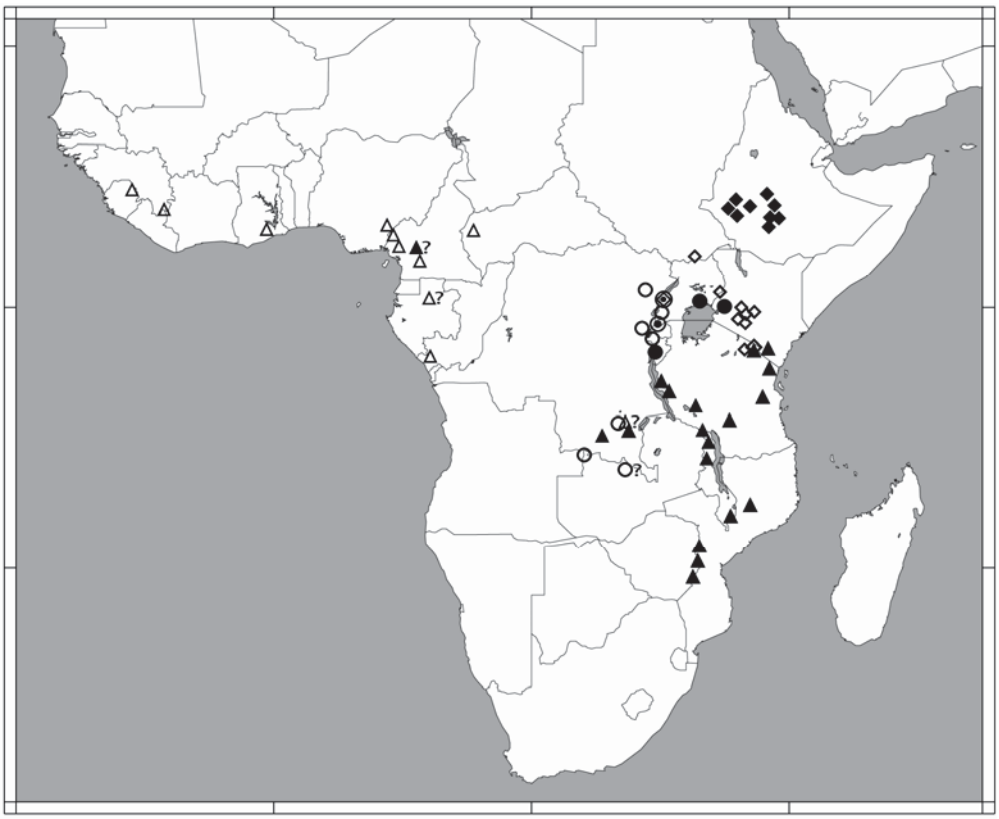

Figure 4.1. Distribution of the genus *Atoconeura*, demonstrating its montane character. Records of *A. luxata* (including that in Atewa) are marked by open triangles, other symbols represent five other *Atoconeura* species. Combined symbols indicate the sympatric presence of species, question marks doubtful or unconfirmed localities.
From: Dijkstra (2006).

5. A single female pertains to the genus *Tragogomphus*, which was previously unknown from Ghana. The taxonomy of the genus is problematic and a definitive identification cannot be made at present.

6. Two collected males are conspecific with *Phyllomacromia legrandi*, known only from the type locality Kpimé in Togo. However, a third male is morphologically identical but much darker, suggesting synonymy with *P. melania*. That species is also new for Ghana, but probably occurs (records require confirmation) both further west (Liberia, Guinea) and east (Nigeria), occurring in rainforest streams as far east as Uganda.

7. *Atoconeura luxata* occurs at fast sections of forest streams flowing off highlands. It had previously been found to the east in Nigeria, Cameroon, Congo-Brazzaville and the Central African Republic, but also in Guinea and Sierra Leone to the west.

8. *Orthetrum saegeri* inhabits streamside forest swamps and had not previously been found reliably west of Cameroon.

The discovery of *Atoconeura luxata* in Atewa is the most significant odonatological find of the RAP survey for a number of reasons. Not only was it first described only recently, with the inclusion of material and photographs taken during the RAP survey (see Dijkstra 2006), but it is also the only regionally threatened species found, being listed as Vulnerable on the IUCN Red List of West African Odonata (as evaluated in Accra shortly after the RAP survey). Unlike the five eastern African *Atoconeura* species, this one does not occur on top of highlands (above 1000 m), but at their base, including the Adamawa Massif and Mts. Nimba and Loma in western Africa (Figure 4.1). The discovery demonstrates Atewa's highland character despite its modest elevation. It is, for instance, also the only place in Ghana where brambles (*Rubus*) grow. The valley in Atewa where *A. luxata* occurs is notable for the presence of treeferns (*Cyathea*), a typical plant of Afro-montane forests. The unexpected discovery of *Africallagma vaginale*, which belongs to a genus of mostly upland species, may be another indication of Atewa's importance as a refuge for 'montane' species in a region presently dominated by lowland habitats.

CONSERVATION RECOMMENDATIONS

The Atewa forest harbors odonate assemblages that are representative of the Upper Guinean rainforest fauna. The forest stream assemblages found match those described by Dijkstra and Lempert (2003), suggesting healthy watersheds, with limited degrees of pollution and streambed erosion. As long as forest cover and natural stream morphology are retained, the existing dragonfly fauna is expected to persist. Considering the imperiled nature of the Upper Guinean rainforest, it is recommended that the forest and the watersheds it protects are conserved. Three major rivers in this densely populated region of Ghana have their headwaters in the Atewa Range, the Ayensu, Birim and Densu, the latter supplying one-third of the water used by Accra. Two observations are relevant in this light:

1. Several torrential downpours during the RAP did not alter the level of the streams and rivers, demonstrating the Atewa Range's capacity to absorb and gradually discharge water.

2. The site sampled on the Densu was heavily disturbed, with trees almost completely removed, but still harbored a diverse fauna, including typical forest dragonflies like *Umma cincta*, *Sapho ciliata*, *Chlorocypha luminosa*, *C. radix*, *Gomphidia gamblesi*, *Ictinogomphus fraseri*, *Cyanothemis simpsoni* and *Zygonyx chrysobaphes*. This suggests that the water quality was sufficient to support these species despite extensive damage to the surrounding landscape.

The steady flow of clean water off the range is determined by the capacity of the soil, swamps and forest on the plateaus and in the valleys to store and filter rainwater, and to buffer for spates and droughts. The populations of both dragonflies and humans around Atewa depend on this healthy and reliable resource for their survival. If the vegetation and deposits are stripped off the range, this would jeopardise the availability of freshwater for millions of Ghanaians and imperil a rich biodiversity with a nationally unique 'highland' character. While we recommend complete protection of Atewa, if any development activities were to take place within the Atewa Range it is of the utmost importance that minimal damage to the watershed be ensured by leaving broad zones around water bodies (e.g., rivers, inundation zones) untouched.

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