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**An electronic journal published by the Animal Demography Unit at the University of Cape Town**


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## ODONATAMAP: PROGRESS REPORT ON THE ATLAS OF THE DRAGONFLIES AND DAMSELFLIES OF AFRICA, 2010–2016


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Recommended citation format:
**Underhill LG, Navarro R, Manson AD, Labuschagne JP, Tarboton WR** 2016. OdonataMAP: progress report on the atlas of the dragonflies and damselflies of Africa, 2010–2016. Biodiversity Observations 7.47: 1–10.

URL: http://bo.adu.org.za/content.php?id=240

Published online: 15 August 2016

**– ISSN 2219-0341 –**

PROJECT REPORT

# ODONATAMAP: PROGRESS REPORT ON THE ATLAS OF THE DRAGONFLIES AND DAMSELFLIES OF AFRICA, 2010–2016

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## Introduction

The first record was uploaded into the OdonataMAP database on 22 September 2010. At its starting point the project described itself as section of the Animal Demography Unit's Virtual Museum which aimed "(1) to map the current distribution of the insect Order Odonata, i.e. dragonflies and damselflies, occurring in Africa; and (2) to serve as a repository of all existing distribution data for this group."

This progress report primarily reviews what OdonataMAP has achieved during this period, until 30 June 2016. The review has a clear bias to the southern third of Africa, south of about 10°S. This the region from which the bulk of the photographic records uploaded to OdonataMAP come.


## The importance of dragonflies and damselflies

The Odonata (dragonflies and damselflies) are superb indicators of the quality of fresh water (Simaika & Samways 2009a, 2010, Bush et al. 2013). All communities rely on water, and especially in rural areas water is used directly from rivers. The habitat of the Odonata represents the source of clean and reliable water. So, in a nutshell: "What is the use of dragonflies?" They are a signpost pointing to healthy freshwater habitat, and freshwater is a resource everyone needs. The dragonflies and damselflies are ambassadors for healthy freshwater ecosystems, and can be used to monitor their quality (Simaika & Samways 2012, Samways & Simaika 2016).

Current OdonataMAP data can be compared with historical data to illustrate range changes which have already taken place. The project is generating a data-rich baseline for the study of future changes in aquatic systems, at both local and global scales.

The Odonata were the first order of insects to be assessed on a global scale for the IUCN Red List of Threatened Species (Clausnitzer 2009). Knowledge of the accurate distribution of each species will contribute to future IUCN assessments and the determination of conservation priorities. It will also contribute to decisions regarding the conservation of freshwater ecosystems (Simaika & Samways 2009b).

OdonataMAP provides an atlas of the up-to-date distributions of the dragonflies and damselflies, a critical component of addressing their own conservation priorities, and also the conservation of freshwater ecosystems. The project will provide a valuable input to a revision of the Red List status of each species.

Besides the distribution maps, OdonataMAP aims to make a contribution to understanding the seasonal phenology of these species. Documenting and quantifying changes in seasonality are a critical component of understanding the impacts of climate change on biodiversity (Hassel et al. 2007, Bush et al. 2013).

Thus OdonataMAP aims not only to mainstream the conservation of the Odonata, but also the freshwater habitat on which they (and we) depend. Besides its own value for the conservation of Odonata, this atlas has the potential to influence government policy on the use of water resources, especially for the rural poor. There is no other taxon which has the potential to be so politically prominent in this way.

The Odonata provide important ecosystem services. Both in the larval stage and as adults, dragonflies and damselflies are mainly predators of insects, and especially mosquitos. There are studies that show that malarial mosquitos tend to avoid laying their eggs in waterbodies in which predators are present (e.g. Munga et al. 2006). There is a study in Kenya which demonstrates that spraying waterbodies with insecticides killed both the malarial mosquitos and their predators; however, the mosquitos re-established themselves rapidly, but that recolonization by the predators was slower (Service 1977).

The Odonata are themselves part of the food chain. The larvae are consumed by fish and other aquatic predators. Adult dragonflies and damselflies are consumed by birds such as bee-eaters, by fish such as bass, and they also get trapped in the webs of spiders (Figure 1). They also get eaten by the larger dragonflies.

**OdonataMAP database**

In the six years since the OdonataMAP section of the ADU Virtual Museum started in 2010, a total of 22,809 submissions have been made (Table 1). 8,438 (37%) records were submitted in the sixth year of the project, highlighting the dramatic growth of OdonataMAP.

Records had been submitted for 31 countries in Africa (Table 2) 20,339 (89%) were from South Africa. Seven countries all in the southern third of Africa had more than 100 records: Botswana (213), Malawi (441), Mozambique (157), Namibia (145), Swaziland (556), Zambia (259) and Zimbabwe (144).

Of the records for South Africa, 7,597 (37%) had been submitted from KwaZulu-Natal (Table 3). Two other provinces had more than 2,000 records: Limpopo with 2,845 and the Western Cape with 2,275.

*Table 1. Annual totals (1 July to 30 June of following calendar year) of submissions to the OdonataMAP section of the ADU Virtual Museum, 2010/11 to 2015/16.*

| Year (July to June) | Number of submissions |
|---|---|
| 2010/11 | 349 |
| 2011/12 | 951 |
| 2012/13 | 4,000 |
| 2013/14 | 5,074 |
| 2014/15 | 3,997 |
| 2015/16 | 8,438 |
| **Total 30 June 2016** | **22,809** |

*Figure 1. Wandering Glider* Pantala flavescens *trapped in the web of an orb web spider, Family Areneidae. OdonataMAP record 11339. Photograph: Alan Manson*

*Table 2. OdonataMAP records for each African country.*

| Country | Number of Records |
|---|---|
| Angola | 14 |
| Benin | 5 |
| Botswana | 213 |
| D R Congo | 4 |
| Egypt | 3 |
| Ethiopia | 90 |
| Gambia | 4 |
| Ghana | 13 |
| Kenya | 82 |
| Lesotho | 5 |
| Liberia | 8 |
| Madagascar | 44 |
| Malawi | 441 |
| Mauritius | 1 |
| Mozambique | 157 |
| Namibia | 145 |
| Nigeria | 75 |
| Republic of the Congo | 7 |
| Rwanda | 6 |
| Senegal | 7 |
| Seychelles | 6 |
| Sierra Leone | 35 |
| Somalia | 1 |
| South Africa | 20,339 |
| Sudan | 13 |
| Swaziland | 556 |
| Tanzania | 51 |
| Togo | 3 |
| Uganda | 73 |
| Zambia | 259 |
| Zimbabwe | 144 |

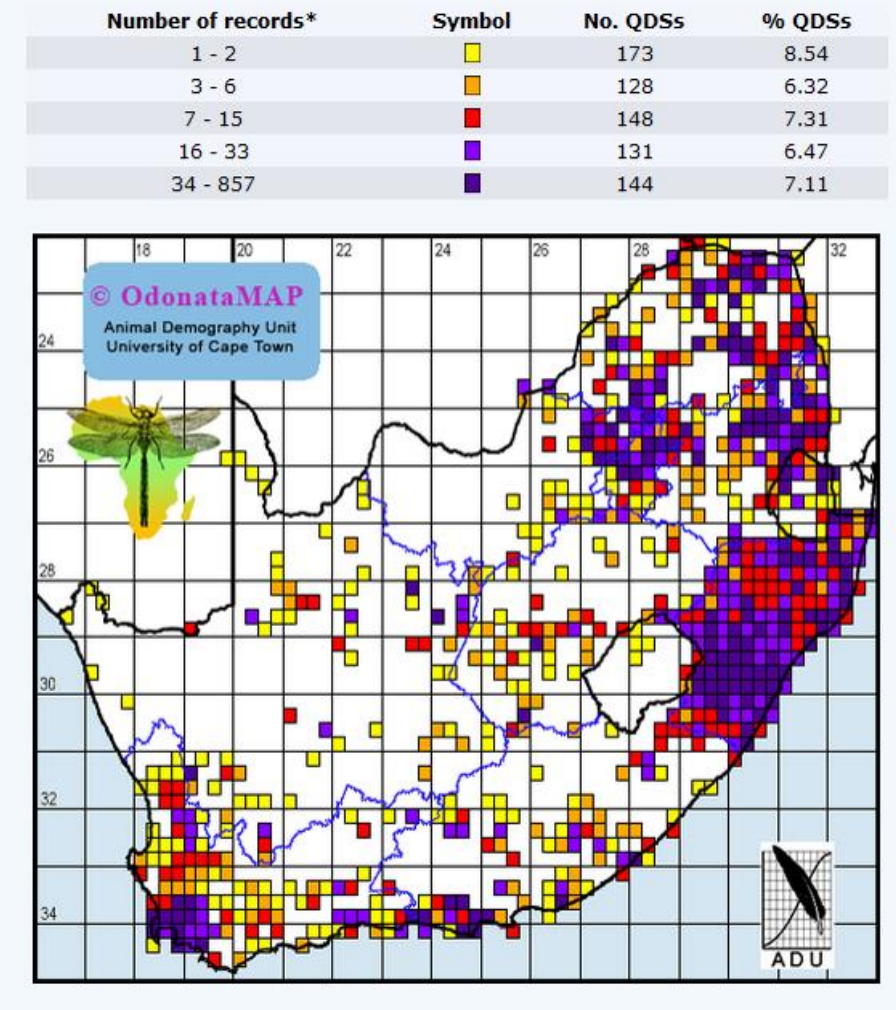


*Figure 2. OdonataMAP coverage density map, showing number of records per grid cell. The cutpoints for the colour ranges are chosen so that, as close as possible, 20% of the grid cells have the same colour*

*Table 3. OdonataMAP records for each province of South Africa.*

| Province | Number of records |
|---|---|
| Eastern Cape | 1,454 |
| Free State | 607 |
| Gauteng | 1,257 |
| KwaZulu-Natal | 7,597 |
| Limpopo | 2,845 |
| Mpumalanga | 2,777 |
| North West | 788 |
| Northern Cape | 566 |
| Western Cape | 2,275 |

18,739 of the OdonataMAP records submitted to June 2016 have been identified to species level; some species can only be identified by careful inspection of their genitalia, often with a magnifying glass. These species are difficult to identify to species level from photographs. Those records which have been identified by the expert panel to species level are for 172 species of dragonfly and damselfly.

16 species have more than 400 records in the OdonataMAP database. Two species have more than 1000 records: Red-veined Dropwing *Trithemis arteriosa* (1,342) (Figure 3) and Broad Scarlet *Crocothemis erythraea* (1,023).

Of the 1,976 quarter degree grid cells in South Africa, there is at least one record in 709. Best provincial coverage is for KwaZulu-Natal, for which there is OdonataMAP data for 166 of the 176 quarter degree grid cells that fall in whole, or in part, into this province. The remarkable coverage of KwaZulu-Natal has been achieved mostly by Alan Manson.

*Table 4. Species of Odonata with 400 or more records in the OdonataMAP database.*

| Common name | Scientific name | Records |
|---|---|---|
| Red-veined Dropwing | *Trithemis arteriosa* | 1,342 |
| Broad Scarlet | *Crocothemis erythraea* | 1,023 |
| Julia Skimmer | *Orthetrum julia* | 821 |
| Tropical Bluetail | *Ischnura senegalensis* | 820 |
| Eastern Blacktail | *Nesciothemis farinosa* | 605 |
| Banded Groundling | *Brachythemis leucosticta* | 574 |
| Orange-winged Dropwing | *Trithemis kirbyi* | 519 |
| Navy Dropwing | *Trithemis furva* | 500 |
| Nomad | *Sympetrum fonscolombii* | 490 |
| Two-striped Skimmer | *Orthetrum caffrum* | 464 |
| Power-faced Sprite | *Pseudagrion kersteni* | 456 |
| Slate Sprite | *Pseudagrion salisburyense* | 451 |
| Common Citril | *Ceriagrion glabrum* | 428 |
| Highland Spreadwing | *Lestes plagiatus* | 421 |
| Little Scarlet | *Crocothemis sanguinolenta* | 405 |
| Jaunty Dropwing | *Trithemis stictica* | 400 |

*Figure 3. Red-veined Dropwing. This is record 666 in OdonataMAP. Photo John Wilkinson*

Three factors underpinned the big increase in OdonataMAP submission in the year 2015/16. The first was the publication of the fieldguide to the dragonflies and damselflies (considered further below) (Tarboton & Tarboton 2015). The second was the creation and growth of the Facebook group called "Dragonflies and Damselflies of Southern Africa", which has grown to 1,529 members since it was formed by Jacobus (Lappies) Labuschagne in May 2015 (https://www.facebook.com/groups/dragonflies.damselflies.southern.Africa/). This group strategically supported OdonataMAP by encouraging the members who posted photos of dragonflies and/or damselflies to the Facebook group to also submit them to the ADU Virtual Museum. The third was the weekly Odonata Indaba every Thursday on the ADU Facebook page, and shared widely. The Odonata Indaba was written by DST/NRF intern Christie Craig, and we acknowledge her contribution.

**Team OdonataMAP**

A total of 295 people had submitted records to OdonataMAP by June 2016. Alan Manson (4,335 submissions) and Christopher Willis (3,318) stood out as the most prolific contributors to OdonataMAP (Table 5).

The seven members of the OdonataMAP expert panel were responsible for the final identification of the records submitted (Table 6). For the first five years of the project, all the identifications were made by Warwick Tarboton (a total of 14,387); this load has subsequently been shared among a larger group of experts (Table 6).

There is great value in OdonataMAPpers going deep in their home areas, especially in rural areas. Here we define "home" as the quarter degree grid cell (QDGC) in which the OdonataMAPper resides. The best example is John Wilkinson; 326 of the 706 records which he submitted were from his home QDGC, 2230CA Tshipise, and were of 70 species. This grid cell is the most species-rich QDGC for Odonata in South Africa. Similarly, there were 591 records containing 43 species from quarter degree grid cell 3030BB, of which 536 were submitted by Christopher Peter Small. Quarter degree grid cell 2732CD had 41 species and 367 records; Ryan Tippet had submitted 327. Quarter degree grid cell 3324DD had 31 species from 261 records; 171 of the records were submitted by Desire Darling and 83 by Gregg Darling. Diagonally adjacent quarter degree grid cell 3424BA had 25 species from 200 records; 135 of the records were submitted by Desire Darling and 65 by Gregg Darling. Quarter degree grid cell 2330CA had 46 species from 204 records; 203 of these records were submitted by Bernadine Altenroxel.

*Table 5. The 12 contributors with the largest numbers of submissions to the OdonataMAP section of the ADU Virtual Museum, September 2010 to June 2016.*

| Contributor | Submissions |
|---|---|
| Manson, Alan | 4,335 |
| Willis, Christopher K. | 3,318 |
| Diedericks, Gerhard | 855 |
| Tippett, Ryan Matthew | 807 |
| Dickinson, Rob | 752 |
| Darling, Desire | 739 |
| Wilkinson, John H | 706 |
| Small, Christopher Peter | 550 |
| Braun, Kate | 497 |
| Stanton, Sharon | 465 |
| Grundlingh, Felicity | 439 |
| Nuttall, Rick | 388 |

*Table 6. The seven expert panel members for OdonataMAP section of the ADU Virtual Museum, and the numbers of identifications each has made, September 2010 to June 2016.*

| Panel member | Identifications |
|---|---|
| Tarboton, Warwick | 14,387 |
| Manson, Alan. | 4,548 |
| Brink, Bertie | 2,057 |
| Tippett, Matthew Ryan | 1,600 |
| Willis, Christopher K. | 768 |
| Grundlingh, Felicity | 365 |
| Labuschagne, Jacobus | 333 |

We encourage OdonataMAPpers to aim to achieve this depth of coverage in the areas they visit. Grid cells with large numbers of records, say hundreds, help provide an indication of number of species in the grid cell. Eventually, the species richness reaches an asymptote and no further species are added. In addition, short-term repeat recording improves our knowledge of the flight periods of the each species (see the section on the Analysis of Seasonality below). Long-term repeat recording indicates the persistence of species at sites from year to year.

The fieldwork strategy should be to aim to submit records of as many species as are present on multiple occasions during the flight periods of the Odonata. Fieldwork at intervals of five days or longer is recommended.

## Noteworthy records

The next paragraphs highlight a tiny fraction of the fascinating records which have been submitted to OdonataMAP.

Until 2014, Balinsky's Sprite *Pseudagrion inopinatum* was only known from two localities, along the Komati River, Badplaas, Mpumalanga, which is the type locality, in 1968, and "a possible old record from the Little Berg" on the Bulwer River in KwaZulu-Natal (Samways 2008, Tarboton & Tarboton 2015). Samways (2008) described it as "very localised endemic".In March 2014, KD Dijkstra found Balinksky's Sprite on the Mkhomazi River in KwaZulu-Natal. Since then it has been found at another three sites in KwaZulu-Natal, and another site in Mpumalanga. These are all OdonataMAP records.

The Harlequin Sprite *Pseudagrion newtoni* is scarce and localised, an endemic to South Africa (Samways 2008). It had not been refound at any of the sites of historical records in the Dundee district of KwaZulu-Natal, with the last record being made in 1961. By 2008, the only known surviving population was on the Blyde River, near Pilgrim's Rest. It was rediscovered by Alan Manson near Pomeroy, KwaZulu-Natal in February 2015, and recorded again in January 2016. These are both OdonataMAP records (Figure 4).

In Samways (2008), the southernmost record of the Great Sprite *Pseudagrion gamblesi* was in 2830BB, probably along the White Mfolosi River, in the Midlands of northern KwaZulu-Natal. Since 2013, Alan Manson has found this species along the following rivers in southern KwaZulu-Natal: Mvoti, Mngeni, Lovu, Mkomazi, Mzimkhulu and Mtamvuna. The Mtamvuna record was actually in the Eastern Cape; the record was made on the southern bank of the river. It remains to be seen how far into the Eastern Cape the species actually extends.

In March 2014, Desire and Gregg Darling recorded the Cherry-eye Sprite *P. sublacteum* at Komdomo in the Eastern Cape, c. 600 km to the southwest of previously known record in KwaZulu-Natal. A year later, in February 2015, Rietta Griesel submitted a record from the northern part of Addo National Park. These two records are the two

*Figure 4. The Harlequin Sprite was rediscovered near Pomeroy, KwaZulu-Natal, after having not been recorded for more than five decades. This is OdonataMAP record 20358 (see [http://vmus.adu.org.za/?vm=OdonataMAP-20358](http://vmus.adu.org.za/?vm=OdonataMAP-20358) for a second close up photograph of the last few segments of the abdomen). Photographer Alan Manson*

southwesternmost records in the distribution of the Cherry-eye Sprite in Figure 5.

*Paragomphus* is a genus in the clubtail family of dragonflies (Gomphidae); they are known as hooktails because of the characteristically down-turned upper appendages. Prior to 2009, three species were known to occur in South Africa (Samways 2008); two *Paragomphus* species have since been added to the South African list, Great Hooktail *P. magnus* and Flapper Hooktail *P. sabicus*. Both species are associated with low-altitude (hot) rivers in eastern Africa as far north as Kenya.

For the Great Hooktail, the total number of records is 28 (considering both the OdonataMAP database and the Odonata Database of Africa (ODA)). Most of these are old records from Zimbabwe. Four records have been made in South Africa since 2008 and all are in OdonataMAP. Wil and Karen Hartog-Leurs found the first in 2012 at Letaba in the Kruger National Park; subsequently it has been found again in Limpopo, and also in Mpumalanga and KwaZulu-Natal.

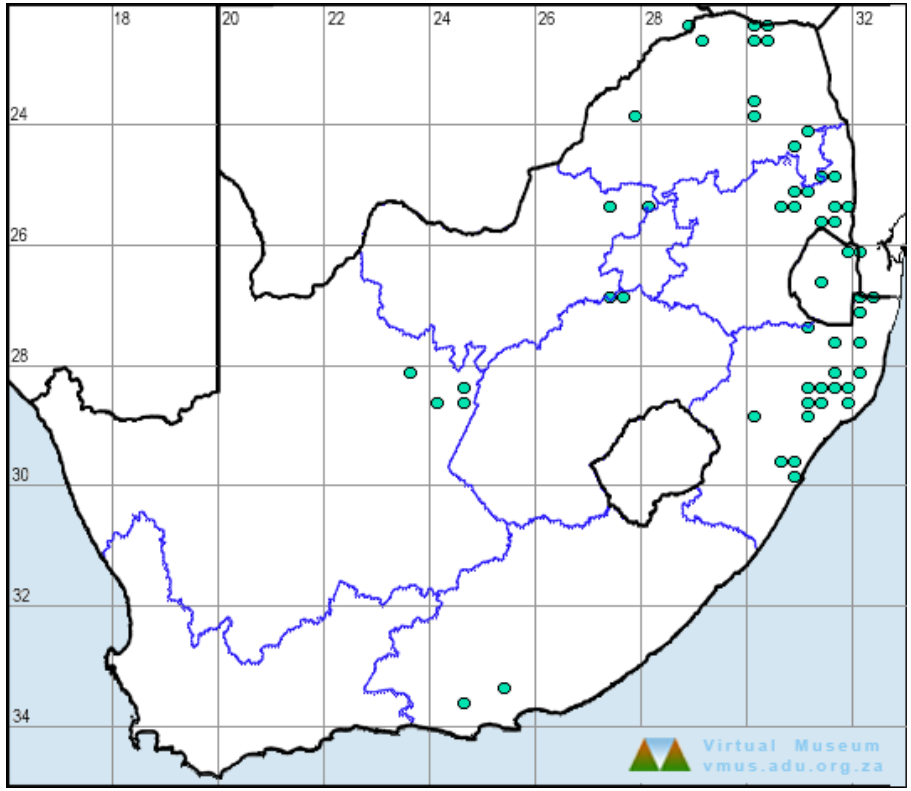


*Figure 5. Distribution map, based on OdonataMAP records, of the Cherry-eye Sprite* Pseudogrion sublacteum*. There are 101 records, from 54 grid cells. The two isolated records from the Eastern Cape are discussed in the text*

The first record in South Africa of Flapper Hooktail was made by Warwick Tarboton on the Limpopo River in February 2009. Subsequently six more records for this species have been made in South Africa, all in OdonataMAP: one in Limpopo, four in Mpumalanga and one in KwaZulu-Natal. There are now a total of 76 records of this species throughout Africa, combining the OdonataMAP database and Odonata Database of Africa (ODA). 11 of these records are in OdonataMAP.

There are many other important records, including first records for South Africa, rediscoveries of species after decades had elapsed since the last sighting, interesting range extensions, and valuable records filling in puzzling gaps in distributions. OdonataMAP has demonstrated its value and has enormous potential.

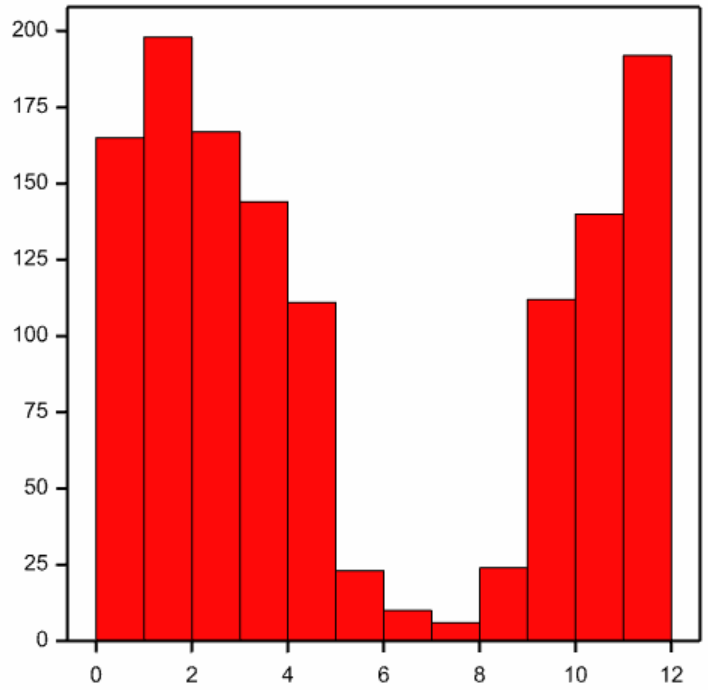


*Figure 6. Seasonality of Red-veined Dropwing. The histogram plots the monthly number of records for the species in the OdonataMAP database.The analysis is limited to records from the moister eastern half of South Africa. The months run from January to December.*

### The analysis of seasonality

The primary aim of the OdonataMAP project is, as the name implies, to map their distributions. There is an extremely important by-product of the mapping exercise. One aspect of the ecology of the Odonata which is poorly known is seasonality, the period of the year during which each species has adults in flight. Without making any special attempt to achieve this, OdonataMAP is collecting impressive data on these flight periods. The species with the most data is Red-veined Dropwing (Figure 2). A simple count of the number of records made in each calendar month shows increasing numbers from October through to a peak in February, followed by a steady decrease during March, April and May (Figure 6). There are only small numbers of records during the cool winter months from May to September.

### Contributions to and from OdonataMAP and the dragonfly and damselfly fieldguide for South Africa, Lesotho and Swaziland

The publication of the Tarboton & Tarboton (2015) fieldguide to the Odonata of South Africa, Lesotho and Swaziland marked a massive step forward to mainstreaming the dragonflies and damselflies in southern Africa. The big surge in submissions to OdonataMAP in 2015/16 (Table 1) is certainly in some measure attributable to the availability of this fieldguide. The book includes a promotion of the OdonataMAP: “all dragonfly enthusiasts are urged to participate and add to our knowledge of Odonata distribution in the country” (Figure 7).

The OdonataMAP data at the time when the book was being prepared were used to help make the distribution maps in the fieldguide more complete than they would otherwise have been. Altogether there about 30,000 distribution records available, and 9,000 of these, almost a third, were from OdonataMAP (WRT pers. obs.).

The fieldguide also includes 48 photographs that were submitted to OdonataMAP. Photographers were approached individually for permission to use their images. This is a tribute to the quality of the photographs submitted to OdonataMAP.

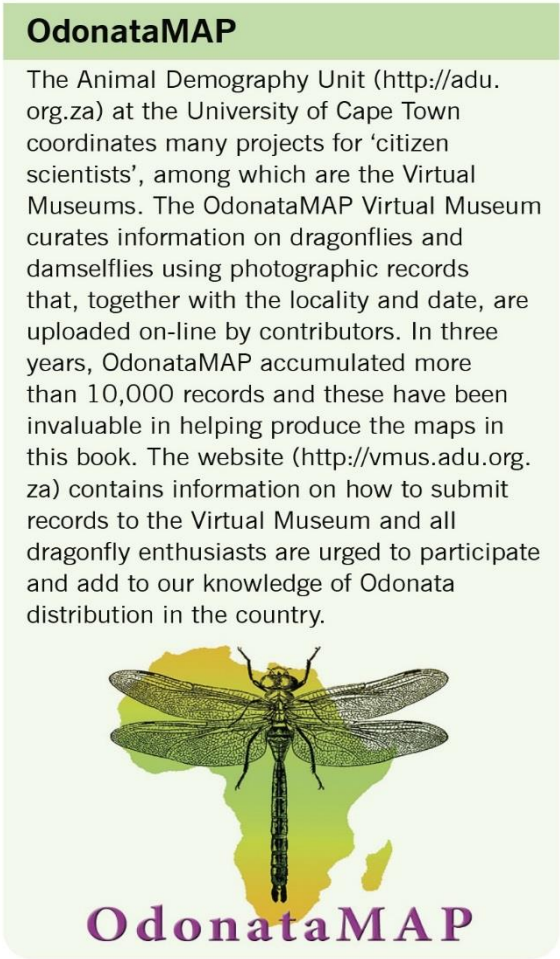


*Figure 7. The acknowledgement by Tarboton and Tarboton (2015) to the contribution which OdonataMAP had made to improving the quality of the distribution maps in their fieldguide, and their encouragement for people to get involved in data submission to OdonataMAP: “All dragonfly enthusiasts are urged to participate and add to our knowledge of Odonata distribution.”*

**Acknowledgements**

We acknowledge the contributions of the citizen scientists who have submitted photographs to OdonataMAP. We especially acknowledge the support of each member of the expert panel. In particular, we thank Klaas-Douwe Dijkstra for his encouragement.

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