

# Observation of swarming behaviour in *Anax parthenope* on the island of Formentera, Spain (Odonata: Aeshnidae)

Joaquín Márquez-Rodríguez

Zoology Department of Physical, Chemical and Natural Systems,  
Faculty of Experimental Sciences, University of Pablo de Olavide, A-376, Km 1,  
41013 Seville, Spain, jmarrod1@upo.es

## Abstract

On 31-viii-2018 a group of several hundred adults of *Anax parthenope* was observed in the surroundings of Calò Des Mort in southeast Formentera. The group consisted of both sexes and flew in a space of 2,000 × 200 m from the cliff and in adjacent forest areas. It is suggested that the aggregation was part of a migrating swarm.

## Zusammenfassung

**Eine Beobachtung von Schwarmverhalten bei *Anax parthenope* auf der spanischen Insel Formentera (Odonata: Aeshnidae)** – Am 31. August 2018 wurde in der Umgebung von Calò Des Mort im Südosten von Formentera eine Gruppe von mehreren hundert *Anax parthenope* beobachtet. Die Gruppe bestand aus beiden Geschlechtern und flog in einem Raum von 2.000 × 200 m von der Klippe und in angrenzende Waldgebiete. Es wird davon ausgegangen, dass diese Ansammlung zu einem rastenden Wanderschwarm gehörte.

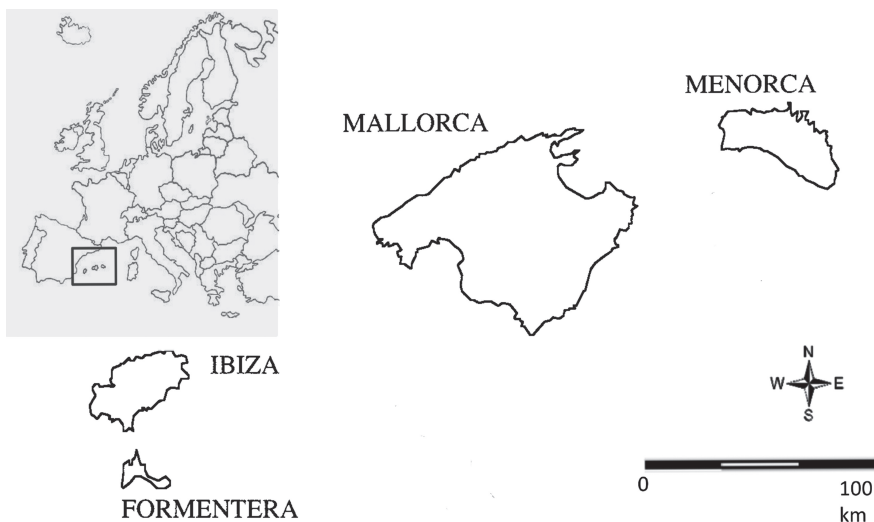
## Introduction

*Anax parthenope* occurs in Mediterranean (BOUDOT et al. 2009). This species is widespread over most of Europe and the area extends from the Iberian Peninsula and from middle and southern Latvia southernmost islands to Lithuania (KALNIŅŠ 2017) through Asia and Africa reaching Russia, Japan, China, and Sahara (ASKEW 1998; DIJKSTRA & LEWINGTON 2006; BOUDOT & KALMAN 2015). *Anax parthenope* range extends to Madeira where is it casual (PELNY 2006). Habitats of this species are standing waters such as ponds and lakes, although adults can be found far from breeding areas (ASKEW 1988; DIJKSTRA & LEWINGTON 2006). Odonata are accomplished fliers and dispersal is probably one of the most relevant and least understood processes (SHELDON et al. 2010; RAZENG et al. 2016;

SUHLING et al. 2017). Migration is a typical character within the life cycle of some odonate species, which is due to their flight capabilities (HOLUŠA 2011). Large scale movements by Odonata raise questions about population connectivity, ecosystem impacts, the nature, and evolution of cues that initiate migration, and effects of climate change on these phenomena (MAY 2012). Whereas migration predominantly takes place very inconspicuously, in some species and under certain conditions it can become a very striking phenomenon by “aggregation”, i.e., grouping in swarms numbering sometimes up to millions of individuals (CORBET 2004). This article presents the first observation of swarming behaviour in *A. parthenope* from the Balearic Islands.

### Observation

The coastal littoral is a biotope sparsely studied due to the lower availability of water. A similar methodology was followed as in other sampling for the Balearic Islands, where Odonata were observed along the path closest to the coastline at noon and in the evening (MÁRQUEZ-RODRÍGUEZ 2014). The prospective coastline was from the beach in Es Copinyar to Regana de Cala de Sa Llenya, southeast Formentera, Spain (Fig. 1). In Formentera there is almost no permanent freshwater. A dry stream was visited within the study area, Torrent des Arbocers (38.65805° N, 1.52111° E, 19 m a.s.l.), inside a forest of *Juniperus phoenicea* L. subsp. *turbinata* (Guss.) Nyman and *Pinus halepensis* Miller.



**Figure 1.** Geographical location of Formentera in the Balearic Islands. – **Abbildung 1:** Geographische Lage von Formentera auf den Balearen.

On 30 August 2018 from 14:30 to 15:45 h CEST), a perching male of *A. parthenope* was observed at a distance of approximately 20 meters from the coastline in Migjorn beach, southeast Formentera, Spain (38.66277° N, 1.51472° E, 2 m a.s.l.). Nearby and aligned towards the sea, four hours later, a male approaching the coastline was observed. Additionally, a group of *Sympetrum fonscolombii* was observed. This comprised only four individuals, two of them males, in Migjorn beach.

On 31 August 2018 from 21:30 to 22:45 h CEST (daily ambient temperature maxima < 29°C, no wind, clear), a group of *A. parthenope* was observed containing several hundred individuals, starting at the foot of the cliff and extending through it. The dragonflies swarm in the surroundings of the Calò Des Mort (38.65972° N, 1.51805° E, 12 m a.s.l.), flew from the base to the cliff's interior in the juniper forest and out again. The group, which was composed of both sexes, was observed in a space of 2,000 × 200 m from the cliff and in adjacent forest areas. On 1 September 2018 from 14:00 to 15:00 h CEST, a group of *A. parthenope* was observed on the Calò Des Mort containing less than thirty individuals. Only a few of them flew at sunset. On 2 September 2018 from 21:30 to 22:45 h CEST, only a male of *A. parthenope* was observed.



**Figure 2.** Habitat where *Anax parthenope* were observed flying in Calò Des Mort (38.659722° N, 1.518056° E), 1-ix-2018. – **Abbildung 2:** Beobachtungsort von *A. parthenope*, 01.09.2018. Photo JMR

The group of *A. parthenope* was observed for one hour flying at a height of 1 to 3 m (predominantly 1.5 to 2.5 m) above the ground. During the flight the majority of dragonflies showed no tendency to alight on the vegetation or ground, they only hunted in the air. Sant Francesc station (Formentera) recorded 15 to 25 km/h winds from the east and 24–30°C ambient temperatures on the days of observation (<https://www.meteoblue.com>).

## Discussion

Formentera is a small Mediterranean island of 82 km<sup>2</sup> with less than 20 species of catalogued Odonata (PRUNIER et al. 2015): *Ischnura elegans*, *Crocothemys erythraea*, *Sympetrum fonscolombii* are considered breeding populations (GARCÍA-AVILES et al. 1995). *Anax parthenope* is common in the Mediterranean countries, becoming scarcer further north, although it can be abundant locally (KALNIŅŠ 2009). This dragonfly is a migrating species, sometimes making mass migrations which include a high proportion of immature individuals (GAMBLES 1960; CORBET 2004; GÜNTHER 2005). Even so, knowledge of swarming behaviour in *A. parthenope* is scarce.

Dragonfly migration occurs on all continents except Antarctica, and this is a well-documented phenomenon (RUSSELL et al. 1998; MOSKOWITZ et al. 2001; FREELAND et al. 2003; ARTISS 2004; CORBET 2004; WIKELSKI et al. 2006). In some species swarming behaviour, migrating under both windy and calm conditions, has been observed. (SCHNEIDER 1981). This case is a report of swarming of *A. parthenope* away from their breeding grounds. The observation of the swirling swarm in the present case can be interpreted as a swarm's stop on its migration, since there was apparently no water in the vicinity suitable for reproduction and no reproductive behaviour was recorded. All these individuals were mature during the observation days and there were easterly winds from the sea. It can be suggested that the swarm used the road leading from Mediterranean areas and through the islands nearby facing east as a guideline for migration, a phenomenon described formerly in the literature (SCHNEIDER 1981; HOLUŠA 2011).

## References

- ARTISS T. (2004) Phylogeography of a facultatively migratory dragonfly, *Libellula quadrimaculata* (Odonata: Anisoptera). *Hydrobiologia* 515: 225–234
- ASKEW R.R. (1988) The Dragonflies of Europe. Harley, Colchester
- BOUDOT J.-P. & V.J. Kalkman (2015) Atlas of the Dragonflies and Damselflies of Europe. KNNV, Utrecht.
- BOUDOT J.-P., V.J. KALKMAN, M.A. AMORÍN, T. BOGDANOVIĆ, A. CORDERO RIVERA, G. DE GABRIELE, J.-L. DOMMANGET, S. FEIRREIRA, B. GARRIGÓS, M. JOVIĆ, M. KOTARAC, W. LOPAU, M. MARINOV, N. MIHOKOVIĆ, E. RISERVATO, B. SAMARAOUI & W. SCHNEIDER (2009) Atlas of the Odonata of the Mediterranean and North Africa. *Libellula Supplement* 9: 1–256

- CORBET P.S. (2004) Dragonflies. Behaviour and Ecology of Odonata. Harley, Colchester
- DIJKSTRA K.-D.B. & R. LEWINGTON (2006) Field guide to the dragonflies of Britain and Europe. British Wildlife Publishing. Gillingham
- DUMONT H.J. & B.O.N. HINNEKINT (1973) Mass migration in dragonflies, especially in *Libellula quadrimaculata* L.: A review, a new ecological approach and a new hypothesis. *Odonatologica* 2: 1–20
- FREELAND J.R., M. MAY, R. LODGE & K.F. CONRAD (2003) Genetic diversity and widespread haplotypes in a migratory dragonfly, the common green darner *Anax junius*. *Ecological Entomology* 28: 413–421
- GAMBLES R.M. (1960) Seasonal distribution and longevity in Nigerian dragonflies. *Journal of the West African Scientific Association* 6: 18–26
- GARCÍA-AVILÉS J., M.A. PUIG, A.G. SOLER & M. FERRERAS-ROMERO (1995) An analysis of habitat distribution and association in the Odonata of the Balearic Islands, Spain. *Odonatologica* 24: 269–283
- GÜNTHER A. (2005) *Anax ephippiger* in Europa – immer Invasionen in eine Sackgasse? (Odonata: Aeshnidae). *Libellula* 24: 241–247
- HOLUŠA O. (2011) Observations of swarming behaviour in *Selysiothemis nigra* on the island of Évia, Greece (Odonata: Libellulidae). *Libellula* 30: 233–236
- KALNIŅŠ M. (2009) Lesser Emperor *Anax parthenope* (Selys, 1839) (Odonata: Aeshnidae) – a New Dragonfly Species in Latvia. *Latvijas Entomologs* 47: 16–20
- KALNIŅŠ M. (2017) Spāres (Odonata) Latvijā. Pētījumu vēsture, bibliogrāfija un izplatība no 18. gadsimta līdz 2016. Biedrība “Zaļā upe”, Sigulda
- MÁRQUEZ-RODRÍGUEZ J. (2014) Contribución al conocimiento de la odonatofauna costera en la isla de Menorca. *Nova Acta Científica Compostelana (Biología)* 21: 7–10
- MAY M.L. (2012) A critical overview of progress in studies of migration of dragonflies (Odonata: Anisoptera), with emphasis on North America. *Journal of Insect Conservation* 17: 1–15
- MOSKOWITZ D., J. MOSKOWITZ, S. MOSKOWITZ & H. MOSKOWITZ (2001) Notes on a large dragonfly and butterfly migration in New Jersey. *Northeastern Naturalist* 8: 483–490
- PELNY H.-J. (2006) Erster Nachweis von *Anax parthenope* auf dem Madeira-Archipel (Odonata: Aeshnidae). *Libellula* 25: 27–30
- PRUNIER F., M. BROTONS, M. CABANA, F. CAMPOS, P. CASANUEVA, D. CHELMICK, A. CORDERO RIVERA, C. DÍAZ MARTÍNEZ, J.M. EVANGELIO, J.A. GAINZARAIN, J. GARCÍA-MORENO, M. LOCKWOOD, L. DE LOS REYES, J. MAÑANI, I. MEZQUITA ARANBURU, J. MUDDEMAN, F.J. OCHARAN, F. OTERO PÉREZ, E. PRIETO-LILLO, C. REQUENA, J. RIPOLL, F. RODRÍGUEZ LUQUE, P. RODRÍGUEZ, A. ROMEO, J. SALCEDO, V. SALVADOR VILARIÑO, J. SÁNCHEZ BALIBREA, R. TAMAJÓN GÓMEZ, A. TORRALBA BURRIAL, C. TOVAR, P. WINTER & R. ZALDÍVAR (2015) Actualización del inventario provincial de Odonatos de España peninsular e Islas Baleares. *Boletín ROLA* 6: 59–84
- RAZENG E., MORÁN-ORDÓÑEZ A., BRIM BOX J., TOMPSON R., DAVIS J. & P. SUNNUCKS (2016) A potential role for overland dispersal in shaping aquatic invertebrate communities in arid regions. *Freshwater Biology* 61: 745–757
- RUSSELL R.W., M.L. MAY, K.L. SOLTESZ & J.W. FITZPATRICK (1998) Massive swarm migrations of dragonflies (Odonata) in eastern North America. *The American Midland Naturalist* 140: 325–342
- SHELDON F., BUNN S.E., HUGHES J.M., ARTHINGTON A.H., BALCOMBE S.R. & C.S. FELLOWS (2010) Ecological roles and threats to aquatic refugia in arid landscapes: dryland

river waterholes. *Marine and Freshwater Research* 61: 885–895

SCHNEIDER W. (1981) Eine Massenwanderung von *Selysiothemis nigra* (van der Linden, 1825) (Odonata: Macrodiplactidae) und *Lindenia tetraphylla* (van der Linden, 1825) (Odonata: Gomphidae) in Süd-jordanien. *Entomologische Zeitschrift* 91: 97–102

SUHLING F., A. MARTENS & I. SUHLING (2017) Long-distance dispersal in Odonata: examples from arid Namibia. *Austral Ecology* 42: 544–552

WIKELSKI M., D. MOSKOWITZ, J.S. ADELMAN, J. COCHRAN, D.S. WILCOVE & M.L. MAY (2006) Simple rules guide dragonfly migration. *Biology Letters* 2: 325–329

*Manuskripteingang: 16. Januar 2019*