The circumtropical *Pantala flavescens* is a regular visitor to Cyprus and reproducing on the island (Odonata: Libellulidae)

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**Abstract.** Although considered one of the most widespread dragonflies in the world, *Pantala flavescens* is rarely recorded in Europe and only irregularly observed in the eastern Mediterranean. The first published records of *P. flavescens* from Cyprus date back to 1957. There are no further published records from Cyprus until 2010 when a single individual and a copula were observed. The latter is also the first record of reproductive activity of the species in the eastern Mediterranean. Since the systematic monitoring of Odonata in Cyprus began in 2013, *P. flavescens* has been recorded on the island every year with one to 13 records each year from 2013 to 2017, 45 in 2018, and with a significant increase to 146 records in 2019, giving a total of 237 records. Reproductive behaviour of *P. flavescens* has been observed 19 times on Cyprus and in 2018 we found a larva and a teneral male. Oviposition mode showed high plasticity and was observed in five cases in non-contact guarding behaviour; five times females were ovipositing alone (unguarded oviposition) and oviposition in tandem was seen only once. Our observations are the first proof of successful reproduction of *P. flavescens* in the eastern Mediterranean.

**Further key words.** Dragonfly, Anisoptera, Mediterranean, range expansion, larva, guarded and unguarded oviposition

**Introduction**

*Pantala flavescens* (Fabricius, 1789) is a well-known highly migratory species that disperses over vast distances and is able to cross oceans (Anderson 2009; Hobson et al. 2012). It is a circumtropical species with an al-
most worldwide distribution, with its main range between latitudes 40° S and 40° N (Walker & Corbet 1975; Buczyński et al. 2014). The species is common in Central and South America, Oceania and Asia (Kalkman & Monnerat 2015). It is also common and widespread in sub-Saharan Africa but rare in most of North Africa and the eastern Mediterranean (Boudot et al. 2009). This is most likely a result of the Sahara presenting a major barrier to dragonfly migration (Corbet 1999; Buczyński et al. 2019). The higher number of observations in Lower Egypt is due to the Nile Valley that forms a migration corridor through the Sahara (Corbet 1999; Laister 2005) and P. flavescens can occur there in swarms from May to December (Dijkstra & Boudot 2010). The species has been regularly observed in the Levant (Dumont 1991; Monnerat & Hoess 2011), in Turkey (Dumont 1977; Seidenbusch 1995; Jödicke 1998; Arlt 1999; Aydin 2006; Hacet & Aktaç 2004; Kalkman & van Pelt 2006; Salur et al. 2012) and in the Arabian Peninsula (Dumont & Safadi 1991; Schneider & Krupp 1993; Lambret et al. 2017) although no breeding populations have been established. It is considered a rare migrant in Europe, where up to the end of 2019 there were only just over 50 published records for the entire continent. Prior to 2012, there were just 12 published records from Turkish Thrace (Hacet & Aktaç 2004), Montenegro (Ober 2008), Greece (Blincow 2005), Rhodes (Laister 2005), the Italian islands of Linosa and Lampedusa (Corso et al. 2012) and Croatia (Finkenzeller 2010). Since 2012 there is a significant increase in the number of published records and from several new countries and islands: Bulgaria (De Knijf 2015), the Maltese Islands (Degabriele 2014; Gauci 2018), the Russian enclave Kaliningrad (Buczyński et al. 2014), the Canary Islands (Martinez-Darve Sanz & Cano-Villegas 2014; Weihrauch et al. 2016), the Azores (Vieira & Cordero-Rivera 2015), Poland (Buczyński et al. 2019), Sicily (Corso et al. 2017; Galasso et al. 2017), mainland Italy (Piretta & Assandri 2019), Lithuania (Jusys et al. 2019), Belarus (unpubl. data on www.observation.org) and France (Soustelle et al. 2020). Most recently, in 2019 and 2020, the species was even able to reproduce in Germany (Günther 2019), Switzerland (Henseler et al. 2019), and Poland (Lewandowska et al. 2020).

Most European records relate to the observation of single individuals. So there is not only a low number of European records for the species, there
is also a correspondingly low abundance with an individual count of below 100 for the whole period. It has been stated that it is unclear if the recent increase in records is the result of increased observer intensity and/or a genuine increase in numbers and range expansion (Piretta & Assandri 2019).

Given the proximity of Cyprus to the Middle East and the Nile valley, the presence of \textit{P. flavescens} is not unexpected. The earliest records of the species were of six specimens collected in Cyprus in 1957 (Kiauta 1963; Lopau & Adena 2002). After 1957, there is a long gap without any published observations of \textit{P. flavescens} from Cyprus, until 2010 when a single individual and a copula were seen (unpubl. data on \url{www.observado.org} and \url{www.treknature.com}). Recognising the lack of Odonata data from Cyprus and the eastern Mediterranean in general, the Cyprus Dragonfly Study Group (CDSG) was established in 2012. Prior to this, with the exception of Flint (2019) who recently reported on year-round monitoring in the northern part of the island from vi-2003 to ix-2004, most records were from visitors, mainly to the southern part of the island from April to July and the phenology and population trends of odonates on the island was not known. The CDSG has had around 15 active and mainly resident recorders and since 2013 has been carrying out island-wide, year-round systematic monitoring. Over 50 sites were selected to give good geographic coverage, to include all habitat types and to be inclusive of all the main species, and were monitored monthly or twice monthly. As a result of the seven years of monitoring, the phenology of the entire island’s odonates, with the exception of a few of the rarer species, has been very-well established, and population trends of the various species documented. In this paper we give an overdue update of the status of \textit{P. flavescens} on Cyprus and provide evidence of local reproduction.

\textbf{Study area and methods}

With a land area of 9 251 km\(^2\) Cyprus is the third largest and most easterly of the Mediterranean islands. It lies at the crossroads of Europe, Asia and the Middle East, and Africa. Turkey is 75 km to the North, Syria and Lebanon 105 km to the East and Egypt 380 km to the South.

The data used in this paper were taken from the CDSG database, the core of which was derived from records submitted by CDSG members. In addition
to the regular sites, the CDSG constantly seeks out new locations for observation and also records incidental sightings. At the end of 2019 the CDSG database contained over 27,000 entries and visits had been made to around 700 locations island-wide. We used this database to give an overview of the status of *Pantala flavescens* on Cyprus. Records prior to 2012 are based on Klauta (1963) and Lopau & Adena (2002), or were derived from internet platforms (www.treknature.com/gallery; www.observado.org).

Based on the records since 2012 and particularly following the increase in numbers in 2018, we increased monitoring intensity during autumn, which corresponds with the main flight season of *P. flavescens* on Cyprus, in four areas in 2018 and 2019 (Fig. 1). These areas were selected based on a higher detection rate of the species during previous years, including the Akrotiri peninsula in the South (123 km²), which is composed of the 11 km² salt lake with the surrounding salt flats and salt marshes. The second is the Cape area in the North-east of the island between Rizokarpaso and Cape Apostolos Andreas. These two regions are well-known for observing migrating species. The Cape is a prime location on the island, particularly for bird migration as migrants are funnelled to its tip by the topography of the Karpasia peninsula (Flint & Stewart 1983, 1992; Flint 2019), but also butterflies and dragonflies, especially *Anax ephippiger* (Burmeister, 1839) (Sparrow et al. 2016; Flint 2019). The third area is the coastal stretch between Paphos and Agios Georgios. This is a significant residential area with numerous private swimming pools which appear to be very attractive to several odonates, including *P. flavescens*. Additionally, monitoring was also increased in 2019 around the Cape Kormakitis area, which, although of lesser importance, was considered to be a potential migratory point for the large number of individuals recorded on the west coast and on Akrotiri peninsula.

Flight season data were derived using the protocol in Boudot & Kalkman (2015) except that, because of the CDSG monitoring schedule, they were grouped into half monthly rather than 10-day periods. Since the earliest and latest sightings often refer to unusual events, the start and end of the flight season are defined as the first and last half month in which a cumulative one to 99 percent of the records respectively have been made. Also the main flight season was determined, its start and end being defined as the first and last half months in which 10 percent or more of the total records occur.
Results
Since 2013, *Pantala flavescens* has been observed at 109 localities in Cyprus. Several localities that are just a few hundred meters apart were amalgamated for conciseness, resulting in a list of 90 sites (Appendix 1). Altogether 237 records of *P. flavescens* were stored in the CDSG database at the end of 2019, comprising 376 adults and one larva (Table 1). Regular monitoring on Cyprus has only been carried out since 01-i-2013, and although *P. flavescens* has been recorded in every year since then the number of records has been highly variable. The results for each of the four selected areas are presented in Table 2, along with the results for all other sites outside of the four areas.

Below we present details of all records of *P. flavescens* from 01-i-2010 to 31-xii-2019 for each of the four defined regions on Cyprus and for the other localities of the island. Details of the sites are given in Appendix 1. Most records relate to the observation of one to three individuals. In detail, there were 176 records involving one individual, 26 involving two individuals, 17 involving three individuals, nine relating to four to ten individuals, two involving twelve individuals and one involving 20 individuals.

![Map of Cyprus showing 109 locations where *Pantala flavescens* was recorded from 2010 to 2019 and the four areas where monitoring intensity was increased in 2018 and 2019.](image)

**Figure 1.** Map of Cyprus showing 109 locations where *Pantala flavescens* was recorded from 2010 to 2019 and the four areas where monitoring intensity was increased in 2018 and 2019.
Figure 2 charts the cumulative number of half monthly records in the CDSG for 2013 to 2019 and Table 3 gives the dates of the earliest and latest sighting of the species for each year.

Abbreviations used:
Loc. - locality; ad. - adult(s); tan. - tandem(s); cop. - copula(e); ovip. - ovipositing.

Akrotiri peninsula
Loc. 1: 1 ad.; Loc. 2a: 1 ♂ in late teneral stage; Loc. 2b: 1 ♂; Loc. 3a: 1 ♂, 2 ♀; Loc. 3b: 2 ♂, 1 ♂ ovip.; Loc 4: 5 ad.; Loc. 5a: 5 ad.; Loc. 5b: 1 ad.; Loc. 6a: 2 ♂; Loc. 6b: 6 ad.; Loc. 6c: 1 cop.; Loc. 6d: 2 ♂, 1 larva; Loc. 6e: 3 ♂; Loc. 7a: 1 ♂; Loc. 7b: 3 ♂; Loc 7c: 1 ad.; Loc. 7d: 3 ♂; Loc. 7e: 1 ad.; Loc. 8a: 2 cop.; Loc. 8b: 3 ♂, 2 tan., 2 cop., 1 ♀ ovip.; Loc. 9: 1 ad.; Loc. 10a: 1 ad.; Loc. 10b: 1 ad.; Loc. 10c: 1 ad.; Loc. 11a: 3 ♂, 1 ♂ ovip.; Loc. 11b: 2 ♂, 1 ♀ ovip.; Loc. 11c: 1 ♂; Loc. 11d: 2 ♂; Loc. 11e: 1 ♂, 2 ♀ ovip.; Loc. 12a: 1 cop.; Loc. 12b: 1 ad.

Cape Apostolos Andreas area
Loc. 13: 1 ♂; Loc. 14a: 1 ♂; Loc. 14b: 1 ad.; Loc. 14c: 4 ad.; Loc. 14d: 4 ad.; Loc. 14e: 1 ad.; Loc. 14f: 3 ad.; Loc. 14g: 1 ♂, 1 ♀ ovip.; Loc. 14h: 2 ♂; Loc. 14i: 1 ♂; Loc. 15: 1 ♀; Loc. 16a: 2 ad.; Loc. 16b: 2 ad.; Loc. 16c: 1 ad.; Loc. 17: 1 ad.; Loc. 18: 1 ♂; Loc. 19a: 1 ♂; Loc. 19b: 1 ad.; Loc. 20a: 2 ad.; Loc. 20b: 2 ad.; Loc. 20c: 1 ad.; Loc. 20d: 2 ad.; Loc. 20e: 1 ad.; Loc. 20f: 3 ad.; Loc. 20g: 10 ad.; Loc. 20h: 1 ad.; Loc. 21a: 1 ♂; Loc. 21b: 1 ad.; Loc. 21c: 1 ♂; Loc. 22: 1 ♂; Loc. 23a: 2 ad.; Loc. 23b: 1 ♂; Loc. 23c: 1 ad.

West coast area
Loc. 24: 1 ad.; Loc. 25a: 1 ad.; Loc. 25b: 1 ♂; Loc. 25c: 1 ad.; Loc. 25d: 2 ad.; Loc. 25e: 1 ♂; Loc. 25f: 1 ad.; Loc. 26a: 1 ♂; Loc. 26b: 1 ♂; Loc. 26c: 1 ♂; Loc. 26d: 1 ♂; Loc. 26e: 1 ♂; Loc. 26f: 1 ad.; Loc. 26g: 1 ♂; Loc. 26h: 1 ♂; Loc. 26i: 1 ♂; Loc. 26j: 1 ad.; Loc. 26k: 1 ad.; Loc. 26l: 1 ♂; Loc. 26m: 1 ad.; Loc. 26n: 1 ad.; Loc. 26o: 1 ♂; Loc. 26p: 1 ad.; Loc. 26q: 1 ad.; Loc. 26r: 1 ad.; Loc. 26s: 1 ad.; Loc. 26t: 1 ad.; Loc. 26u: 1 ♂, 1 ♀; Loc. 26v: 1 ad.; Loc. 26w: 1 ♀ ovip.; Loc. 26x: 1 ♂, 1 ♀ ovip.; Loc. 26y: 2 ♂, 1 cop.; Loc. 26z: 1 ad.; Loc. 26aa: 1 ad.; Loc. 26ab: 1 ad.; Loc. 26ac: 1 ♂; Loc. 26ad: 1 ad.; Loc. 26ae: 1 ad.; Loc. 26af: 1 ♂; Loc. 26ag: 1 ad.; Loc. 26ah: 1 ad.; Loc. 26ai: 1 ad.; Loc. 26aj: 1 ad.; Loc. 26ak: 1 ad.; Loc. 26al: 1 ad.; Loc. 26am: 1 ad.; Loc. 27a: 1 ad.; Loc. 27b: 1 ♂; Loc. 27c: 1 ad.; Loc. 27d: 1 ♀ ovip.; Loc. 27e: 1 ad.; Loc. 28: 1 ad.; Loc. 29: 1 ad.; Loc. 30a: 1 ad.; Loc. 30b: 1 ad.; Loc. 31a: 1 ad.; Loc. 31b: 1 ad.; Loc. 32: 4 ad.; Loc. 33: 1 ♂; Loc. 34: 1 ad.; Loc. 35a: 1 ♂; Loc. 35b: 2 ad.; Loc. 35c: 1 ♂, 2 ♀; Loc. 36a: 1 ad.; Loc. 36b: 1 ad.; Loc. 37a: 1 ♂;
Status of *Pantala flavescens* on Cyprus

Loc. 37b: 1♂, 1 copula; Loc. 37c: 1 ad.; Loc. 37d: 1 ad.; Loc. 37e: 1 ad.; Loc. 37f: 1 ad.; Loc. 37g: 1 ad.; Loc. 37h: 1 ad.; Loc. 37i: 1 ad.; Loc. 37j: 1 ad.; Loc. 37k: 1♂; Loc. 38a: 1 ad.; Loc. 38b: 1 ad.; Loc. 39: 1 ad.; Loc. 40: 1 ad.; Loc. 41a: 2♂; Loc. 41b: 1♂; Loc. 41c: 1 ad.; Loc. 42: 1 ad.

**Cape Kormakitis area**

Loc. 43: 1♂; Loc. 44: 2 ad.; Loc. 45: 1♂, 1 tan.; Loc. 46: 1 ad.; Loc. 47: 1 ad.

**Other localities**

Loc. 48: 2 ad.; Loc. 49a: 1♂; Loc. 49b: 1♂; Loc. 50: 1 ad.; Loc. 51a: 1 ad.; Loc. 51b: 1 ad.; Loc. 51c: 12♂; Loc. 51d: 1 ad.; Loc. 52a: 1 ad.; Loc. 52b: 1♂; Loc. 53: 1♀; Loc. 54a: 1 ad.; Loc. 54b: 1 cop.; Loc. 54c: 2 ad.; Loc. 54d: 1 ad.; Loc. 54e: 3 ad.; Loc. 55a: 1 copula; Loc. 55b: 1 ad.; Loc. 55c: 1 ad.; Loc. 55d: 3 ad.; Loc. 56a: 1 ad.; Loc. 56b: 1 ad.; Loc. 57: 1 ad.; Loc. 58: 1 ad.; Loc. 59a: 1 ad.; Loc. 59b: 2 ad.; Loc. 60: 2 ad.; Loc. 61a: 1 ad.; Loc. 61b: 1♂; Loc. 62: 1 ad.; Loc. 63a: 1 ad.; Loc. 63b: 1 ad.; Loc. 64a: 1 ad.; Loc. 64b: 1♂, 1♀ ovip.; Loc. 65a: 2 ad.; Loc. 65b: 1 ad.; Loc. 66: 1 ad.; Loc. 67: 1 ad.; Loc. 68: 5 ad.; Loc. 69: 1 ad.; Loc. 70: 1 ad.; Loc. 71: 1 ad.; Loc. 72: 1 ad.; Loc. 73: 1 ad.; Loc. 74: 1 ad.; Loc. 75a: 2♂, 1♀ ovip.; Loc. 75b: 1♂; Loc. 76: 1 ad.; Loc. 77: 1 ad.; Loc. 78: 1 ad.; Loc. 79a: 3♂; Loc. 79b: 1♂; Loc. 79c: 1♂, 1 cop.; Loc. 78d: 1♂; Loc. 80: 1 ad.; Loc. 81: 1 ad.; Loc. 82: 1 ad.; Loc. 83: 20 ad.; Loc. 84a: 1♂; Loc. 84b: 3♀; Loc. 85: 1♂; Loc. 86: 1♂; Loc. 87: 1♂, 1♀; Loc. 88a: 1♂; Loc. 88b: 1♂; Loc. 89: 1 ad.; Loc. 90: 1♂.

![Graph showing total number of half monthly records for *Pantala flavescens* on Cyprus in the CDSG database from 2013 to 2019.](image_url)

**Figure 2.** Total number of half monthly records for *Pantala flavescens* on Cyprus in the CDSG database from 2013 to 2019.
Table 1. Yearly records of *Pantala flavescens* in Cyprus on the CDSG database, with indication of the individual counts and number of sites; ad. – adult(s); tan. – tandem(s); cop. – copula(e); ovip. – ovipositing female.

<table>
<thead>
<tr>
<th>Year</th>
<th>n records</th>
<th>Individual counts</th>
<th>n sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1957</td>
<td>6</td>
<td>6 (1♂, 1♀, 4 ad.; KIAUTA 1963)</td>
<td>2</td>
</tr>
<tr>
<td>2010</td>
<td>2</td>
<td>3 (1 ad., 1 cop.)</td>
<td>2</td>
</tr>
<tr>
<td>2013</td>
<td>1</td>
<td>1 (1 ad.)</td>
<td>1</td>
</tr>
<tr>
<td>2014</td>
<td>13</td>
<td>24 (16♂, 6 ad., 2 ovip.)</td>
<td>9</td>
</tr>
<tr>
<td>2015</td>
<td>2</td>
<td>5 (3♂, 2 ovip.)</td>
<td>1</td>
</tr>
<tr>
<td>2016</td>
<td>9</td>
<td>13 (7♂, 6 ad.)</td>
<td>6</td>
</tr>
<tr>
<td>2017</td>
<td>13</td>
<td>17 (5♂, 4♀, 7 ad., 1 ovip.)</td>
<td>10</td>
</tr>
<tr>
<td>2018</td>
<td>45</td>
<td>74 (23♂, 3♀, 30 ad., 2 tan., 6 cop., 2 ovip., 1 larva)</td>
<td>28</td>
</tr>
<tr>
<td>2019</td>
<td>146</td>
<td>233 (72♂, 3♀, 143 ad., 1 tan., 4 cop., 5 ovip.)</td>
<td>77</td>
</tr>
</tbody>
</table>

Table 2. Number of records and number of individuals of *Pantala flavescens* on Cyprus in the CDSG database divided over the four selected regions and for the rest of the island; ad. – adult(s); tan. – tandem(s); cop. – copula(e); ovip. – ovipositing female.

<table>
<thead>
<tr>
<th>Area</th>
<th>n records</th>
<th>Individual counts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akrotiri peninsula</td>
<td>31</td>
<td>80 (28♂, 4♀, 25 ad., 2 tan., 6 cop., 6 ovip., 1 teneral)</td>
</tr>
<tr>
<td>Cape Apostolos Andreas</td>
<td>42</td>
<td>60 (13♂, 1♀, 45 ad., 1 ovip.)</td>
</tr>
<tr>
<td>West coast</td>
<td>86</td>
<td>100 (31♂, 3♀, 59 ad., 2 cop., 3 ovip.)</td>
</tr>
<tr>
<td>Cape Kormakitis</td>
<td>5</td>
<td>8 (3♂, 3 ad., 1 ovip.)</td>
</tr>
<tr>
<td>Other localities</td>
<td>73</td>
<td>128 (52♂, 3♀, 65 ad., 3 cop., 2 ovip.)</td>
</tr>
</tbody>
</table>

Table 3. Earliest and latest sightings of *Pantala flavescens* on Cyprus from 2013 to 2019. * – 2014 flight season extended into 2015.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Earliest sighting</td>
<td>03-xi</td>
<td>10-ix</td>
<td>15-x</td>
<td>15-viii</td>
<td>02-viii</td>
<td>09-vii</td>
<td>24-vii</td>
</tr>
<tr>
<td>Latest sighting</td>
<td>–</td>
<td>11-i*</td>
<td>–</td>
<td>03-xi</td>
<td>08-xii</td>
<td>10-x</td>
<td>21-xii</td>
</tr>
</tbody>
</table>

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Based on these data, the flight season of *P. flavescens* on Cyprus extends from the second half of July to the end of December. We have just one observation of the species in January (2015) which is likely to be a consequence of the 2014 season being later than normal. We do not then have any records of the species until the first half of July. The main flight season is from the first half of August to the first half of November.

*Pantala flavescens* is not only observed regularly in Cyprus, but also reproductive behaviour and proof of successful breeding has been determined. Altogether 19 cases of reproductive behaviour (in tandem, in copulae or oviposition) have been observed on Cyprus (Table 4; Fig. 3). In addition, a larva in a late stage of development was found on the Akrotiri marsh (Loc. 6d; Fig. 4) on 31-x-2018. Ten days later, on 10-xi-2018, a male in late teneral stage was discovered on the south side of the Akrotiri salt lake, just nearby the site where the larva was found. Oviposition was observed in tandem formation (*n* = 1; Fig. 5), non-contact guarding (*n* = 5; Fig. 6) and un-guarded (*n* = 5).

![Figure 3. *Pantala flavescens* in copula at the Zakaki Marsh, Akrotiri peninsula, southern Cyprus – the first document of the species’ reproductive behaviour in the eastern Mediterranean. Photo: C. Makris (07-xi-2010)](image-url)
Table 4. Reproductive behaviour of Pantala flavescens on Cyprus with reference to the type of ovipositing. Time – EET/EEST; OT – Oviposition type; TAN – oviposition in tandem; NCG – oviposition with non-contact guarding; UNG – unguarded oviposition; tan. – tandem(s); cop. – copula(e); ovip. – ovipositing female.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Locality</th>
<th>Behaviour</th>
<th>OT</th>
</tr>
</thead>
<tbody>
<tr>
<td>07-xi-2010</td>
<td>12</td>
<td>Zakaki</td>
<td>1 cop.</td>
<td>–</td>
</tr>
<tr>
<td>03-xi-2014</td>
<td>14:00</td>
<td>Zakaki, rut in a track</td>
<td>1 ovip.</td>
<td>NCG</td>
</tr>
<tr>
<td>03-xi-2014</td>
<td>14:00</td>
<td>Zakaki, rut in a track</td>
<td>1 ovip.</td>
<td>NCG</td>
</tr>
<tr>
<td>15-x-2015</td>
<td>11:30</td>
<td>Zakaki, rut in a track</td>
<td>2 ovip.</td>
<td>NCG</td>
</tr>
<tr>
<td>25-x-2015</td>
<td>54</td>
<td>Ezousa river below Agia Varvara</td>
<td>1 cop.</td>
<td>–</td>
</tr>
<tr>
<td>03-ix-2017</td>
<td>3</td>
<td>Akrotiri, gravel pits</td>
<td>1 ovip.</td>
<td>UNG</td>
</tr>
<tr>
<td>20-ix-2018</td>
<td>6</td>
<td>Akrotiri</td>
<td>1 cop.</td>
<td>–</td>
</tr>
<tr>
<td>08-x-2018</td>
<td>8</td>
<td>Akrotiri</td>
<td>2 cop.</td>
<td>–</td>
</tr>
<tr>
<td>26-x-2018</td>
<td>55</td>
<td>Agia Varvara</td>
<td>1 cop.</td>
<td>–</td>
</tr>
<tr>
<td>31-x-2018</td>
<td>6</td>
<td>Akrotiri</td>
<td>1 larva</td>
<td>–</td>
</tr>
<tr>
<td>31-x-2018</td>
<td>8</td>
<td>Akrotiri, pool 1</td>
<td>2 tan., 2 cop., 1 ovip. TAN</td>
<td></td>
</tr>
<tr>
<td>07-xi-2018</td>
<td>15:05</td>
<td>Lympia, semi-permanent stream</td>
<td>1 ovip.</td>
<td>NCG</td>
</tr>
<tr>
<td>10-xi-2018</td>
<td>15:10</td>
<td>Akrotiri Orchid Walk</td>
<td>1 teneral</td>
<td>–</td>
</tr>
<tr>
<td>02-vii-2019</td>
<td>37</td>
<td>Pegeia, swimming pool</td>
<td>1 cop.</td>
<td>–</td>
</tr>
<tr>
<td>04-vii-2019</td>
<td>11:00</td>
<td>Pervolia, swimming pool</td>
<td>1 ovip.</td>
<td>NCG</td>
</tr>
<tr>
<td>08-vii-2019</td>
<td>10:45</td>
<td>Chlorakas, swimming pool</td>
<td>1 ovip.</td>
<td>UNG</td>
</tr>
<tr>
<td>10-vii-2019</td>
<td>11:00</td>
<td>Chlorakas, swimming pool</td>
<td>1 ovip.</td>
<td>UNG</td>
</tr>
<tr>
<td>11-vii-2019</td>
<td>10.00</td>
<td>Chlorakas, swimming pool</td>
<td>1 cop.</td>
<td>–</td>
</tr>
<tr>
<td>15-ix-2019</td>
<td>27</td>
<td>Paphos, swimming pool</td>
<td>1 ovip.</td>
<td>UNG</td>
</tr>
<tr>
<td>04-xi-2019</td>
<td>12:00</td>
<td>Morphou area, stream</td>
<td>1 tan.</td>
<td>–</td>
</tr>
<tr>
<td>02-xii-2019</td>
<td>12.00</td>
<td>Rizokarpso pool 2</td>
<td>1 ovip.</td>
<td>UNG</td>
</tr>
</tbody>
</table>

Figure 4. The Akrotiri marsh area in southern Cyprus (Loc. 6), habitat of larvae of Pantala flavescens. Photo: DJS & RLS (20-ix-2018)
Figure 5. *Pantala flavescens* ovipositing in tandem at the Akrotiri marsh in southern Cyprus. Photo: MSS (31-x-2018)

Figure 6. *Pantala flavescens* ovipositing alone with the male giving non-contact guarding at a semi-permanent feeder stream to the Lym-pia reservoir south of Nicosia, Cyprus (Loc. 75). Photo: DJS & RLS (07-xi-2018)
Discussion

Annual occurrence on Cyprus

Since 2013, when regular odonate monitoring in Cyprus began, *Pantala flavescens* has been recorded every year, with a considerable annual variation in the number of records (Table 1). In the period 2013 to 2017 it was a rare migrant to the island, but since 2018 and especially in 2019 an increase in the numbers of observations was noted, and the species was relatively common. Although monitoring intensity was increased in 2018 and particularly in 2019, this only resulted in a maximum of five additional records on new sites out of a total of 45 in 2018 and around ten additional records out of a total of 146 in 2019. Due to the constant monitoring effort since 2013 in Cyprus, we can conclude that the increase in records in 2018 and in 2019 was primarily a result of an increase in the abundance of *P. flavescens*. The increased number of sightings in Europe ([Kalkman & Monnerat 2015; Piretta & Assandri 2019]) might be rather the result of the increased number of observers and recorder effort in many regions in the last two decades. Prior to 2013 there are confirmed records of *P. flavescens* from Cyprus in just two years. In 1957 Mavromoustakis collected six specimens around Limassol and Germasogeia from 04-xi to 24-xii ([Kiauta 1963]), which are the earliest records. It seems not unlikely that with six individuals being collected over a 21 day period from a small area this was the result of an (large) influx in 1957. The next records are from 2010 when a single individual was observed near the Paphos harbour on 12-viii and a copula at the Zakaki marsh on 07-xi (unpubl. data on www.observado.org and www.treknature.com). Although there are no records available from 1957 to 2010, the species certainly was present on Cyprus but observations were not published. However, in some years, e.g. 2010, it was very common on the island's wetlands (C. Makris pers. comm.). *Pantala flavescens*, therefore, has a long history on Cyprus and can be considered as a regular visitor to the island. With global warming an increase in the abundance of *P. flavescens* on Cyprus is likely in future.

Seasonal migrations of *P. flavescens* are well-known and occur in large swarms with millions of individuals covering long distances over land and sea ([Corbet 1999: 400; Cao et al. 2018]). This seasonal migration is often related to the monsoon pattern ([Anderson 2009]) and is influenced by weath-
er conditions. Considering the scarcity of records in Europe, it remains unclear from where all observed individuals originated. Given the proximity of Egypt to Cyprus, we are convinced that most or all individuals seen on Cyprus have an African origin and followed the Nile valley to the Mediterranean. In the Nile Delta migrating swarms have been observed between May and January (Kalkman & Monnerat 2015). In August 2019 millions of individuals were reported from the Göksu Delta on the south coast of Turkey (www.observation.org), just 84 km north of the Cape Apostolos Andreas area. This suggests that many *P. flavescens* individuals only had a short stop-over on Cyprus before heading north to Turkey or even further north to Europe or following the Black Sea coastline to cross the Caucasus into Russia. The time of movement corresponds with the period when most observations were made in Europe. Most of the records from Europe, however, relate to just one to three individuals (Kalkman & Monnerat 2015) and our records from Cyprus are consistent with that. The CDSG database contains 231 records from the period 2010 to 2019 with a count of 370 individuals, an average of just 1.6 individuals per record.

Although *P. flavescens* can be observed at nearly every location in Cyprus, concentrations of records and observations of several individuals are confined to specific parts of the island. The area where most individuals are seen is the Akrotiri peninsula on the south coast. A second region with a high number of records is along the west coast. Individual *P. flavescens* were frequently observed here patrolling over swimming pools after arriving from across the Mediterranean. Males typically patrolled for up to 20 minutes and then departed to the north. However, in spite of the high number of records, the concentration of individuals on this coast was lower than that on the Karpasia peninsula. Cape Kormakitis is far less remote than Cape Apostolos Andreas and several sites in the area have been regularly monitored since 2013. There are, however, only five records from this area: one in 2014 and four in 2019. There thus appear to be two northward migratory routes (Fig. 1). The main one is along the Karpasia peninsula to Cape Apostolos Andreas at the extreme north-eastern tip of Cyprus but its remoteness makes frequent monitoring difficult. A second migratory route is along the west coast from Paphos up to the Akamas peninsula. With sev-
eral members of the CDSG living in this area, monitoring is intense, resulting in a total of 86 records, and has also been consistent over the seven years of recording.

Reproduction on Cyprus
Prior to 2019 there was no reported successful breeding of *Pantala flavescent* in Europe (Günther 2019) nor even of any reproductive activity (Kalkman & Monnerat 2015; Corso et al. 2017) with the exception of a teneral male on Rhodes on 29-viii-2001 (Laister 2005). Successful breeding in Europe was only noticed in 2019, when an exuvia and an adult were discovered in south-eastern Brandenburg, Germany (Günther 2019) and when an exuvia was found in the canton of Aargau, Switzerland (Henseler et al. 2019). Nevertheless, several indications of reproductive activity are known from Cyprus (Table 4). In 2010 a copula was photographed at Zakaki marsh (Fig. 3; www.TrekNature.com) but never published and hence overlooked until now. Next, an ovipositing female was observed twice in 2014. Since then, almost yearly indications of local reproduction in Cyprus were observed (Table 4). Since 2013, when regular monitoring started, 18 instances of reproductive activity have been observed. Most are from the Zakaki/Akrotiri marsh area. This is a viable breeding location for *P. flavescent* as evidenced by the discovery of a larva in a late stage of development on 31-x-2018. Five weeks later, on 10-xi-2018, a teneral male was photographed in the vicinity, likely from successful reproduction in Cyprus. Water temperature at the Zakaki pool (Loc. 10) was 20°C on 12-i-2019 and also 20°C near the Akrotiri Orchid walk on 01-xii-2019. Although this is well above the 15°C minimum required for successful larvae development (Ichikawa et al. 2017), there is no evidence that larvae overwinter on Cyprus. Instead we believe that each year migrating individuals arrive on the island, and that some of them can reproduce in suitable habitats.

Oviposition behaviour
Corbet (1999) distinguished unguarded and guarded oviposition, when the male remains with the female for a few seconds or for much longer, and he made a further distinction between contact and non-contact guarding. Sharma (2017) reported on the mating behaviour of *P. flavescent* in India
and noted that copulae last between 70 sec to 3 min, followed by exophytic oviposition in tandem for 1 to 2 min, after which the tandem breaks and the male gives non-contact guarding to defend the female. The total duration of the reproductive behaviour was stated to be three to six minutes. Of the eleven females observed ovipositing on Cyprus, all exophytically, only one was observed doing so in tandem (Table 4; Fig. 5). In five cases, a total of six females were observed ovipositing alone while a male was hovering nearby (non-contact guarding; Fig. 6). Also in five cases, we observed females ovipositing while no male was detected around (unguarded ovipositing). Whether guarded ovipositing occurs or not may be determined by both intrinsic factors such as territoriality and by extrinsic factors such as the density and aggression of conspecific males (Corbet 1999). Many libellulid males apparently adjust their guarding intensity to changing probabilities of male harassment and female re-mating (McMillan 1991). From the five instances of unguarded oviposition, three of these involved oviposition into swimming pools. This unguarded oviposition is likely related to the absence of other males and so no harassment by them as already noted by McMillan (1991).

**Phenology**
The 237 records in the CDSG database are sufficient to give a reliable idea of the time *Pantala flavescens* is present on Cyprus and of its arrival. The first individuals are seen from mid-July and the species remains present until the end of the year. Nevertheless, the main flight season is from the beginning of August to mid-November, when numbers rapidly drop. The single record from January is without doubt a late appearance from the 2014 brood. There are no records from the second half of January to the end of June. In the Nile Valley, however, the species may be present all year round although swarms are more frequently observed between May and January (Kalkman & Monnerat 2015), which most likely explains the timing of the occurrence of the species on Cyprus. Most of the records from the southern part of Europe also fall within the Cyprus flight season timeframe. The few notable exceptions are from northern Europe where records are available from May and June, specifically from Kaliningrad Oblast, western Russia, on 29-v-2013 (Buczyński et al. 2014), Nasutów, Poland on 08-vi-2016 (Buczyński
et al. 2019) and Ventės Ragas, Lithuania, on 22-v-2019 (Jusys et al. 2019). Their origin might not be from Africa but rather from the Asian range. It is well documented that *P. flavescens* arrive in Central Asia in spring from the South, reproduce locally and their offspring migrate southward again in autumn (Borisov 2012, 2015). It is not unlikely that in some years several individuals continue their northward migration and can be seen in northeastern Europe. This phenomenon of individuals coming from the South during May and June for breeding in more temperate regions has also been observed in the Russian Far East (Borisov & Malikova 2019). The few European records do not yet provide evidence of a reverse migration from Europe to Africa (Kalkman & Monnerat 2015). Our observations clearly show that *P. flavescens* migrates in a northerly direction, but even with the increased abundances in 2018 and 2019 we have still not observed any migration in the reverse direction.

**Acknowledgements**

We would like to thank all past and present members of the CDSG whose monitoring work since 2013 have added greatly to our knowledge of the Odonata fauna of Cyprus. Special thanks go to Roger and Heather Kent, Bill Stokes and Heather Stroud who provided records involving reproductive behaviour of *Pantala flavescens*. Christodoulos Makris is thanked for the permission to publish Figure 3 and for his very helpful comments on the presence of the species in Cyprus prior to 2010. Jean-Pierre Boudot kindly provided some additional references and provided interesting discussion. Our thanks also go to the anonymous reviewers and Florian Weihrauch whose helpful comments improved our manuscript.

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Appendix 1. List of localities where *Pantala flavescens* has been observed on Cyprus between 01-i-2013 and 31-xii-2019. For each locality coordinates in decimal degrees (WGS84), altitude and date of sightings are given.

**Akrotiri peninsula**

<table>
<thead>
<tr>
<th>Loc.</th>
<th>Description</th>
<th>Coordinates</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Bishop’s pool: permanent freshwater pool (34.59739°N, 32.98586°E, 10 m a.s.l.), 08-xii-2017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2a.</td>
<td>Orchid Walk 2: marsh (34.60083°N, 32.96531°E, sea level); 2a: 10-xi-2018; 2b: 19-xii-2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3a.</td>
<td>Akrotiri gravel pits (34.60308°N, 32.93978°E, sea level); 3a: 29-viii-2017; 3b: 03-ix-2017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Akrotiri Salt Lake north: (34.62569°N, 32.95975°E, sea level), 26-ix-2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5a.</td>
<td>Fasouri south: marsh (34.62697°N, 32.93833°E, sea level); 5a: 04-xii-2014; 5b: 13-viii-2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7a.</td>
<td>Fasouri north: marsh (34.63175°N, 32.93314°E, sea level); 7a: 28-xii-2014; 7b: 21-xii-2014; 7c: 30-x-2018; 7d: 11-x-2019; 7e: 10-xi-2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8a.</td>
<td>Akrotiri pool 1: marsh and small pools (34.63195°N, 32.99370°E, sea level); 8a: 08-x-2018; 8b: 31-x-2018</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Lady’s Mile Beach: track running between a beach and the salt lake (34.63929°N, 33.00945°E, sea level), 31-viii-2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10a.</td>
<td>Zakaki: small man-made permanent pool surrounded by a marshy area (34.64128°N, 32.98983°E, sea level); 10a: 08-xii-2017; 10b: 03-x-2014; 10c: 29-vii-2019</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11a.</td>
<td>Zakaki: spring alongside a track which has been dry since 2016 (34.64219°N, 32.98280°E, sea level); 11a: 03-x-2014; 11b: 03-xi-2014; 11c: 28-xi-2014; 11d: 11-i-2015; 11e: 15-x-2015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12a.</td>
<td>Zakaki hide: marshy area and pool (34.64242°N, 33.00347°E, sea level); 12a: 07-xi-2010; 12b: 12-viii-2018</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Cape Apostolos Andreas area**

<table>
<thead>
<tr>
<th>Loc.</th>
<th>Description</th>
<th>Coordinates</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>Rizokarpaso: Kocareis Hotel (35.58842°N, 34.42303°E, 2 m a.s.l.), 22-viii-2019</td>
<td></td>
<td></td>
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<tr>
<td>17.</td>
<td>Karpasia: road (35.64847°N, 34.56431°E, 45 m a.s.l.), 08-x-2018</td>
<td></td>
<td></td>
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<tr>
<td>18.</td>
<td>Karpasia near the Oasis: puddle in a track (35.64875°N, 34.44678°E, 30 m a.s.l.), 07-xi-2017</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>near Apostolos Andreas monastery: temporary pool formed from an overflowing tank (35.65650°N, 34.650°E, 20 m a.s.l.); 19a: 05-x-2019; 19b: 06-xi-2019</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Status of *Pantala flavescens* on Cyprus

Loc. 20. Karpasia: track between Apostolos Andreas monastery and the Cape; 20a: (35.66225°N, 34.57263°E, 14 m a.s.l.), 09-x-2019; 20b: (35.66311°N, 34.56444°E, 20 m a.s.l.), 08-x-2019; 20c: (35.67888°N, 34.57703°E, 2 m a.s.l.), 02-xii-2019; 20d: (35.68248°N, 34.57627°E, 18 m a.s.l.), 09-x-2019; 20e: (35.68731°N, 34.57828°E, 21 m a.s.l.), 07-x-2018; 20f: (35.68760°N, 34.57413°E, 20 m a.s.l.), 09-x-2019; 20g: (35.69353°N, 34.58558°E, 10 m a.s.l.), 06-xi-2019; 20h: 21-xii-2019


Loc. 22. Karpasia: tank (35.67752°N, 34.56772°E, 88 m a.s.l.), 07-x-2018

Loc. 23. Karpasia: pools formed from a leaking pipe (35.68765°N, 34.57656°E, 14 m a.s.l.); 23a: 06-xi-2019; 23b: 02-xii-2019; 23c: 03-xii-2019

West Coast area

Loc. 24. Paphos: Mosaics (34.75470°N, 32.40220°E, 8 m a.s.l.), 12-viii-2010


Loc. 28. Lembra Municipal Beach: permanent stream flowing into the sea (34.81275°N, 32.39472°E, 3 m a.s.l.), 16-xi-2019

Loc. 29. Emba: swimming pool (34.81463°N, 32.42692°E, 156 m a.s.l.), 31-viii-2019


Loc. 32. Tala: swimming pool (34.84800°N, 32.43289°E, 337 m a.s.l.), 14-viii-2019

Loc. 33. Mavrokolympos valley: dry stream below dam (34.85058°N, 32.39664°E, 50 m a.s.l.), 28-ix-2019

Loc. 34. Coral Bay: car park (34.85623°N, 32.37834°E, 49 m a.s.l.), 10-xii-2019

Loc. 35. Mavrokolympos: reservoir feeder stream (34.85986°N, 32.41803°E, 139 m a.s.l.); 35a: 05-ixi-2014; 35b: 18-viii-2019; 35c: 07-xi-2019

Loc. 36. Pegeia: swimming pool (34.87634°N, 32.37424°E, 110 m a.s.l.); 36a: 02-vii-2018; 36b: 09-viii-2017

Loc. 37. Pegeia: swimming pool (34.87892°N, 32.36603°E, 99 m a.s.l.); 37a: 15-viii-2018;
Loc. 38. Avakas Gorge: car park (34.91943°N, 32.33722°E, 36 m a.s.l.), 27-viii-2019
Loc. 41. Pano Arodes: village (34.93542°N, 32.40553°E, 586 m a.s.l.), 29-viii-2019
Loc. 42. Cape Kormakitis area
Loc. 43. Morphou area: puddle in a track (35.24544°N, 33.00986°E, 76 m a.s.l.), 12-x-2014
Loc. 44. Morphou area: above a reservoir (35.25389°N, 32.98250°E, 78 m a.s.l.), 04-xi-2019
Loc. 45. Morphou area: semi-permanent stream (35.22514°N, 33.04280°E, 86 m a.s.l.), 04-xi-2019
Loc. 46. Kormakitis: field tank (35.33203°N, 33.00836°E, 159 m a.s.l.), 10-ix-2019
Loc. 47. Other localities
Loc. 48. Androthiosis: coastal beach (34.69945°N, 32.53092°E, 9 m a.s.l.), 05-ix-2019
Loc. 50. Diarizos river: Kouklia reed beds (34.71683°N, 32.57353°E, 34 m a.s.l.), 11-xi-2019
Loc. 53. Achleia: canal (34.74230°N, 32.48420°E, 41 m a.s.l.), 29-viii-2017
Loc. 55. Ezousa valley: soakaways (34.75619°N, 32.50807°E, 70 m a.s.l.); 55a: 26-x-2018; 55b: 30-x-2018; 55c: 31-x-2018; 55d: 10-xi-2019
Loc. 56. Xeros river: weir on feeder stream to the Asprokremnos reservoir (34.76217°N, 32.57969°E, 83 m a.s.l.); 56a: 14-ix-2019; 56b: 15-xi-2019
Loc. 57. Germasogeia: feeder stream to reservoir (34.76555°N, 33.10043°E, 90 m a.s.l.), 11-x-2019
Loc. 58. Ezousa river: soakaways (34.76608°N, 32.49506°E, 70 m a.s.l.), 30-x-2018
Loc. 59. Diarizos 1: river below Pastio (34.78578°N, 32.68594°E, 220 m a.s.l.); 59a: 26-x-2019; 59b: 14-x-2019
Loc. 60. Diarizos 5: river below X-treme View cafe (34.78778°N, 32.69467°E, 234 m a.s.l.), 22-x-2019
Loc. 61. Ezousa: river at the iron bridge below Episkopi (34.81192°N, 32.52886°E, 162 m a.s.l.); 61a: 03-xi-2016; 61b: 24-ix-2019
Loc. 62. Diarizos 10: river upstream from Kidasi (34.81458°N, 32.71724°E, 290 m a.s.l.), 14-x-2019
Loc. 64. Pervolia: swimming pool (34.82989°N, 33.60486°E, 1 m a.s.l.); 64a: 04-viii-2018; 64b: 04-viii-2019
Loc. 65. Arakapas 1: large agricultural tank (34.84789°N, 33.07975°E, 458 m a.s.l.); 65a: 10-x-2019; 65b: 12-xi-2019
Loc. 66. Larnaca Sewage Works: waste water lagoons (34.86034°N, 33.62714°E, 2 m a.s.l.), 08-ix-2017
Loc. 67. Agioi Vavatsinias: medium sized agricultural tank (34.86992°N, 33.19328°E, 562 m a.s.l.), 27-x-2016
Loc. 68. Larnaca: airport complex (34.87211°N, 33.60840°E, 11 m a.s.l.), 22-ix-2016
Loc. 69. Tekke Mosque: salt lake (34.88530°N, 33.61074°E, 4 m a.s.l.), 31-vii-2018
Loc. 70. Amiantos 3: stream (34.89906°N, 32.94109°E, 839 m a.s.l.), 27-viii-2019
Loc. 71. Farmakas: agricultural tank (34.92010°N, 33.13551°E, 850 m a.s.l.), 10-x-2019
Loc. 72. Agros: reservoir (34.92420°N, 33.01430°E, 1 132 m a.s.l.), 24-ix-2019
Loc. 73. Stavrostis Psokas river: near Skarfos bridge: (34.95372°N, 32.51364°E, 209 m a.s.l.), 01-x-2019
Loc. 74. Mathiatis: stream (34.97475°N, 33.32086°E, 330 m a.s.l.), 14-ix-2019
Loc. 75. Lympia: semi-permanent feeder stream to a reservoir (34.97819°N, 33.41625°E, 215 m a.s.l.); 75a: 07-xi-2018; 75b: 11-xi-2019
Loc. 76. Pediaios river: Kotsiatis reservoir (34.98947°N, 33.38735°E, 310 m a.s.l.), 11-xi-2014
Loc. 77. Pediaios river: pool downstream from Loc. 75 (34.99200°N, 33.33436°E, 304 m a.s.l.), 21-viii-2019
Loc. 78. Chrysochou: stream (35.00109°N, 32.43622°E, 55 m a.s.l.), 17-x-2019
Loc. 80. Polis: coastal area (35.04474°N, 32.42736°E, sea level), 21-vii-2018
Loc. 81. Achna: reservoir (35.04700°N, 33.80575°E, 36 m a.s.l.), 03-xi-2013
Loc. 82. Offshore nr Baths of Aprodite (35.05594°N, 32.35330°E, sea level), 08-viii-2018
Loc. 83. Kouklia: wetland (35.12300°N, 33.76422°E, 21 m a.s.l.), 01-x-2019
Loc. 84. Manglis: reservoir (35.12729°N, 33.30882°E, 180 m a.s.l.); 84a: 30-viii-2019; 84b: 17-ix-2019
Loc. 85. Nicosia: temporary pool formed after a rainstorm (35.13339°N, 33.31306°E, 210 m a.s.l.), 21-x-2019
Loc. 86. Nicosia: Pediaios river (35.15200°N, 33.34700°E, 172 m a.s.l.), 22-x-2019
Loc. 87. Mia Milia: sewage lagoons (35.18772°N, 33.44200°E, 100 m a.s.l.), 19-ix-2018
Loc. 88. Siggrassi: semi-permanent reservoir (35.28241°N, 33.85047°E, 35 m a.s.l.); 88a: 11-ix-2016; 88b: 05-x-2016
Loc. 89. Kelipini east: reservoir (35.31661°N, 33.44392°E, 87 m a.s.l.), 20-ix-2018
Loc. 90. Kelipini west: reservoir (35.32570°N, 33.43200°E, 34 m a.s.l.), 05-xi-2019