BIODIVERSITY OBSERVATIONS
RESEARCH PAPER (CITIZEN SCIENCE)

Dragonflies and damselflies of the Western Cape - OdonataMAP report, August 2018

Author(s):
Underhill LG, Loftie-Eaton M and Navarro R

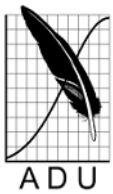
Journal editor:
Pete Laver

Manuscript editor:
Pete Laver

Received: August 30, 2018; Accepted: September 6, 2018; Published: September 06, 2018

Citation: **Underhill LG, Loftie-Eaton M and Navarro R. 2018. Dragonflies and damselflies of the Western Cape - OdonataMAP report, August 2018. Biodiversity Observations 9.7:1-21**

Journal: https://journals.uct.ac.za/index.php/BO/
Manuscript: https://journals.uct.ac.za/index.php/BO/article/view/643
PDF: https://journals.uct.ac.za/index.php/BO/article/view/643/554
HTML: http://thebdi.org/blog/2018/09/06/odonata-of-the-western-cape



Biodiversity Observations is an open access electronic journal published by the Animal Demography Unit at the University of Cape Town, available at https://journals.uct.ac.za/index.php/BO/

The scope of Biodiversity Observations includes papers describing observations about biodiversity in general, including animals, plants, algae and fungi. This includes observations of behaviour, breeding and flowering patterns, distributions and range extensions, foraging, food, movement, measurements, habitat and colouration/plumage variations. Biotic interactions such as pollination, fruit dispersal, herbivory and predation fall within the scope, as well as the use of indigenous and exotic species by humans. Observations of naturalised plants and animals will also be considered. Biodiversity Observations will also publish a variety of other interesting or relevant biodiversity material: reports of projects and conferences, annotated checklists for a site or region, specialist bibliographies, book reviews and any other appropriate material. Further details and guidelines to authors are on the journal website (https://journals.uct.ac.za/index.php/BO/).

ISSN 2219-0341

Dragonflies and damselflies of the Western Cape - OdonataMAP report, August 2018

Les G Underhill *Animal Demography Unit, Department of Biological Sciences, University of Cape Town, Rondebosch, 7701 South Africa; Biodiversity and Development Institute, 25 Old Farm Road, Rondebosch, 7700 South Africa*
Megan Loftie-Eaton *Animal Demography Unit, Department of Biological Sciences, University of Cape Town, Rondebosch, 7701 South Africa; Biodiversity and Development Institute, 25 Old Farm Road, Rondebosch, 7700 South Africa*
Rene Navarro *Animal Demography Unit, Department of Biological Sciences, University of Cape Town, Rondebosch, 7701 South Africa; FitzPatrick Institute of African Ornithology, Department of Biological Sciences, University of Cape Town, Rondebosch, 7701 South Africa*

What is this document about, and for whom was it written?

This paper is about the Odonata (dragonflies and damselflies) of the Western Cape. It contains a summary of the information in the combined database of the OdonataMAP project and the ODA initiative. It provides a species list for the province. It gives instructions that enable the reader to obtain up-to-date distribution maps for each species, and to obtain up-to-date lists of species for quarter degree grid cells in the Western Cape.

The main users will be the citizen scientists who collect photographic data of dragonflies and damselflies and submit it to OdonataMAP. We believe the information contained here will be useful for planning purposes, and to guide citizen scientists to the areas within the Western Cape where the data needs are greatest.

The paper also aims to provide a model for the presentation of biodiversity data in such a way that can be used by managers and policy makers, by researchers, and by conservation advocacy NGOs. For these groups of people it aims (1) to provide a snapshot, at a point in time, of the quality and volume of data available for the Western Cape, and (2) to provide links to the relevant databases, so that they have access to useful summaries of the ongoing data collection effort. The data can clearly be repackaged in many different formats (for example, species lists for individual sites, such as nature reserves). The aim here is to provide a broad brush overview at the provincial level.

What are the headlines?

- In the two-year period 1 July 2016 to 30 June 2018, citizen scientists added seven species to the list of dragonflies and damselflies in the Western Cape, bringing the total to 76 species (Figure 1).

Biodiversity Observations is an open access electronic journal published by the Animal Demography Unit at the University of Cape Town, available at https://journals.uct.ac.za/index.php/BO/. A permanent link for an online version of this manuscript can be found at https://journals.uct.ac.za/index.php/BO/article/view/643, which includes the PDF: https://journals.uct.ac.za/index.php/BO/article/view/643/554. An HTML version can be found at http://thebdi.org/blog/2018/09/06/odonata-of-the-western-cape.
Journal editor: Pete Laver; **Manuscript editor**: Pete Laver; **Corresponding author**: les.underhill@uct.ac.za
Received: August 30, 2018; **Accepted**: September 6, 2018; **Published**: September 06, 2018
Recommended citation: Underhill LG, Loftie-Eaton M and Navarro R. 2018. Dragonflies and damselflies of the Western Cape - OdonataMAP report, August 2018. Biodiversity Observations 9.7:1-21
Manuscript subject: Citizen Science

- The database available for this report contained 11,267 records of dragonflies and damselflies. This includes the specimen record dating back to the start of the 20th century.
- Of these records 2,433 records (22%) were added between July 2016 and June 2017, and 4,202 (37%) between July 2017 and June 2018.
- Thus 59% of the entire Western Cape database of records of dragonflies and damselflies was contributed by citizen scientists in two years.

Figure 1: This was the third record of the Vagrant Emperor *Anax ephippiger* in the Western Cape. Somerset West, 15 May 2017, Corrie du Toit. (http://vmus.adu.org.za/?vm=OdonataMAP-33845)

Where is the study area?

The Western Cape is a province of South Africa, situated on the southwestern section of the country (Figure 2). Of South Africa's nine provinces, it is the fourth largest with an area of 129,449 km^2. The Western Cape is the third most populated province, with an estimated 6.5 million inhabitants in 2017 (Statistics South Africa 2017).

The Western Cape Province is roughly L-shaped, extending northward and eastward from the Cape of Good Hope, in the southwestern corner of South Africa. It stretches 400 km northward along the Atlantic Ocean coast, about halfway to Namibia, and 500 km eastward along the south coast, ending at Natures Valley on the Indian Ocean. It is bordered on the north by the Northern Cape and on the east by the Eastern Cape.

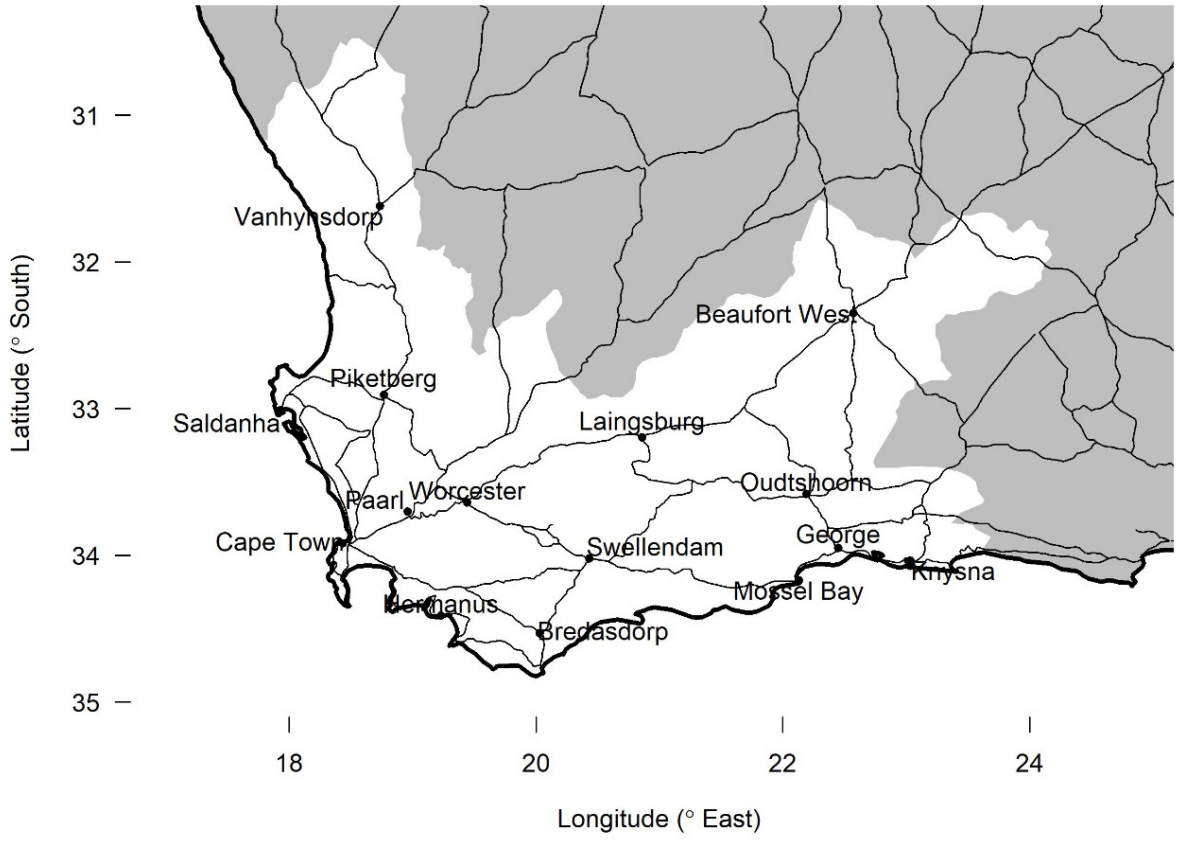


Figure 2: Map of the Western Cape, showing some of the keys centres of human population, and the main road network.

The province has large variation in rainfall, with the eastern end, bordered by the warm Indian Ocean, being almost forest, and the northern end, bordered by the cold Atlantic Ocean, being semi-desert. This wet-dry gradient has a strong influence on the distribution of Odonata within the province. The other major factor in Odonata distribution is a series of almost linear ranges of mountains, roughly parallel to the coast, but at varying distances from it.

There are 262 quarter degree grid cells (Figure 2) which are entirely or partly within the Western Cape. 186 are entirely within the Western Cape. 76 are partly within the Western Cape; 52 are shared with the Northern Cape, 22 are shared with the Eastern Cape, and there are two which are shared between the three provinces (3124CA Winterhoekberge and 3124CC Winterhoek). This report is based on all 262 grid cells which are "in" the Western Cape.

What data are available for the dragonflies and damselflies in the Western Cape?

On 14 August 2018, there were 11,267 records of Odonata in the combined database of OdonataMAP and the Odonata Database of Africa (ODA), recorded since 1980 for Western Cape (Table 1). These were the records strictly within the boundaries of the Western Cape. Of these, 8,938 (80%) had been submitted by citizen scientists as photographic records and the balance were from ODA.

The Odonata Database of Africa (ODA) is an open access database developed by a JRS-funded project (Clausnitzer et al. 2012, Dijkstra 2016). It contains records of the distribution of dragonflies and damselflies across Africa and includes most of the museum specimen records for the region. It is available online as the African Dragonflies and Damselflies Online (ADDO) (http://addo.adu.org.za/). ADDO is a collaboration between the Department of Conservation Ecology and Entomology (University of Stellenbosch) and the ADU (University of Cape Town). Although the two databases are separate, search queries made to the OdonataMAP database can include a search of the Odonata Database of Africa. This was done for this report. This collaboration represents a major consolidation of data resources.

The records in the database are georeferenced, often to an accuracy of metres. But for the purposes of this report each record has been allocated to its "quarter degree grid cell", a well-known mapping standard in South Africa, which has been used for many biodiversity atlases. The quarter degree grid cells are defined on a geographical grid, and are 15 minutes of latitude north to south, about 27 km, and 15 minutes of longitude east to west, about 25 km at the latitude of the Western Cape (Figure 2). Each quarter degree grid cell has a six-character code, and a name, usually that of a town (or farm) in the grid cell. Exact localities are not disclosed in this report, but are available to anyone with a bona fide need for them.

The Western Cape section of the database has seen spectacular growth over the past two years: 2,433 records were added between July 2016 and June 2017, and 4,202 between July 2017 and June 2018. The total for the six-year period from 2010 to June 2016 was 2,275 records (Loftie-Eaton et al. 2018). In percentages, 22% of the database was added in the 2016/17 year, and 37% in the 2017/18 year. Thus 59% of the 11,267 records in the Western Cape database was contributed by citizen scientists in two years.

Of the 262 quarter degree grid cells "in" the Western Cape, there is at least one species of dragonfly or damselfly for 157 (60%) of them (Table 1, Figure 3). The total number of records submitted for these grid cells was 11,885 (Table 2), reflecting the fact that there were 618 records in the sections of the 74 grid cells which were part of the Northern Cape or Eastern Cape.

From this database, a total of 76 Odonata species were recorded in the Western Cape (Table 1). The Cape Skimmer *Orthetrum capicola* had the most, 1002, records; the most recent observation was on 3 August 2018, 11 days prior to the data extraction for this report (Table 1). The second most abundant species was Red-veined Dropwing *Trithemis arteriosa* with 963 records, followed by Tropical Bluetail *Ischnura senegalensis* (859), Broad Scarlet *Crocothemis ery-*

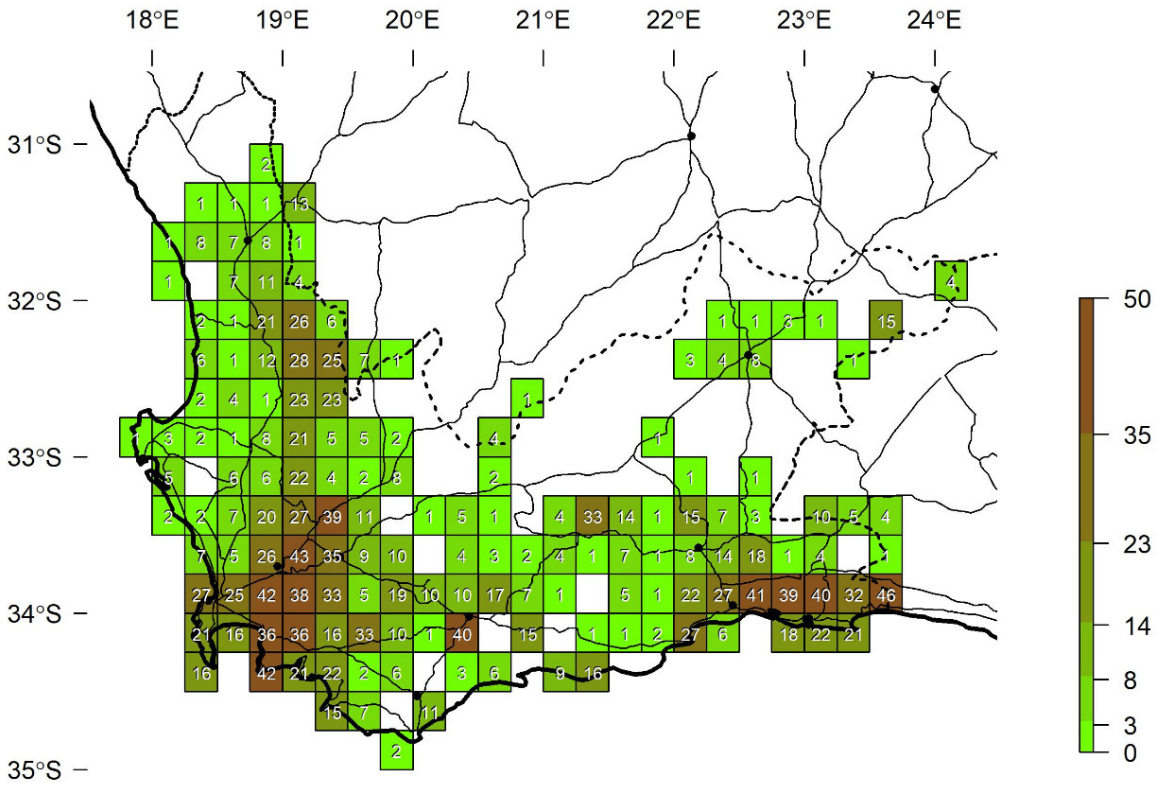


Figure 3: Numbers of species of dragonflies and damselflies recorded per quarter degree grid cell in the Western Cape. Based on OdonataMAP database, January 1980 to August 2018.

thraea (712) and Red-veined Darter *Sympetrum fonscolombii* (531). There were 26 species with between 100 and 500 records, and 23 with between 20 and 99 records. The five species with between 10 and 18 records, and the 18 species with fewer than 10 records were all given careful consideration, with checks to confirm identifications. Eight of the 76 species recorded in the Western Cape were in IUCN Threat Categories (Table 1).

Two quarter degree grid cells had more than a thousand records: 3418BB Somerset West had 2,230 and 3418BD Hangklip had 1,268 (Table 2), both on the eastern side of False Bay. There were 25 grid cells with 100 or more records, and 57 with between 10 and 99 records.

How many new species been added to the Western Cape list recently?

Amazingly, seven species of Odonata were added to the Western Cape list in the most recent two years, 2016/17 and 2017/18.

There are three records of the Vagrant Emperor *Anax ephippiger* in the Western Cape. They come from two quarter degree grid cells: two records, in April and May 2017, from distinct sites within 3219AA Pakhuis in the northern Cederberg range; one record, in May 2017, in quarter degree grid cell 3418BB Somerset West (Figure 1). The nearest record to these is in the Great Karoo in the Northern Cape, from quarter degree grid cell 3022CA Garskolk near Carnarvon, made in December 2016. There are five records in the Eastern Cape in three quarter degree grid cells: from west to east these are from 3324DD Hankey in March 2017, three from 3325DC Port Elizabeth in May 2017, November 2017 and February 2018, and from 3237CB Stutterheim, an older record from March 2006.

The Spotted Spreadwing *Lestes tridens* also has four Western Cape records, all at the eastern end of the Western Cape, with a scattering of records in the adjacent part of the Eastern Cape. The Western Cape records, arranged from west to east are in three quarter degree grid cells 3322CD George in April 2018, 3322DC The Wilderness in December 2016 (two records), and 3423AB Plettenberg Bay in January 2018 (Figure 4). Over the border in the Eastern Cape, there are six records from quarter degree grid cell 3424BA Kruisfontein (with Oyster Bay as a more well-known locality within the grid cell) dated between January and April 2017, one record from the adjacent quarter degree grid cell 3424BB Humansdorp in September 2014, six records from quarter degree grid cell 3325CC Loerie dated between December 2017 and April 2018. There are four more records between Port Elizabeth and East London, then a gap to the KwaZulu-Natal border, and many records in the start of the core of the distribution, along the KwaZulu-Natal coast.

There are eight records of Red Basker *Urothemis assignata* in the Western Cape, all made in the quarter degree grid cell 3322DD Karatara, immediately north of Sedgefield (Figure 5). The eight records were made by three observers at two localities between February and May 2018. There is a single record in the Eastern Cape (quarter degree grid cell 3325DC Port Elizabeth) made in May 2017. There are multiple records in coastal KwaZulu-Natal.

The Denim Dropwing *Trithemis donaldsoni* has three Western Cape records from two quarter degree grid cells, which are both in the interior: 3119CC Doringbos, north of the Cederberg range, in November 2016, and 3321BC Matijesvlei, north of Calitzdorp (two records in January in 2017). There are no records for the Eastern Cape and a single record for the Northern Cape in 2823DA Danielskuil, northwest of Kimberley, in January 2017. This record is itself vastly out of the known range, in the savanna biome in the northeast of South Africa.

The first Western Cape record of the Cherry-eye Sprite *Pseudagrion sublacteum* was made in January 2018 in quarter degree grid cell 3323DC Nature's Valley, close to the border with the Eastern Cape. There are seven records of Cherry-eye Sprite from five quarter degree grid cells in the western half of the Eastern Cape in the database, all dated 2014 or later; the suggestion is that the distribution of this species is moving westwards from KwaZulu-Natal through the

Figure 4: The third record of Spotted Spreadwing *Lestes tridens* in the Western Cape. Plettenberg Bay, 6 January 2018, Andre Marais. (http://vmus.adu.org.za/?vm=OdonataMAP-42514)

Figure 5: The seventh record of Red Basker *Urothemis assignata* in the Western Cape. Karatara, inland from Sedgefield, 1 May 2018, Andre Marais. The first record had been made only three months earlier (http://vmus.adu.org.za/?vm=OdonataMAP-50295)

Eastern Cape and has recently reached the Western Cape.

The single record of Southern Banded Groundling *Brachythemis leucosticta* for the Western Cape was made in April 2017, in quarter degree grid cell 3320CC Montagu (Figure 6). The nearest records are in the western Eastern Cape, with four records in quarter degree grid cell 3325CD Uitenhage, west of Port Elizabeth. There is a thin scattering of records along the Eastern Cape coast, all dating from 2012 or later, suggesting that the distribution of Southern Banded Groundling is expanding westwards along the coast from KwaZulu-Natal.

The single record of Deceptive Widow *Palpopleura deceptor* for the Western Cape was made in March 2017, in quarter degree grid cell 3319BB Inverdoorn, south of the Cederberg range, north of Ceres. There is a single record for the Eastern Cape, from quarter degree grid cell 3129CB Tombo (near Port St Johns) and there are eight records, from four quarter degree grid cells for KwaZulu-Natal.

There are two alternative explanations of the occurrence of these species in the Western Cape. They have been present for decades, but have been overlooked until the proliferation of citizen science observers and observations associated with OdonataMAP. Alternatively, these are genuine range expansions. Many bird species have, during various decades of the past 50 years, extended their ranges westwards into the Western Cape. Well known examples are Hadeda Ibis *Bostrychia hagadash* and Fork-tailed Drongo *Dicrurus adsimilis* (Ainsley et al. 2016, Second Southern African Bird Atlas Project unpubl. data). Perrisnotti et al. (2011) reported on range expansions in South Africa between 1980s and the 2002 of some conspicuous insects: fruit chafers (Coleoptera, Scarabaeidae, Cetoniinae), longhorn beetles (Coleoptera, Cerambycidae) and butterflies (Lepidoptera, Rhopalocera). All except one of the eight species they considered showed range expansions of the order of 500-800 km from KwaZulu-Natal in the direction of the Western Cape along the coastline. Although the evidence is anecdotal, it seems that the Golden Orb-web Spider (or Black-legged Nephila) *Nephila fenestra* expanded its range westwards reaching the Cape Peninsula in the first 10 years of the 21st century, and have become abundant.

How do I obtain up-to-date maps of species?

Up-to-date distribution maps (i.e. for use in the future) for all species can be obtained from the following link:

http://vmus.adu.org.za/vm_map_afr.php?spp=668670&database=odonata&grid=1&key=1&map=25&cell_m=15&outline=1 .

This gives the Western Cape distribution map for the species with species code number 668670, the Red-veined Dropwing (Figure 7). The species codes are provided in the second column of Table 1. (The method to create a species map for South Africa from the Virtual Museum database is described in this slideshow: https://www.slideshare.net/Animal_Demography_Unit/how-to-create-aspeciesmap .)

How do I obtain lists of species for quarter degree grid cells?

Up-to-date lists of the species recorded in a quarter degree grid cell can be obtained from the following link: https://www.slideshare.net/Animal_Demography_Unit/how-to-create-a-species-list-from-the-virtual-museum-data The list of grid cell codes is provided in Table 1. In the link below, replace the "locus" with the code for the QDGC required (consult also Figure 2). The link below provides the species list for the quarter degree grid cell 3219AA Pakhuis, in the northern Cederberg:

http://vmus.adu.org.za/vm_locus_map.php?vm=OdonataMAP&locus=3219AA .

Figure 6: The first record of Southern Banded Groundling *Brachythemis leucosticta* in the Western Cape. Montagu, 30 April 2017, Shaun Hayes, Christine Hayes and Kathy de Wet. (http://vmus.adu.org.za/?vm=OdonataMAP-34004)

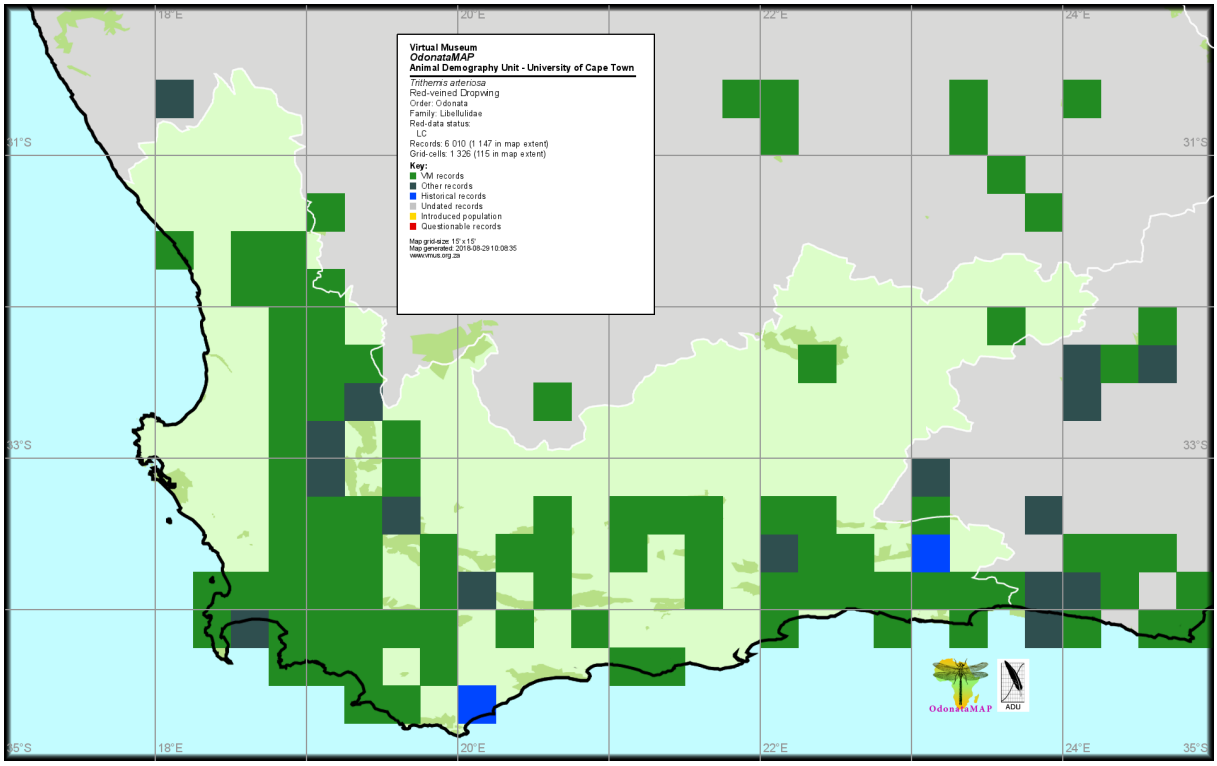


Figure 7: The distribution of the Red-veined Dropwing *Trithemis arteriosa* in the Western Cape. See text.

This link provides a map of the quarter degree grid cell, a list of the species recorded in it, the number of records for each species and the date of the most recent record. In addition, you can look at all the details for all the individual records of a species. It is also possible to get the list of all the records for the quarter degree grid cell. These are presented in batches of 30 records. This feature is particularly useful if there is a relative handful of records for a grid cell, and you want to see the details for all of them at once.

How up-to-date is the database?

In Table 1, the most recent date on which each of the 77 species has been recorded in the Western Cape is provided in the last column. The median of these dates was 5 April 2018; in other words, half of the species recorded in the Western Cape have been recorded there since 5 April, in the most recent four months prior to the download of the database for this. Of the 77 species, 59 species had last been recorded in the Western Cape during 2018 and a further 10 during 2017 (Table 1). This is a remarkable achievement. Seven of the eight species in IUCN threat categories had most recently been recorded in 2017 or 2018, and one Rustic Presba *Syncordulia serendipator* was last recorded in March 2016 (Table 1, Figure 8).

In the same way as the up-to-dateness of the provincial database can be assessed using the median of the most recent date for each species, this same approach can be applied to individual quarter degree grid cells. This median date is calculated and presented whenever the species list for a grid cell is downloaded (see section above). Special fieldwork attention needs to be paid to quarter degree grid cells for which the median date is more than three years from the present. For example, quarter degree grid cell 3223BA Toorfontein, in the Great Karoo near Murraysburg, contains 15 species, but their median date is 24 January 2013, more than five years ago. The species list for this grid cell can be downloaded using

Figure 8: The most recent record of the Vulnerable Rustric Presba *Syncordulia serendipator* was made near Stellenbosch on 28 March 2016 by Corrie du Toit. (http://vmus.adu.org.za/?vm=OdonataMAP-21577)

http://vmus.adu.org.za/vm_locus_map.php?vm=OdonataMAP&locus=3223BA .

Are there species which have not been recorded in recent years?

For four species, the most recent record was prior to 2010. All these records come from the Odonata Database for Africa, and are supported by specimens, mostly curated in the Stellenbosch University Entomology Collection.

The Highland Skimmer *Orthetrum machadoi* has been recorded only once in the Western Cape, in 1991, in quarter degree grid cell 3219CB Grootrivier, in the southern Cederberg range. Until 2017, the nearest records to this one were in KwaZulu-Natal. However, in February 2017, Highland Skimmer was recorded in the western Eastern Cape, in QDGC 3325CB Uitenhage North (http://vmus.adu.org.za/?vm=OdonataMAP-30854), and seven further records have been made from this locality.

There is a single record of Little Skimmer *Orthetrum abbotti* for the Western Cape, made in 2004 in quarter degree grid cell 3421AC Vermaaklikheid, along the south coast. There are OdonataMAP records for this species in five grid cells of the Eastern Cape, two of which are near Port Elizabeth (3325CC Loerie, four records in May 2018, and 3325CB Uitenhage North, 16 records between November 2017 and April 2018).

Both Western Cape records of the Black Emperor *Anax tristis* were made in 2005 in quarter degree grid cell 3418BD Hangklip, which includes the village of Bettys Bay. The nearest record was made in quarter degree grid cell 2930CB Pietermaritzburg in KwaZulu-Natal in 1991, with recent records slightly to the northeast (2830DA Collessie in November 2012 and 2831DA Nkwalini in January 2018).

There are three records of the Slate Sprite *Pseudagrion salisburyense* in the eastern half of the Western Cape: in quarter degree grid cells 3321AD Ladismith in 2005, in 3322CA Oudtshoorn in December 2009 and in 3323DC Nature's Valley in April 2008. There is a scattering of records throughout the Eastern Cape.

The continued occurrence of these four species in the Western Cape needs confirmation. The first place to search is at the location of the original discovery.

What are the priority areas for data collection in the Western Cape?

There were 156 quarter degree grid cells in, or partially in, the Western Cape with at least one species of dragonfly or damselfly identified to species level (Table 2, Figure 3). The largest number of species record in a quarter degree grid cell was 46 (in 3323DC Nature's Valley, at the eastern limit of the province (Figure 2). 13 quarter degree grid cells had 36 or more species, and are shaded brown in Figure 3, and a further 12 had between 24 and 35 species, and were shaded dark green-brown in Figure 3.

These 25 quarter degree grid cells are characterised by areas of rugged and mountainous terrain. The grid cells of the mountains of the Boland, immediately east of Cape Town, show consistently large species richness, as do the mountains along the Garden Route in the eastern edge of the Western Cape. The intervening mountain ranges have patchy coverage. In simplistic terms, there are ranges of mountains to the south and the north of the Little Karoo. The main range to the south is the Langeberg; the quarter degree cell 3420AB Swellendam which lies along this axis has 40 species. The range to the north is known as the Groot Swartberge; within this range, quarter degree grid cell 3321AD Ladismith has 33 species. This gap, between the eastern and western ends of the Western Cape, probably represents the biggest challenge of fieldwork in the province, in the summer of 2018/19.

The second biggest challenge lies north of the mountains of the Boland, towards the Cederberg, and northwards along the Escarpment immediately inland of Vanrhynsdorp.

The third challenge is the Great Karoo, where the majority of the quarter degree grid cells without any coverage lie. The fact that quarter degree grid cell 3223BA Toorfontein, south of Murraysberg, has a list of 15 species (Table 2) is indicative of what is achievable in the Great Karoo.

The fourth coverage challenge lies in the Swartland and Overberg regions north and east of Cape Town, respectively. Large parts of these regions are almost totally transformed to agriculture, with complete loss of natural habitats to fields of wheat and canola, to vineyards and to orchards. A sensible strategy in these areas would be to increase the number of records per quarter degree grid cell to at least 50, and preferably 100, and to examine the species accumulation curves. Three candidate quarter degree grid cells in the Swartland, chosen only because they are conveniently close to Cape Town, are 3318DA Philadelphia (five species, 10 records), 3318BC Malmesbury (seven species, 10 records) and 3318BA Moorreesburg (six species, 12 records) (Table 2).

Any quarter degree grid cell in the Western Cape with fewer than 100 records should be regarded as a priority. That excludes only 25 grid cells (Table 2). Even for the grid cells with large volumes of data, every record should be submitted to the OdonataMAP database. There are three reasons for this: (1) it "refreshes" the record for the species, confirming the continued presence of the species in the grid cell; (2) it is only in the grid cells with the most data that studies of changes in species composition through time are going to be feasible; (3) every record contributes to our understanding of the "phenology" (the flight period) of the species. Studies of phenology require large data volumes.

How do I go about participating in data collection for this project?

In a nutshell, the protocol is simple. Take photos of dragonflies and damselflies, and upload them to the OdonataMAP section of the Virtual Museum website. There is no need to identify the species in the photograph. This gets done by an expert panel.

There is a slideshow entitled "How to shoot your dragon" at https://www.slideshare.net/Animal_Demography_Unit/how-to-shoot-your-dragon

Taking photographs of dragonflies and damselflies is less challenging than most people anticipate. Most individuals have a perch which they return to routinely after each foraging flight and generally remain on the perch for long enough for several photographs to be taken, from different angles. The foraging flights seldom last for more than a few minutes, so a measure of patience is required. Each time they land, they tend to perch differently, so this provides an opportunity to take photographs at several angles. The entire spectrum of cameras are in use; the most versatile for this type of photography are the new generation of "compact" cameras

Before you can upload into the Virtual Museum you need to register as a citizen scientist. The procedure for doing this is described here: https://www.slideshare.net/Animal_Demography_Unit/how-to-register-as-a-citizen-scientist-with-the-animal-demography-unit

Once you are registered you logon to the website using your email address and password. A "Data upload" section now becomes visible. The critical information that needs to be uploaded into the database is date, place and a series of one to three photographs of a single species, usually different angles on the same individual. Guidance on the upload process is provided in this slideshow: https://www.slideshare.net/Animal_Demography_Unit/how-to-submit-records-to-the-virtual-museums

The expert panels for each project consists of taxon experts and the most experienced citizen scientists. For OdonataMAP, many records get confirmed identifications within a week. Some records take longer, and for some photographs a positive identification to species level is not possible. Records are sometimes identified to genus or family level. Some species can readily be identified from a poor, even partially blurred photograph. At the other extreme a few species

can only be identified in the hand. As a beginner participant, the best strategy for a positive confirmed identification is to submit the best one, two or three photographs, preferably from different angles. The most important parts of the dragonfly or damselfly to get in sharp focus are the thorax and a wing.

There is an exceptional fieldguide to the dragonflies and damselflies of South Africa. It was written by Warwick and Michèle Tarboton. It is called A Guide to the Dragonfllies and Damselflies of South Africa, and published by Struik Nature. It describes and illustrates 164 species of Odonata recorded in South Africa at the time of publication (Tarboton & Tarboton 2015). It is widely available in good bookshops, and an ebook version is also available (see https://www.warwicktarboton.co.za/Dragonfly%20Book.html).

Acknowledgements

Many friends and colleagues made helpful suggestions which improved this report: Sharon Stanton, Eugene Moll, John Wilkinson, Alan Manson, Warwick Tarboton and Lappies Labuschagne. Pete Laver prepared the maps. We acknowledge funding from the JRS Biodiversity Foundation, Seattle, USA. But above all, we celebrate the amazing contributions made by the citizen scientists responsible for 80% of the data upon which this report is based.

References

Ainsley J, Underhill LG, López Gómez M, Brooks M 2016. Bird distribution dynamics 8 - Hadeda Ibis *Bostrychia hagedash* in South Africa, Lesotho and Swaziland. Biodiversity Observations 8.6: 1-10. Available online at https://journals.uct.ac.za/index.php/BO/article/view/404

Clausnitzer V, Dijkstra K-DB, Koch R, Boudot J-P, Darwall WRT, Kipping J, Samraoui B, Samways MJ, Simaika JP, Suhling F 2012. Focus on African freshwaters: hotspots of dragonfly diversity and conservation concern. Frontiers in Ecology and the Environment 10: 129-134.

Dijkstra, K-DB 2016. African Dragonflies and Damselflies Online. (Version 1 July 2016). Available online at http://addo.adu.org.za .

Loftie-Eaton M, Underhill LG, Navarro R 2018. OdonataMAP: progress report on the atlas of the dragonflies and damselflies of Africa, 2016/17 and 2017/18. Biodiversity Observations.

Perissinotto R, Pringle EL, Giliomee JH 2011. Southward expansion in beetle and butterfly ranges in South Africa. African Entomology 19: 61-69.

Samways MJ, Simaika JP 2016. Manual of Freshwater Assessment for South Africa: Dragonfly Biotic Index. Suricata 2. South African National Biodiversity Institute, Pretoria.

Statistics South Africa 2017. Mid- year population estimates. Available online at http://www.statssa.gov.za/publications/P0302/P03022017.pdf

Tarboton W, Tarboton M 2015. A Guide to Dragonflies and Damselflies of South Africa. Struik Nature, Cape Town.

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. Available online at https://journals.uct.ac.za/index.php/BO/article/view/340

Table 1: The 76 species of Odonata (dragonflies and damselflies) in the Western Cape based on the combined databases of OdonataMAP and ODA (see text). The species are sorted first by family, then genus and species names. The Red List (RL) classification of the species is that of Samways and Samaika (2016) and the eight species in threat categories are in boldface. The quantitative information is the number of quarter degree grid cells, in the parts strictly within the Western Cape each species has been recorded in since 1980 (QDGC), and the number of records of the species (N). The final column gives the last date on which the species was recorded, prior to 14 August 2018, when this table was created from the database.

Family	Species code	Scientific name	Common name	RL	QDGC	N	Last recorded
Aeshnidae							
	664070	*Anaciaeschna triangulifera*	Evening Hawker	LC	6	6	23/01/2017
	664120	*Anax ephippiger*	Vagrant Emperor	LC	2	3	15/05/2017
	664140	*Anax imperator*	Blue Emperor	LC	66	350	30/07/2018
	664170	*Anax speratus*	(Eastern) Orange Emperor	LC	23	83	05/04/2018
	664180	*Anax tristis*	Black Emperor	LC	1	2	01/01/2005
	664470	*Pinheyschna subpupillata*	Stream Hawker	LC	27	126	18/03/2018
	664510	*Zosteraeschna minuscula*	Friendly Hawker	LC	30	75	14/04/2018
Chlorocyphidae							
	661180	*Platyypha caligata*	Dancing Jewel	LC	2	2	12/03/2018
	661210	*Platycypha fitzsimonsi*	Boulder Jewel	LC	13	100	27/02/2018
	662330	*Africallagma glaucum*	Swamp Bluet	LC	45	202	27/07/2018
	662370	*Africallagma sapphirinum*	Sapphire Bluet	LC	2	3	20/12/2013
	662470	*Agriocnemis falcifera*	White-masked Wisp	LC	6	12	16/12/2017
	662630	*Azuragrion nigridorsum*	Sailing Bluet	LC	21	72	04/05/2018
	662720	*Ceriagrion glabrum*	Common Citril	LC	41	301	15/05/2018
	663100	*Ischnura senegalensis*	Tropical Bluetail	LC	87	859	08/08/2018
	663160	***Proischnura polychromatica***	**Mauve Bluet**	**EN**	**3**	**45**	**21/10/2017**
	663260	*Pseudagrion citricola*	Yellow-faced Sprite	LC	11	21	06/02/2018
	663300	*Pseudagrion draconis*	Mountain Sprite	LC	38	254	01/04/2018
	663350	*Pseudagrion furcigerum*	Palmiet Sprite	LC	36	329	30/04/2018
	663410	*Pseudagrion hageni*	Painted Sprite	LC	5	48	26/03/2018
	663460	*Pseudagrion kersteni*	Powder-faced Sprite	LC	43	245	05/06/2018
	663820	*Pseudagrion massaicum*	Masai Sprite	LC	28	160	29/05/2018
	663560	*Pseudagrion salisburyense*	Slate Sprite	LC	3	3	03/12/2009
	663880	*Pseudagrion sublacteum*	Cherry-eye Sprite	LC	1	1	04/05/2018
Gomphidae							
	664550	*Ceratogomphus pictus*	Common Thorntail	LC	31	121	08/04/2018
	664560	***Ceratogomphus triceraticus***	**Cape Thorntail**	**NT**	**20**	**58**	**14/02/2018**
	665740	*Paragomphus cognatus*	Rock Hooktail	LC	38	202	12/03/2018
	665790	*Paragomphus genei*	Common Hooktail	LC	11	18	21/04/2018
Lestidae							
	660360	*Lestes plagiatus*	Highland Spreadwing	LC	7	35	04/05/2018
	660330	*Lestes tridens*	Spotted Spreadwing	LC	3	4	08/04/2018
	660300	*Lestes virgatus*	Smoky Spreadwing	LC	5	21	06/06/2018
Libellulidae							
	667030	*Brachythemis leucosticta*	Southern Banded Groundling	LC	1	1	30/04/2017
	667130	*Crocothemis erythraea*	Broad Scarlet	LC	83	712	06/07/2018
	667140	*Crocothemis sanguinolenta*	Little Scarlet	LC	46	259	05/06/2018
	667200	*Diplacodes lefebvrii*	Black Percher	LC	16	60	27/04/2018
	667690	*Nesciothemis farinosa*	Eastern Blacktail	LC	21	154	01/04/2018
	667780	*Orthetrum abbotti*	Little Skimmer	LC	1	1	01/01/2004
	667860	*Orthetrum caffrum*	Two-striped Skimmer	LC	49	244	15/05/2018
	667890	*Orthetrum capicola*	Cape Skimmer	LC	61	1002	03/08/2018
	667900	*Orthetrum chrysostigma*	Epaulet Skimmer	LC	22	31	22/06/2018
	667950	*Orthetrum julia*	Julia Skimmer	LC	40	125	23/03/2018
	668000	*Orthetrum machadoi*	Highland Skimmer	LC	1	1	01/01/1991
	668120	*Orthetrum trinacria*	Long Skimmer	LC	37	150	22/04/2018
	668180	*Palpopleura deceptor*	Deceptive Widow	LC	1	1	23/03/2017
	668190	*Palpopleura jucunda*	Yellow-veined Widow	LC	13	25	12/03/2018
	668230	*Pantala flavescens*	Wandering Glider	LC	15	32	22/06/2018
	668370	*Rhyothemis semihyalina*	Phantom Flutterer	LC	5	11	14/03/2018
	668420	*Sympetrum fonscolombii*	Red-veined Darter or Nomad	LC	77	531	09/08/2018
	668540	*Tetrathemis polleni*	Black-splashed Elf	LC	2	2	01/04/2018
	668620	*Tramea basilaris*	Keyhole Glider	LC	3	3	21/03/2014
	668630	*Tramea limbata*	Ferruginous Glider	LC	27	106	22/06/2018
	668660	*Trithemis annulata*	Violet Dropwing	LC	6	31	06/07/2018

Table 1: Continued ...

Family	Species code	Scientific name	Common name	RL	QDGC	N	Last recorded
Libellulidae							
	668670	*Trithemis arteriosa*	Red-veined Dropwing	LC	81	963	31/05/2018
	668800	*Trithemis donaldsoni*	Denim Dropwing	LC	2	3	05/01/2017
	668870	*Trithemis dorsalis*	Highland Dropwing	LC	31	104	18/05/2018
	668890	*Trithemis furva*	Navy Dropwing	LC	58	370	05/06/2018
	669120	*Trithemis kirbyi*	Orange-winged Dropwing	LC	44	103	30/06/2018
	668900	*Trithemis pluvialis*	Russet Dropwing	LC	10	79	09/04/2018
	669080	*Trithemis stictica*	Jaunty Dropwing	LC	40	286	05/05/2018
	669180	*Urothemis assignata*	Red Basker	LC	1	8	03/05/2018
	669390	*Zygonyx natalensis*	Blue Cascader	LC	20	63	27/02/2018
	669420	*Zygonyx torridus*	Ringed Cascader	LC	1	1	18/01/2018
Libelluloidea incertae							
	666270	***Syncordulia gracilis***	**Yellow Presba**	**VU**	**7**	**82**	**19/11/2017**
	666280	***Syncordulia legator***	**Gilded Presba**	**VU**	**7**	**28**	**21/10/2017**
	666290	***Syncordulia serendipator***	**Rustic Presba**	**VU**	**3**	**13**	**28/03/2016**
	666300	***Syncordulia venator***	**Mahogany Presba**	**VU**	**10**	**34**	**22/02/2018**
Macromiidae							
	666620	*Phyllomacromia picta*	Darting Cruiser	LC	6	10	18/11/2012
Platycnemididae							
	661480	*Allocnemis leucosticta*	Goldtail	LC	23	162	05/04/2018
	661790	*Elattoneura frenulata*	Sooty Threadtail	LC	28	240	18/03/2018
	661810	*Elattoneura glauca*	Common Threadtail	LC	31	85	27/02/2018
	662140	***Spesbona angusta***	**Ceres Streamjack**	**EN**	**4**	**71**	**30/11/2017**
Synlestidae							
	660070	*Chlorolestes conspicuus*	Conspicuous Malachite	LC	19	135	22/04/2018
	660120	*Chlorolestes fasciatus*	Mountain Malachite	LC	5	5	30/03/2018
	660130	*Chlorolestes tessellatus*	Forest Malachite	LC	12	118	14/05/2018
	660080	*Chlorolestes umbratus*	White Malachite	LC	23	305	03/08/2018
	660150	***Ecchlorolestes nylephtha***	**Queen Malachite**	**NT**	**12**	**67**	**06/06/2018**
	660160	***Ecchlorolestes peringueyi***	**Rock Malachite**	**NT**	**10**	**99**	**21/03/2018**

Table 2: The number of records of Odonata for each of 157 quarter degree grid cells in the Western Cape, South Africa. The six-character codes for the grid cells are given and the official names of the 1:50,000 map sheets for the grid cell. The final column gives the total number of records available for the grid cell for which identifications have been made at species, genus or family level. The third column gives the number of species in each grid cell, and the fourth column the number of records that were identified to species level. The fifth column provides a count of the overall number of taxa, including species, genus and family.

QDGC	QDGC Name	Species	Records	Taxa	Total
3118AD	Kliphoek	1	1	2	2
3118BB	Douse The Glim	2	2	2	2
3118BC	Wolwenes	1	1	1	1
3118BD	Grootdrif	1	2	1	2
3118CA	Papendorp	1	1	1	1
3118CB	Lutzville	8	9	8	9
3118CC	Doringbaai	1	1	1	1
3118DA	Van Rhynsdorp	7	14	7	14
3118DB	Urionskraal	8	27	9	28
3118DC	Klawer	7	11	7	11
3118DD	Bulshoek	11	15	13	18
3119AC	Nieuwoudtville	13	45	17	53
3119CA	Lokenburg	1	2	2	3
3119CC	Doringbos	4	6	4	6
3124CC	Winterhoek	4	4	4	4
3217DD	Vredenburg	1	1	1	1
3218AB	Lambert's Bay	2	2	2	2
3218AD	Elandsbaai	6	6	6	6
3218BA	Graafwater	1	1	1	1
3218BB	Clanwilliam	21	39	22	41
3218BC	Redelinghuys	1	1	1	1
3218BD	Oliewenboskraal	12	18	15	24
3218CB	Aurora	2	2	2	2
3218CC	Velddrif	3	3	3	3
3218CD	Bergrivier	2	4	2	4
3218DA	Goergap	4	4	4	4
3218DB	Eendekuil	1	1	1	1
3218DC	Moravia	1	1	1	1
3218DD	Piketberg	8	19	9	20
3219AA	Pakhuis	26	154	31	166
3219AB	Uitspankraal	6	9	6	9
3219AC	Wuppertal	28	103	31	110
3219AD	Grootberg	25	39	25	39
3219BC	Elandsvlei	7	7	7	7
3219BD	Middeldrif	1	1	1	1
3219CA	Citrusdal	23	48	24	51
3219CB	Grootrivier	23	76	24	77
3219CC	Keerom	21	38	21	38
3219CD	De Meul	5	6	7	8

Table 2: Continued ...

QDGC	QDGC Name	Species	Records	Taxa	Total
3219DC	Groenfontein	5	7	5	7
3219DD	Kareekolk	2	3	2	3
3220DB	Komsberg	1	1	1	1
3220DC	Kruispad	4	6	4	6
3221DD	Fraserburg Road	1	1	1	1
3222AB	Rosedene	1	1	1	1
3222AC	Paalhuis	3	3	3	3
3222AD	Klipbank	4	4	4	4
3222BA	Kuilspoort	1	1	1	1
3222BB	Renosterkop	3	4	4	5
3222BC	Beaufort West	8	18	8	18
3223AA	Nelspoort	1	1	1	1
3223AD	Oorlogspoort	1	1	2	3
3223BA	Toorfontein	15	26	20	32
3224AA	Toorberg	0	0	1	1
3318AA	Saldanha Bay	5	12	6	13
3318AC	Yzerfontein	2	2	2	2
3318AD	Darling	2	4	2	4
3318BA	Mooreesburg	6	11	7	12
3318BB	Porterville	6	7	6	7
3318BC	Malmesbury	7	10	7	10
3318BD	Riebeek-Kasteel	20	42	21	43
3318CB	Melkbosstrand	7	15	7	15
3318CD	Cape Town	27	377	30	404
3318DA	Philadelphia	5	10	5	10
3318DB	Paarl	26	77	29	80
3318DC	Bellville	25	182	30	193
3318DD	Stellenbosch	42	357	48	382
3319AA	Groot-Winterhoek	22	70	23	71
3319AB	Gydopas	4	4	5	5
3319AC	Tulbagh	27	43	28	44
3319AD	Ceres	39	155	40	156
3319BA	Baviaanshoek	2	4	2	4
3319BB	Inverdoorn	8	10	8	10
3319BC	De Doorns	11	14	11	14
3319CA	Bain's Kloof	43	573	49	591
3319CB	Worcester	35	109	37	111
3319CC	Franschhoek	38	389	43	396
3319CD	Villiersdorp	33	134	34	135
3319DA	Nuy	9	10	9	10
3319DB	Koo	10	17	10	17
3319DC	Langvlei	5	7	5	7
3319DD	Robertson	19	43	19	43
3320AC	Touwsrivier	1	1	1	1
3320AD	Bloutoring	5	6	5	6
3320BA	Matjiesfontein	2	2	2	2
3320BC	Fisantekraal	1	2	1	2

Table 2: Continued ...

QDGC	QDGC Name	Species	Records	Taxa	Total
3320CB	Allemorgens	4	6	4	6
3320CC	Montagu	10	13	10	13
3320CD	Scheepersrus	10	28	10	28
3320DA	Kareevlakte	3	3	3	3
3320DB	Plathuis	2	2	2	2
3320DC	Barrydale	17	25	19	27
3320DD	Warmwaterberg	7	10	8	11
3321AC	Vleiland	4	4	5	5
3321AD	Ladismith	33	85	33	85
3321BC	Matjiesvlei	14	22	17	26
3321BD	Kruisrivier	1	1	1	1
3321CA	Algerynskraal	4	4	4	4
3321CB	Van Wyksdorp	1	1	1	1
3321CC	Muiskraal	1	1	1	1
3321DA	Calitzdorp	7	7	9	13
3321DB	Vleirivier	1	1	1	1
3321DC	Langberg	5	6	5	6
3321DD	Attakwaskloof	1	1	1	1
3322AA	Prince Albert	1	1	1	1
3322AC	Kangogrotte	15	54	19	62
3322AD	Rosselerf	7	11	9	15
3322BA	Seekoegat	1	1	1	1
3322BC	De Rust	3	4	3	4
3322CA	Oudtshoorn	8	11	8	11
3322CB	Dysselsdorp	14	41	15	44
3322CC	Jonkersberg	22	60	26	65
3322CD	George	27	144	31	170
3322DA	Stompdrift	18	49	21	58
3322DB	Buffelsdrif	1	1	1	1
3322DC	The Wilderness	41	594	48	633
3322DD	Karatara	39	354	42	377
3323AC	Barandas	10	15	10	15
3323AD	Willowmore	5	7	5	7
3323BC	Willowmore (East)	4	4	4	4
3323CA	Uniondale	4	4	4	4
3323CC	Kruisvallei	40	383	47	422
3323CD	The Crags	32	111	36	115
3323DA	Voorkloof	1	1	1	1
3323DC	Nature's Valley	46	594	52	612
3418AB	Cape Peninsula (central)	21	239	26	269
3418AD	Cape Peninsula (Cape Point)	16	42	16	42
3418BA	Mitchells Plain	16	38	16	38
3418BB	Somerset West	36	2166	49	2230
3418BD	Hangklip	42	1212	51	1268
3419AA	Grabouw	36	116	38	118

Table 2: Continued ...

QDGC	QDGC Name	Species	Records	Taxa	Total
3419AB	Caledon	16	39	17	40
3419AC	Hermanus	21	52	22	53
3419AD	Stanford	22	117	25	122
3419BA	Greyton	33	179	39	195
3419BB	Riviersonderend	10	21	11	23
3419BC	Jongensklip	2	2	2	2
3419BD	Napier	6	6	6	6
3419CB	Gansbaai	15	82	18	89
3419DA	Baardskeerdersbos	7	9	8	10
3419DD	Elim	2	2	2	2
3420AA	Stormsvlei	1	1	1	1
3420AB	Swellendam	40	177	44	184
3420AD	Wydgelee	3	6	3	6
3420BB	Heidelberg	15	23	15	23
3420BC	Malgas	6	11	6	11
3420CA	Bredasdorp	11	14	11	14
3421AB	Riversdale	1	1	1	1
3421AC	Vermaaklikheid	9	10	9	10
3421AD	Stilbaai	16	51	16	51
3421BA	Albertinia	1	1	1	1
3421BB	Herbertsdale	2	2	2	2
3422AA	Mosselbaai	27	219	32	269
3422AB	Pacaltsdorp	6	12	6	12
3422BB	Sedgefield	18	122	22	130
3423AA	Knysna	22	86	23	88
3423AB	Plettenberg Bay	21	59	22	60