Atlas of the Odonata of western Sicily

Salvatore Surdo

Abstract - Given their sensitivity to environmental alterations, odonates act as reliable bioindicators of possible changes in freshwater ecosystems and associated terrestrial habitats. The geographical area spanning from Carini to Trapani and Sciacca (Provinces of Palermo, Trapani, and Agrigento - Sicily, Italy) is largely urbanized, and its territory is heavily altered, especially in proximity to the seacoast at low altitude. Despite this pervasive anthropization, the area is still characterized by a variety of freshwater habitats, possibly harboring rich odonate assemblages that, however, have never been thoroughly investigated. This study, aimed at producing the first commented checklist of the Odonata of this area enriched by distribution maps, is based on 2951 records derived from the literature (n=293), citizen-science projects (n=102), and unpublished data mainly collected by the author and spanning from 2015 to 2023 (n=2556). Despite being densely populated, strongly urbanized, agriculturally exploited, and characterized by scarce and altered heterogeneous freshwater habitats, the geographical area encompassed in this study still hosts a remarkable diversity of Odonata. Indeed, 39 species observed in the study area represent almost half (41%) of the species ever recorded in Italy (n=95) and 27% of those recorded in Europe (n=146). Despite extensive research, two species reported in the bibliography, namely *Lestes dryas* and *Aeshna cyanea* have not been contacted.

Key words: checklist, conservation, distribution, dragonflies, map, Trapani.

Riassunto - Atlante degli Odonata della Sicilia occidentale.

Data la loro sensibilità alle alterazioni ambientali, gli odonati fungono da bioindicatori affidabili per valutare gli effetti dei cambiamenti negli ecosistemi d'acqua dolce e negli habitat terrestri associati. L'area compresa tra Carini, Trapani e Sciacca (Province di Palermo, Trapani e Agrigento - Sicilia, Italia) è una delle più urbanizzate della penisola italiana e gran parte del suo territorio è stato fortemente modificato, soprattutto a bassa quota. Nonostante questa pervasiva antropizzazione, l'area è ancora caratterizzata da una varietà di habitat di acqua dolce, le cui comunità di odonati non sono mai state studiate a fondo. Questo studio, che mira a produrre la prima checklist commentata degli odonati di quest'area, arricchita da mappe di distribuzione, si basa su 2951 record derivati da letteratura (n=293), progetti di citizen-science (n=102) e da dati non pubblicati raccolti principalmente dall'autore tra il 2015 e il 2023 (n=2556). L'area di studio, nonostante la forte urbanizzazione, lo sfruttamento agricolo, l'alterazione e la scarsità di habitat d'acqua dolce ospita ancora una notevole diversità di Odonata. Le 39 specie confermate, rappresentano circa la metà (41%) di quelle registrate in Italia (n=95) e il 27% di quelle registrate in Europa (n=146). Due specie riportate in bibliografia, *Lestes dryas* e *Aeshna cyanea,* nonostante approfondite ricerche dell'autore, non sono state più ricontattate.

Parole chiave: checklist, conservazione, distribuzione, libellule, mappa, Trapani.

Agricultural, Food and Forestry Sciences Department, University of Palermo, Italy.

* Corresponding author: salvatore.surdo@unipa.it

Received for publication: 22 April 2024
Accepted for publication: 15 March 2025
Online publication: 1 April 2025

INTRODUCTION

Biodiversity loss is one of the most pressing issues that is currently facing the planet. Insects are vital components of biodiversity since they comprise over half of the world's terrestrial species, excluding eubacteria, archaea, and viruses (Stork, 2018).

The decline of terrestrial insects worldwide and the consequent future possibility of a global ecosystem collapse have now become an undeniable fact (Cardoso *et al*., 2020; Wagner, 2020).

The decline of aquatic insects is even more severe than that of terrestrial species, with generalist species (e.g., pollution-tolerant), rapidly replacing specialists (Sánchez-Bayo & Wyckhuys, 2019). Odonate assemblages respond rapidly to environmental changes, making them reliable sentinels of aquatic habitat alterations and indicators of the wider freshwater communities (Corbet, 1999; Simaika & Samways, 2011; Assandri & Bazzi, 2022).

Odonates are popular with the public and easy to identify; their large size, brilliant colors, and attractive flying patterns make them one of the most studied groups of insects by both researchers and amateurs, along with a highly appreciated subject by wildlife photographers.

In the last decades, citizen science databases have greatly contributed to the advancement of odonatological general knowledge and specialist research in European countries, including Italy. Evidence of such contribution is the publication of a national preliminary Atlas listing 93 different species, each recorded at least once (Riservato, Festi *et al*., 2014). Nevertheless, knowledge of the distribution of many Odonata species is still scarce and fragmented in large parts of the country, showing wide poorly investigated areas on the map. Western Sicily is one of them. The purpose of this work is to improve the limited odonatological knowledge of this area to be able to evaluate and interpret future changes.

MATERIALS AND METHODS

Database

This study was performed in the years 2015-2023 and includes 2951 records derived from the literature (n=293), citizen-science projects (n=102), and unpublished data mainly collected by the author and spanning from 2015 to 2023 (n=2556).

Distribution maps

All records were mapped on a 10×10 km UTM (Universal Transverse Mercator) military grid reference system (WGS84 geodesic system). The distribution maps were made with QGIS 3.22 (QGIS, 2024).

Study area

Information on the odonates of western Sicily prior to 2015 is scarce and based on a few publications that largely replicate or rework previously published information. To carry out this study, data were collected by investigating the UTM squares covering the province of Trapani and extended to partially include the provinces of Palermo up to Villagrazia di Carini (to the northeast), and Agrigento up to Sciacca (to the southeast) (Fig. 1).

Eight UTM squares containing small portions of dry land were merged with the adjacent UTM square (Fig. 2) and the Odonate species present in them were aggregated accordingly. Consequently, the number of UTM dials considered for statistical calculations was 44.

Adult individuals were mostly monitored through visual counts, using 10×40 binoculars. In some cases, specimens were collected with entomological hand nets (Ketelaar & Plate, 2001) for closer observation and identification to the species level following Dijkstra *et al.* (2020); doubts in identification were resolved by taking digital photographs of the critical specimens, which were

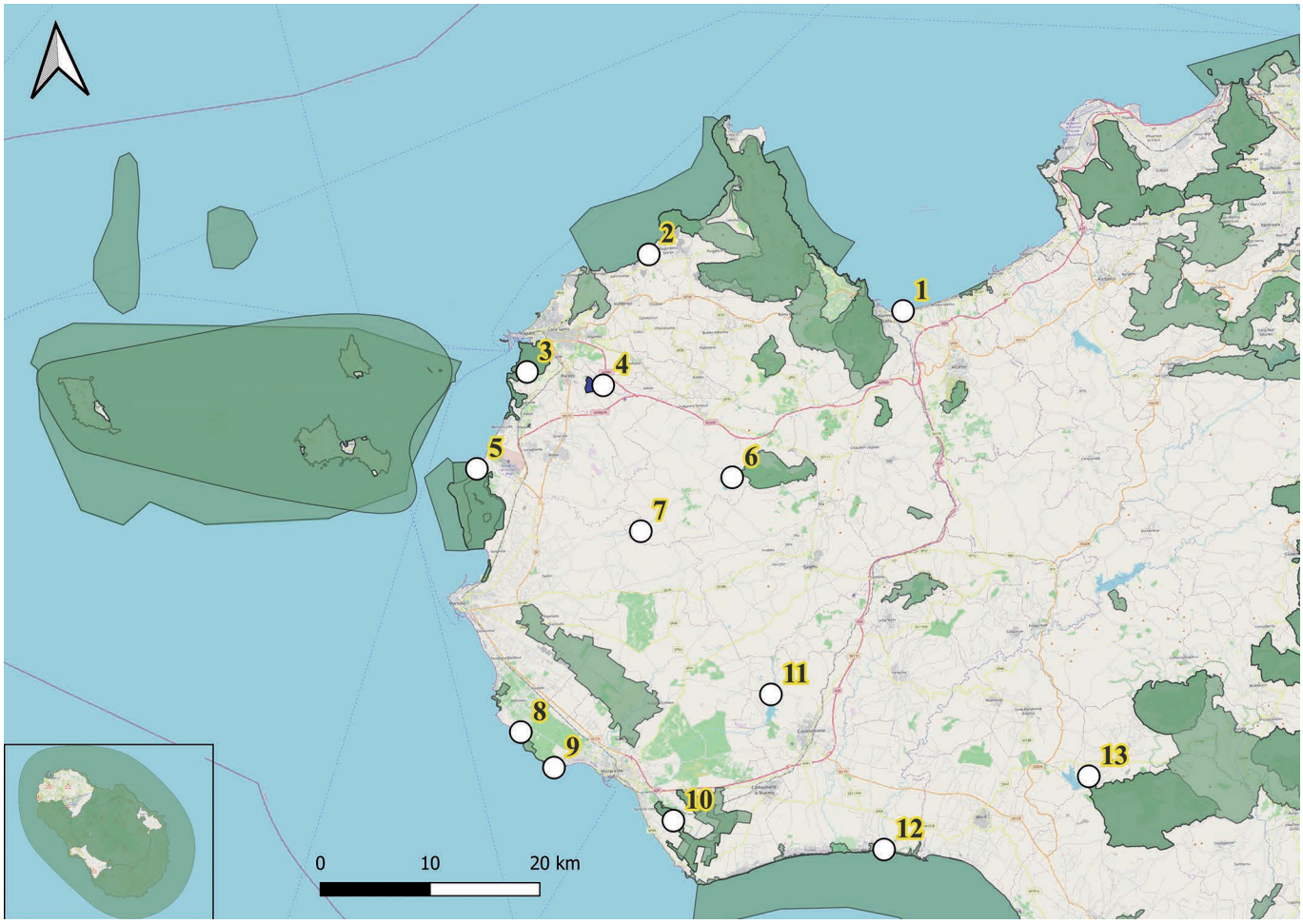


Fig. 1 – Map of the study area. The main freshwater locations and the three main cities are indicated. Regional parks, Natural Reserves and Natura 2000 sites are shown in dark green. Main localities cited in the text: 1) River San Bartolomeo; 2) Rio Forgia; 3) Saltpans of Trapani; 4) Dam Paceco; 5) Stagnone; 6) Dam Rubino; 7) Dam Zaffarana; 8) Margi Milo; 9) Capo Feto; 10) Lake Preola; 11) Dam Trinità; 12) River Belice; 13) Dam Arancio. / Cartina dell'area di studio. Le principali località e le tre città sono evidenziate. Le zone protette (Parchi regionali, Riserve Naturali e siti Natura 2000) sono evidenziati in verde scuro. Principali località citate nel testo: 1) Fiume San Bartolomeo; 2) Rio Forgia; 3) Saline di Trapani; 4) Diga Paceco; 5) Stagnone; 6) Diga Rubino; 7) Diga Zaffarana; 8) Margi Milo; 9) Capo Feto; 10) Lago Preola e Gorghi Tondi; 11) Diga Trinità; 12) Fiume Belice; 13) Diga Arancio.

then subjected to closer examination. All the individuals were released soon after the capture. Breeding behaviors were recorded following the criteria provided by Chovanec & Waringer (2001).

Observations collected by the author were used to implement a national citizen science Odonate database (www.ornitho.it), thus increasing knowledge about this family of insects.

Photos of dragonflies observed in the area under investigation were also obtained from two Facebook pages devoted to biodiversity, namely 'Fauna Siciliana' and 'Libellule d'Italia' (La Mantia *et al*., 2021; Surdo *et al*., 2023; Surdo & Verducci, 2023).

The following abbreviations and symbols have been used in the checklist to indicate breeding and conservation statuses:

Breeding status

- R: reproduction confirmed in the study area following these criteria: newly hatched imagines (teneral); larvae; reproduction behavior (copula, tandem, egg deposition); imagines observed in abundance and/or imagines over a period 1 month, and/or the same species at several water bodies situated in the area
- R?: reproduction possible, although not confirmed following these criteria: observations of an individual and on a single date or close dates.
- NR: reproduction not confirmed in the study area when there is a lack of recent observations

Conservation status

For each species treated in the checklist, we provided details on:

- hd: Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora). The Annexes (II and/or IV) in which the species is listed are specified;
- erl: European Red List of Dragonflies (Kalkman *et al*., 2010);
- irl: Italian Red List of Dragonflies (Riservato, Fabbri, *et al*., 2014).

In both Red Lists, risk categories are provided using the abbreviations codified by IUCN (2024):

- VU: vulnerable;
- NT: near threatened;
- LC: least concern;
- DD: data deficient.

The list follows the nomenclature and systematic arrangement of the Italian checklist of odonates (La Porta *et al*., 2023).

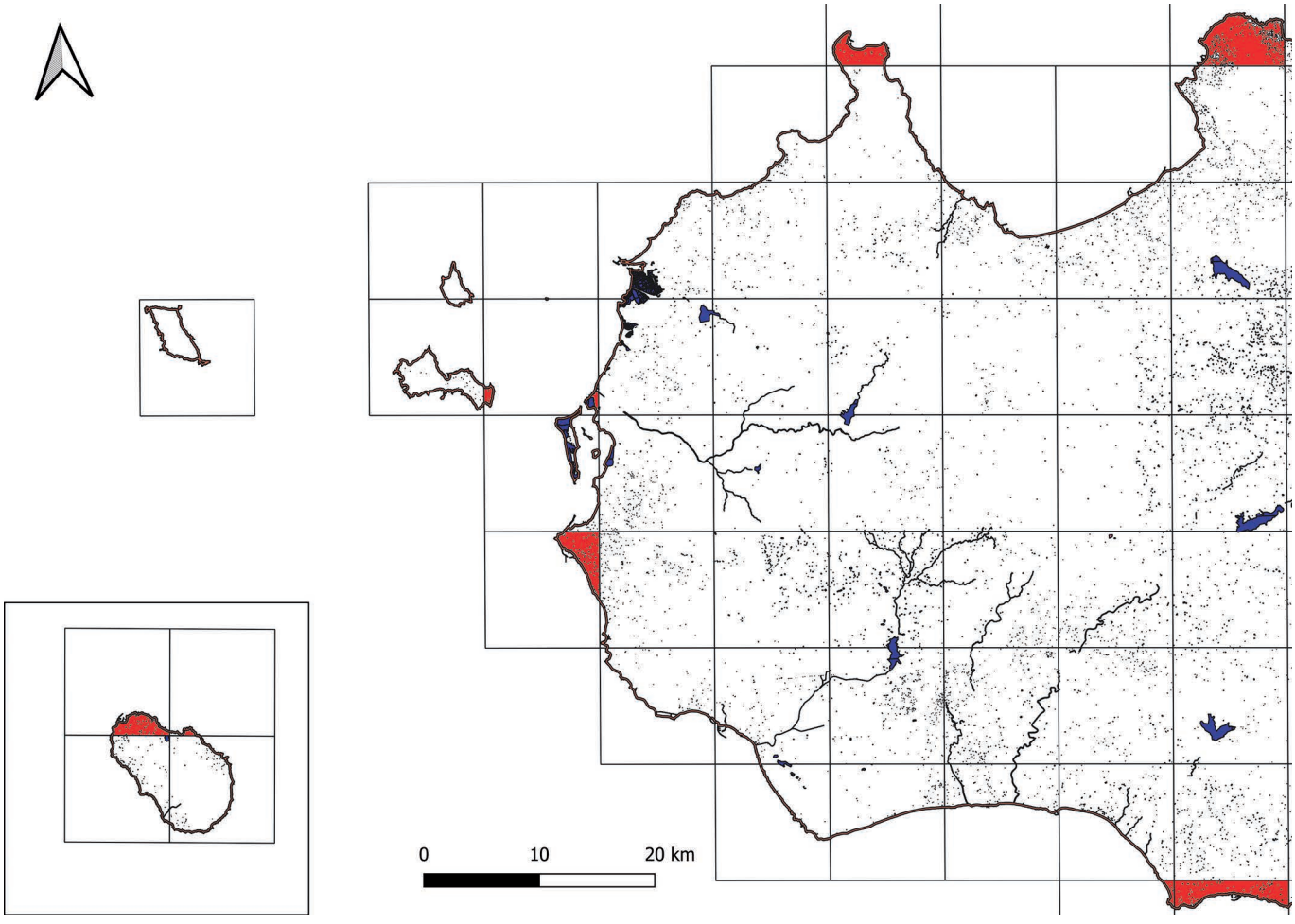


Fig. 2 – Map of the study area: in red, the merged UTM squares. / Cartina dell'area di studio: in rosso i quadranti UTM accorpati.

Studies on Odonata in Sicily

Sicily has a good naturalistic tradition, well diversified and deeply rooted over time. The first study on Odonata dates to the work by Ghiliani (1842), followed by the publications by Martens (1844), Chindieni (1846), De Selys Longchamps (1842, 1851, 1860), Pirotta (1879) and Griffini (1897). The works mentioned above have a national approach and include various orders of insects, while incidentally mentioning the Sicilian odonatofauna. During the same years, two Sicilian naturalists, Francesco Minà Palumbo (1858, 1871) and Luigi Failla Tedaldi (1887), published some entomological works focused on Sicily. From 1900 onward, odonatological research activities slowed down further, resulting in a handful of papers by Bentivoglio (1908), Capra (1934, 1963), and Bucciarelli (1971, 1977). Scientific publications on odonates regained strength only from the 1980s, when the island became the subject of extensive research, albeit mainly concentrated on the eastern side of the island (Carfi *et al*., 1980; Galletti *et al*., 1987; Lohmann, 1989; Carfi & Terzani, 1993; Pavesi & Utzeri, 1995; Malavasi, 1996; Bedjanic & Salamun, 1999; Galasso *et al*., 2016; Galasso *et al*., 2020; Galasso & Ientile, 2020; Surdo & Barbera, 2024).

RESULTS

List of species of Odonata present in western Sicily. The distribution maps are shown in Appendix 1 and follow the numbering indicated in the text next to the species name.

Calopterygidae

1. *Calopteryx haemorrhoidalis* (Vander Linden 1825)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III April - II November

Species well distributed in the study area but only with few individuals (max 250). Already reported in a few squares in the Atlas of Italian Dragonflies (Riservato, Festi *et al*., 2014), always in rivers and even highly polluted freshwater streams.

Lestidae

2. *Sympecma fusca* (Vander Linden 1820)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: I February - III November

S. fusca is common and widespread across a large part of the Mediterranean Basin (Boudot *et al.*, 2009).

Previous reports, for the geographical area of our study, consist of a single Sicilian UTM square in the previous Atlas of Italian Dragonflies (Riservato, Festi *et al*., 2014). This species is known to overwinter as an adult. During the maturation and hibernation phase, it is easy to find it in forest areas, even far away from water – from sea level up to 834 m above sea level. Probably the absence of this species in some inspected quadrants may be due to a lack of targeted research in forest environments.

3. *Chalcolestes viridis* (Vander Linden 1825)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: I July - III October

Reported in a few Sicilian squares in the "Atlas of Italian Dragonflies" (Riservato, Festi *et al*., 2014). Well-distributed in the northern part, less common in southwestern Sicily. It mainly frequents standing waters with abundant vegetation.

From sea level up to 457 m above sea level. During the maturation phase, it frequents woodland areas even far from water.

4. *Lestes barbarus* (Fabricius 1798)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III April - III November

Lestes barbarus is widespread in southern Europe but has an even wider patch distribution in north Africa (Boudot *et al.*, 2009). In Italy, the species has stable populations mainly in the center and south, but it is highly dispersive and undertakes regular movements towards the north (Riservato, Festi *et al*., 2014).

This species has a habit of frequenting areas far from the reproductive sites.

5. *Lestes dryas* (Kirby 1890)
Native status: NR
Conservation status: erl: LC; irl: LC

Lestes dryas is a Holartic species, which is largely restricted to mountainous areas in the southern parts of its range (Boudot *et al.*, 2009).

Not found personally; there is recent data for Pantano dell'Anguillara (Troia *et al*., 2016); but this species has not been observed since 2015 (C. Muscarella, pers. comm.). Not reported in these areas in the Atlas of Italian dragonflies (Riservato, Festi *et al*., 2014).

6. *Lestes virens* (Charpentier 1825) (Fig. 3)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: II May - III October

L. virens ranges from western Europe and northern Africa to Central Asia.

L. virens is a relatively common species, found in a variety of standing waters, either seasonal or permanent, particularly in lakes, ponds bordered with bushes, reeds, rushes, sedges and grasses, marshes, and brackish swamps (Boudot & Kalkmann, 2015).

This species has a habit of frequent areas far from the reproductive sites.

7. *Ischnura fountaineae* Morton 1905
Native status: R?
Conservation status: erl: VU; irl: VU

The only European locality reported was the island of Pantelleria (Lohmann, 1989).

The species has not been observed in recent years (T. La Mantia, A. Cusmano, L. Barraco, A. Barbera, P. Ferrandes, F. Di Nicola, pers. comm.). Targeted research is needed to determine if a viable population still exists on the island of Pantelleria.

8. *Ischnura genei* (Rambur 1842)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III February - II November

Ischnura genei is endemic to the Tyrrhenian Islands, Sicily, and the Maltese Islands.

Widely distributed and common in both flowing and standing waters with abundant vegetation. Reported in several squares in the previous Atlas of Italian Dragonflies (Riservato, Festi *et al*., 2014). Observed at altitudes ranging from 0 to 840 meters above sea level.

The distribution of occupied squares from 2015 to today has not changed while it seems in a clear numerical decrease. In 2015, in a transect of 500 meters along the river Baiata within the Saline of Trapani Reserve, at least 600 individuals of *I. genei* were counted; in recent years, in the same area, most are counted a few tens of individuals.

Same situation in other places like Dam Zaffarana.

9. *Coenagrion caerulescens* (Fonscolombe 1838)
Native status: R
Conservation status: erl: NT; irl: LC
Notes: flight period: III April – III August

C. caerulescens is a western Mediterranean endemic, which is rare in southern France but is reasonably common further south (Boudot *et al*., 2009).

C. caerulescens is found in running waters with hydrophytes and/or bordered by herbaceous plants. These habitats vary from small streams and seepages to medium-sized rivers. Due to the scarcity of watercourses in the study area, the species is very localized. It is replaced by its close relative, *C. scitulum*, in standing and slow-flowing waters.

Fig. 3 – *Lestes virens* (photo/foto: S. Surdo).

10. *Coenagrion puella* (Linnaeus 1758)
Native status: R
Conservation status: erl: LC; irl: LC

C. puella is common and widespread in large parts of Europe and the Mediterranean basin (Boudot *et al*., 2009). The species is rather localized in the study area, occurring only in a few localities.

11. *Coenagrion scitulum* (Rambur 1842)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III April – I September

C. scitulum has largely a Mediterranean distribution and is most common in the west of its range.

It prefers lentic or slow-flowing waters rich in aquatic vegetation, usually only observed a few individuals for each locality, rarely with abundant populations (e.g., Zaffarana Dam).

12. *Erythromma lindenii* (Selys 1840)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: II May – III August

In the study area, the species is mainly located along the southern watercourses rich in aquatic vegetation.

13. *Erythromma viridulum* (Charpentier 1840)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III May - III September

E. viridulum is a common and widespread species in large parts of Europe and the Mediterranean (Boudot *et al*., 2009).

In the study area, the species occurs in lakes, channels, or slow-flowing rivers with warm waters and rich floating aquatic vegetation.

14. *Ceriagrion tenellum* (De Villers 1789)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III June - II October

C. tenellum has a large European and North African range and reaches at least Albania in the Balkans.

Rather localized, in the study area, it occurs at well-preserved mature marshes (Margi Milo), medium-sized lakes (Lago Preola), and along freshwater streams and rivers (Barbera & Surdo, 2024).

Aeshnidae

15. *Aeshna affinis* (Vander Linden 1820)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: II June - II July

Rather localized, it has been recorded by the author only in a few locations: Salina Fiume at Marausa, Dam Arancio, and in S. Bartolomeo river.

16. *Aeshna cyanea* (Müller 1764)
Native status: NR
Conservation status: erl: LC; irl: LC

The core of the European range of *A. cyanea* is located in central and western Europe at middle latitudes, where the species is widespread and among the most common anisopterans. In Sicily, it has a patchier distribution and is likely to be affected by climate change. Species not observed by the author, only reported by old bibliography.

17. *Aeshna isoceles* (Müller 1767)
Native status: R?
Conservation status: erl: LC; irl: LC
Notes: flight period: I May - II July

Rare and localized species, observed by the author only in two localities (River Birgi and dam Trinità). Much more common in eastern Sicily.

18. *Aeshna mixta* Latreille 1805
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: I June - III November

A. mixta is common and widespread in large parts of Europe and the Mediterranean basin. The species is a strong migrant.

Except for a couple of observations in June, all the others occurred in the autumn. Migratory species can be observed also in big groups in flight in every kind of habitat.

19. *Anax imperator* Leach 1815
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: II April - II November

A. imperator is common and widespread in Europe, one of the most common species in the study area.

20. *Anax parthenope* (Selys 1839) (Fig. 4)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: II April – I December

A. parthenope is widely diffused but less common than the congener *A. imperator*.

Fig. 4 – *Anax parthenope* (photo/foto: S. Surdo).

21. *Anax ephippiger* (Burmeister 1839)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III March - II November

The presence of *A. ephippiger* in Europe is largely dependent on migration from Africa and the number of individuals arriving varies greatly between years.

The species is on the wing throughout the year in northern Africa. Migrations also take place throughout the year.

Reproduction was ascertained in the study area (e.g., Salina Fiume Marausa)

22. *Paragomphus genei* (Selys 1841)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: I May - III September

P. genei is a widespread Afrotropical species that reaches north to the Iberian Peninsula, Corsica, and southern Italy.

Its distribution is not as rare as indicated by the previous Atlas. It can easily escape observation due to the presence of few individuals per biotope and the habit of resting at a distance from the water body.

23. *Onychogomphus forcipatus* (Linnaeus 1758)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III May - I August

Present with few individuals only in the water streams rich in vegetation and with an adequate flow of water.

24. *Lindenia tetraphylla* (Vander Linden 1825)
Native status: R
Conservation status: erl: VU; irl: NT
Notes: flight period: I June – I September

The main distributional range of *L. tetraphylla* is the eastern Mediterranean and the Middle East.

The species was found for the first time in Sicily at the Trinità dam (Surdo, 2017), then in 2019 also at the Paceco dam (Surdo, 2019), both lakes rich in marsh vegetation.

L. tetraphylla is included in Annexes II and IV of the Habitats Directive, therefore better studies are needed for monitoring this species, including in relation to its extreme rarity (Trizzino *et al*. 2013).

25. *Libellula depressa* Linnaeus 1758
Native status: NR
Conservation status: erl: LC; irl: LC

Even if it is among the most common species of dragonflies in Italy, this species was not directly observed by the author; data are only from old indications in the bibliography and one observation in 2024 (I. Sparacio, pers. comm.).

26. *Orthetrum brunneum* (Fonscolombe 1837)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III April - I October

In the study area, *O. brunneum* is rather widespread in a broad variety of habitats such as small, medium, and large lakes, marshlands, rivers, and ditches.

27. *Orthetrum cancellatum* (Linnaeus 1758)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III April - I September

Uncommon but widespread in the study area, it occurs in a wide range of habitats, such as small, medium, and large lakes, marshlands, and rivers.

28. *Orthetrum coerulescens* (Fabricius 1798)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: II May - III September

Rather widespread in the study area in a broad variety of habitats such as small, medium, and large lakes, marshlands, rivers and ditches.

29. *Orthetrum nitidinerve* (Sélys 1841)
Native status: R?
Conservation status: erl: VU; irl: DD
Notes: flight period: III June – I July

An individual of this species was observed two times at the Trinità dam along a stream created by the overflowing of the river Delia (Surdo, 2017), with no subsequent observations or confirmation of a breeding population, despite the habitat appearing suitable and being thoroughly surveyed in the following years. The habitat can be classified as a slow-flowing small brook (often <1 m wide).

Very slow-flowing brooks are key habitats for the species as they often harbor large populations (Assandri *et al*., 2020).

30. *Orthetrum trinacria* (Sélys 1841) (Fig. 5)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III May - I November

O. trinacria still has a limited European distribution but seems to have expanded its range throughout the Mediterranean.

It prefers lentic systems such as man-made reservoirs and marshes with well-developed bank-side vegetation (Sánchez *et al*., 2009; De Knijf & Demolder, 2010; Loureiro, 2012). More rarely the species is found at slow-flowing stretches of rivers.

31. *Crocothemis erythraea* (Brullé 1832)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: II April - III October

C. erythraea is a widespread and common Afrotropical species, which has expanded its European range strongly to the north in the last decades (Ott, 2001).

The species is very common in the study area and occupies a wide range of lentic and lotic habitats, both mature and newly established also in degraded and rather urbanized areas.

The record for the island of Pantelleria has not been reconfirmed but there is a lack of recent odonatological research in that area.

32. *Sympetrum fonscolombii* (Sélys-Longchamps 1840)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: II January - III November

Probably the most abundant species in certain periods of the year (autumn) and present in every type of wetlands; also migrating individuals can be observed far away from breeding sites, such as urban areas, islands, and open sea.

33. *Sympetrum meridionale* (Sélys-Longchamps 1841) (Fig. 6)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III April – III October

S. meridionale is common in the Mediterranean and in parts of central Europe. It is uncommon in most of the Iberian Peninsula (Sánchez García *et al*., 2009) and southern Italy. This species habit to frequent areas far from the reproductive sites.

34. *Sympetrum sanguineum* (Müller 1764)
Native status: R
Conservation status: erl: LC; irl: LC

Only a record during this survey. Some individuals in two small ponds at Mt. San Genuardo at 800 m asl.

In the bibliography, it is reported in three other squares but surely now it is really rare and very localized.

Fig. 5 – *Orthetrum trinacria* (photo/foto: S. Surdo).

Fig. 6 – *Sympetrum meridionale* (photo/foto: S. Surdo).

35. *Sympetrum striolatum* (Charpentier 1840) (Fig. 7)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: II May – III December

Widespread, it occurs in small and medium lakes, ponds, marshlands, and slow-flowing portions of rivers and streams. Dispersing individuals can be found far away from suitable breeding habitats.

Adults are usually found from mid-May to December. Exceptionally they survive until the first month of the following year (one observation on 3 January 2020).

36. *Brachythemis impartita* (Karsch 1890)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: I May – I October

Localized in a few areas and only in some cases with relevant concentrations of individuals.

It also colonizes artificial water reservoirs with bare or little vegetated banks. The adults are also found in open spaces, such as the prairies, where they often accompany the great mammals in movement (sometimes even humans), taking advantage of the insects put in flight. Because of its behavior, if present in a biotope, this species hardly escapes detection.

Fig. 7 – *Sympetrum striolatum* (photo/foto: S. Surdo).

37. *Trithemis annulata* (Palisot de Beauvais 1805)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III May – I November

Within a few decades, *T. annulata* has colonized most of Mediterranean Europe and is now common and widespread at both coastal and inland localities.

T. annulata is a ubiquitous species and inhabits a wide range of sun-exposed, slow-flowing, and standing water. It favors warm conditions and is often found in ditches, natural and man-made lakes, troughs, small basins, and sluggish streams and rivers.

38. *Selysiothemis nigra* (Vander Linden 1825) (Fig. 8)
Native status: R
Conservation status: erl: LC; irl: LC
Notes: flight period: III May – I November

S. nigra has a widespread but patchy distribution from southwest and central Asia to the Arabian Peninsula, North Africa and the Mediterranean basin. Despite being widely distributed; the species is generally scarce throughout most of its range.

This species has shown an increasing trend in Europe in the last decades, with genuine growth in the number of populations within its existing range thanks to the creation of numerous man-made ponds and reservoirs (Brochard & van der Ploeg, 2013; Boudot, 2014; Uboni *et al*., 2015).

All the observations collected are generally related to one-three individuals per locality except for a record of at least 40 individuals near Castelvetrano.

39. *Zygonyx torridus* (Kirby 1889)
Native status: R
Conservation status: erl: VU; irl: DD
Notes: Flight period: I June – I September

Three males were collected in Sicily in 1976 (Kunz *et al*., 2006); a male was photographed in 2013 and three exuviae were collected in 2014 at the same locality, demonstrating the presence of a breeding population (Riservato, Fabbri *et al*., 2014; Soinski, 2015).

Observed regularly since 2015 (Surdo, 2015), almost all observations are related to the Belice river basin whose waters also receive geothermal source input. This peculiarity has already been noted for this species (Martin, 2019).

Fig. 8 – *Selysiothemis nigra* (photo/foto: S. Surdo).

CONCLUSIONS

In the area we considered for this study, semi-arid climatic conditions have constrained freshwater ecosystems to small temporary habitats and artificial reservoirs (Naselli-Flores *et al*., 1998).

Moreover, lowland areas are mostly occupied by intensive agriculture and infrastructures, which replaced most of the natural and semi-natural habitats.

Concerning dragonflies, it is evident how this taxon is positively influenced by the increase of artificial irrigation lakes and, on the other hand, negatively influenced by intensive farming practices, which determine the deterioration of the environmental matrix of freshwater habitats (Lee Foote & Rice Hornung, 2005; Raebel *et al*., 2012).

In the sites investigated, intensive agriculture has negatively impacted freshwater biodiversity through multiple factors: from active water abstractions, which consequently influences water levels and hydroperiod, to the dramatic increase in the use of fertilizers (both natural and chemical), driven by the intensification of livestock farming in the last decades (Massa & La Mantia, 2007). This has led to the eutrophication of water bodies further aggravated by the pesticides, which are washed and taken up into water bodies (Bartzen *et al*., 2010).

In Italy, since the release of the first provisional atlas of distribution of odonates (Riservato *et al*., 2014a), efforts to fill the 'Wallace deficit' (Lomolino, 2004) have also increased steadily for this taxonomic group (Sindaco *et al*., 2018; Assandri, 2019; Corso *et al*., 2019; Dal Cortivo & Roncen, 2019; Bonometto, 2020; Zandigiacomo *et al*., 2020; Assandri & Bazzi, 2022). This contribution follows this red line by providing the first extensive synthesis of odonates in a densely inhabited area of the region, which has been surprisingly neglected and ignored by odonatologists until now. I hope this paper will represent a solid basis for other studies and provide information for freshwater conservation actions and landscape planning in the Sicily Region.

From a conservation perspective, it should be noted that several key sites (Tab. 1) are not yet included in protected areas, e.g., all dams (Poma, Rubino, Paceco, Zaffarana, Trinità, Arancio and Garcia) or are protected without any real and effective conservation action e.g., Capo Feto, Margi Spanò (Fig. 9), Milo and Nespolillo, Pantano Leone. All these localities deserve particular attention because of their importance for odonates and other taxa (e.g., birds).

Despite being densely populated, strongly urbanized, agriculturally exploited, and characterized by altered and heterogeneous freshwater scarcity habitat, the study area still hosts a remarkable diversity of Odonata. Indeed, the 39 confirmed species, reproduce - or have reproduced in the past - in the study area, representing about the half

Fig. 9 – Marsh Capo Feto and Margi Spanò: Tab. 1, row 9 (photo: A. Barbera) / Paludi di Capo Feto e Margi Spanò: Tab. 1, riga 9 (foto: A. Barbera).

Tab. 1 – Characteristics of the localities studied. The list includes sites with at least 50 records and 10 species of dragonflies. Localities are numbered in accordance with Fig. 1. / Caratteristiche delle località studiate. L'elenco comprende siti con almeno 50 record e 10 specie di libellule. Le località sono numerate in base alla Fig. 1.

	Locality	Records	No. species	Typical habitat	Altitude (m a.s.l.)	Area
1	River San Bartolomeo	80	15	River	0-210	14 km
2	Rio Forgia	96	17	River	0-200	12 km
3	Saltpans of Trapani	325	17	Saltpans	2	910 ha
4	Dam Paceco	135	17	Dam	41	226 ha
5	Stagnone	64	15	Lagoon	1	2012 ha
6	Dam Rubino	107	21	Dam	186	157 ha
7	Dam Zaffarana	143	17	Dam	84	24 ha
8	Margi Milo	58	12	Coastal marsh	2	19 ha
9	Capo Feto	35	12	Coastal marsh	2	165 ha
10	Lake Preola	51	11	Natural lake	4	150 ha
11	Dam Trinità	162	21	Dam	68	180 ha
12	River Belice	201	24	River	0-90	34 km
13	Dam Arancio	64	15	Dam	180	370 ha

(41%) of 95 species ever recorded in Italy (La Porta *et al*. 2023) and 27% of the 146 recorded in Europe (Boudot & Kalkman, 2015; Dijkstra *et al*., 2023)

The loss and degradation of freshwater biodiversity have far-reaching implications with respect to our chances for achieving many of the globally agreed goals and targets, such as the Sustainable Development Goals (SDGs). For instance, the SDGs include targets: to protect and restore water related ecosystems (Target 6.1); to ensure the conservation, restoration, and sustainable use of terrestrial and inland freshwater ecosystems and their services (Target 15.1); to reduce the degradation of natural habitats, halt the loss of biodiversity and protect and prevent the extinction of threatened species (Target 15.5). Despite these laudable objectives, without a change in policy direction these and other targets for freshwater ecosystems conservation will not be reached.

ACKNOWLEDGEMENTS

I would like to thank the observers who provided some of the data on which this atlas is based: Antonino Barbera, Luigi Barraco, Andrea Cusmano, Davide D'Amico, Calogero Muscarella, Ignazio Sparacio, Giovanni Spinella. A special thanks to Paolo Galasso for reviewing and improving the first draft of the manuscript. I am particularly grateful to the editor Giorgio Chiozzi for his helpful comments and review of the English text.

REFERENCES

Assandri G., 2019 – A critical review of the odonate fauna of Trentino: annotated checklist and new relevant data for Italy (Insecta: Odonata). *Fragmenta Entomologica*, 51: 75-88.

Assandri G. & Bazzi G., 2022 – Natural and anthropogenic determinants of peatland dragonfly assemblages: implications for management and conservation. *Biodiversity and Conservation*, 31 (2): 703-722.

Assandri G., Bazzi G., Maggioni D., Galimberti A. & Kunz B., 2020 – Distribution, autecology, genetic characterization, and conservation of the Western Mediterranean endemic dragonfly *Orthetrum nitidinerve* (Selys, 1841): insights from Italy. *International Journal of Odonatology*, 23: 405-422.

Bartzen B.A., Dufour K.W., Clark R.G. & Caswell F.D., 2010 – Trends in agricultural impact and recovery of wetlands in prairie Canada. *Ecological Applications*, 20: 525-538.

Bedjanic M. & Šalamun A., 1999 – Contribution to the knowledge of the odonate fauna of Sicily, with some additional data from Basilicata, southern Italy. *Opuscula Zoologica Fluminensia*, 169: 1-14.

Bentivoglio T., 1908 – Distribuzione geografica dei Libellulidi in Italia. *Atti della Società dei Naturalisti e Matematici di Modena*, serie IV, IX: 22-47.

Bonometto L., 2020 – Le libellule del Cadore. Le specie, gli habitat, le tutele possibili. *Parco Naturale Regionale delle Dolomiti d'Ampezzo*, Quinto di Treviso.

Boudot J.-P., 2014 – A brief observation of egg laying in *Lindenia tetraphylla* (Odonata: Gomphidae) on Kríti (Crete), Greece. *Notulae odonatologicae*, 8 (4): 94-96.

Boudot J.P. & Kalkman V.J., 2015 – Atlas of the European dragonflies and damselflies. *KNNV Publishing*, Eindhoven.

Boudot J.P., Kalkman V.J., Azpilicueta Amorin M., Bogdanovic T., Cordero Rivera A., Degabriele A., Dommanget J.L., Ferreira S., Garrigos B., Jovic M., Kotarac M., Lopau W., Marinov M, Mihokovic N., Riservato E., Samraoui B. & Schneider W., 2009 – Atlas of the Odonata of the Mediterranean and north Africa. *Libellula Supplement*, 9: 1-256.

Brochard C. & van der Ploeg E., 2013 – Searching for exuviae of endemic Odonata species in Greece. *Brachytron*, 15: 83-101.

Bucciarelli I., 1971 – Presenza in Sicilia di una colonia di *Selysiothemis nigra* (V.d.Lind.) e note su altre specie raccolte nell'isola e nell'Italia meridionale. II contributo alla conoscenza degli Odonata. *Bollettino della Società Entomologica Italiana*, 103: 175-185.

Bucciarelli I., 1977 – Dati preliminari sul popolamento odonatologico di Calabria, Sicilia e Sardegna (VIII contributo alla conoscenza degli Odonati). *Annali del Museo civico di Storia Naturale Giacomo Doria*, 81: 374-386.

Capra F., 1934 – Su alcuni Odonati e Mirmeleonidi di Sicilia. *Annali del Museo civico di Storia Naturale Giacomo Doria*, 57: 92-97.

Capra F., 1963 – Odonati raccolti in Sicilia durante il VII Convegno del G.I.B.. *Rivista di Idrobiologia*, 2 (2-3): 129-133.

Cardoso P., Barton P.S., Birkhofer K., Chichorro F., Deacon C., Fartmann T., Fukushima C.S., Gaigher R., Habel J.C., Hallmann C.A., Hill M.J., Hochkirch A., Kwak M.L., Mammola S., Noriega J.A., Orfinger A.B., Pedraza F., Pryke J.S., Roque F.O., Settele J., Simaika J.P., Stork N.E., Suhling F., Vorster C. & Samways M.J., 2020 – Scientists' warning to humanity on insect extinctions. *Biological Conservation*, 242: 108426.

Carfi S. & Terzani F., 1993 – Attuali conoscenze del popolamento odonatologico della Sicilia e delle isole dipendenti (Odonata). *Memorie della Società Entomologica Italiana*, 71 (2): 427.

Carfi S., Del Centina P. & Terzani F., 1980 – Odonati raccolti in Sicilia, Calabria e Basilicata negli anni 1963-1977. III contributo alla conoscenza degli Odonati italiani. *Redia*, 63: 37-47.

Chindieni S., 1846 – L'Anapo, il Ciane, ed il Papiro. *Giornale del Gabinetto Letterario dell'Accademia Gioenia*, 9: 26.

Chovanec A. & Waringer J., 2001 – Ecological integrity of river-floodplain systems. Assessment by dragonfly surveys (Insecta: Odonata). *Regulated Rivers Research & Management*, 17 (4-5): 493-507.

Corbet P., 1999 – Dragonflies: behaviour and ecology of Odonata. *Harley Books*, London.

Corso A., Janni O., Fracasso C., Biscaccianti A. & De Lisio L., 2019 – New data on the distribution of the endangered dragonflies *Oxygastra curtisii* (Dale, 1834), *Somatochlora meridionalis* (Vander Linden, 1825) and *S. flavomaculata* Nielsen, 1935 in Central Southern Italy (Odonata Cordulidae). *Biodiversity Journal*, 10 (3): 195-200.

Dal Cortivo M. & Roncen N., 2019 – Nuovi dati sulle Libellule della Provincia di Belluno (Insecta: Odonata). *Bollettino del Museo Civico di Storia Naturale di Verona*, 43: 5-12.

De Knijf G. & Demolder H., 2010 – Odonata records from Alentejo and Algarve, southern Portugal. *Libellula*, 29: 61-90.

De Selys Longchamps E., 1842 – Enumération des libellulidées de l'Italie. *Atti della Terza Riunione degli Scienziati italiani tenuta in Firenze nel settembre del 1841*, 338-339.

De Selys Longchamps E., 1851 – Résumé géographique sur les libellules de l'Italie continentale et insulaire. *Memorie della Reale Accademia delle Scienze di Torino*, 11: 64-68.

De Selys Longchamps E., 1860 – Catalogue des Odonates de la Sicile, établi après un examen des chasses de M. E. Bellier de la Chavignerie. *Annales de la Société Entomologique de France*, 8: 741-745.

Dijkstra K., Assandri G. & Galimberti A., 2023 – Morphological and molecular evidence supports the species status of the Italian endemic *Coenagrion castellani* Roberts, 1948 (Coenagrionidae). *International Journal of Odonatology*, 26: 44-53.

Dijkstra K.D.B., Schröter A. & Lewington R., 2020 – Libellule d'Italia e d'Europa. *Ricca Editore*, Roma.

Failla Tedaldi L., 1887 – Escursione entomologica all'isola di Lampedusa. *Il Naturalista Siciliano*, 6: 53-56.

Galasso P., Curcuraci N. & Marletta A., 2016 – First record of *Brachytron pratense* (Müller, 1764) in Sicily (Odonata Aeshnidae). *Biodiversity Journal*, 7 (1): 51–54.

Galasso P., Marletta A. & Corso A., 2020 – Odonata of Sicilian southeast swamp lakes "Pantano Cuba" and "Pantano Longarini" (SE-Sicily, Italy). *Biodiversity Journal*, 11 (1): 57-64.

Galasso P. & Ientile R., 2020 – Odonata checklist of nature reserve and SAC (special area of conservation) "Vallone di Piano della Corte" (Sicily, Italy). *Biodiversity Journal*, 11 (4): 837-844.

Galletti P.A., Pavesi M. & Romano F.P., 1987 – *Brachythemis leucosticta* (Burm.) e considerazioni su altri Odonati nuovi per la Sicilia (Insecta, Odonata). *Il Naturalista Siciliano*, 11 (1-4): 27-46.

Ghiliani V., 1842 – Insetti di Sicilia determinati dal sig. F. Ghiliani nel suo viaggio in questa isola anno 1839. *Atti dell'Accademia Gioenia di Scienze Naturali*, 18: 19-48.

Griffini A., 1897 – Imenotteri, neurotteri, pseudoneurotteri, ortotteri e rincoti italiani. Entomologia IV. *Hoepli*, Milano.

Kalkman V.J., Boudot J.P., Bernard R., De Knijf G., Dyatlova E., Ferreira S., Jovic M., Ott J., Riservato E. & Sahlén G., 2010 –European red list of dragonflies. *Publications Office of the Atlantic Union*, Luxembourg

Ketelaar R. & Plate C., 2001 – Manual Dutch dragonfly monitoring scheme. Report VS2001.028. *Dutch Butterfly Conservation & Centraal Bureau voor de Statistiek*, Wageningen and Voorburg.

Kunz B., Ober S.V. & Jödicke R., 2006 – The distribution of *Zygonyx torridus* in the Palaearctic (Odonata: Libellulidae). *Libellula*, 25 (1/2): 89-108.

IUCN, 2024 – The IUCN red list of threatened species. Version 2024-1. <https://www.iucnredlist.org>

La Mantia T., Cusimano C., La Mantia A., Lo Duca R., Surdo S. & Massa B., 2021 – Aggiornamento sulla distribuzione del Succiacapre *Caprimulgus europaeus* (Aves Caprimulgidae) in Sicilia. *Il Naturalista Siciliano*, 45 (1-2): 153-158.

La Porta G., Landi F., Leandri F. & Assandri G., 2023 – The new checklist of the Italian Fauna: Odonata. Biogeographia. *Journal of Integrative Biogeography*, 38 (1): uc1009.

Lee Foote A. & Rice Hornung C.L., 2005 – Odonates as biological indicators of grazing effects on Canadian prairie wetlands. *Ecological Entomology*, 30: 273-283.

Lohmann H., 1989 - *Ischnura fountainei* Morton auf der Insel Pantelleria, Italien: Erstnachweis für Europa (Zygoptera: Coenagrionidae). *Notulae odonatologicae*, 3 (4): 61.

Lomolino M.V., 2004 – Conservation biogeography. In: Frontiers of biogeography: new directions in the geography of nature. Lomolino M.V., Heaney L.R. (eds.). *Sinauer Associates*, Sunderland.

Loureiro N.S., 2012 – New data on the distribution of *Orthetrum trinacria* in Algarve, southern Portugal (Odonata: Libellulidae). *Libellula*, 31: 77-87.

Malavasi D., 1996 – Contributo alla conoscenza degli Odonati dell'isola di Ustica (Odonata). *Bollettino dell'Associazione Romana di Entomologia*, 50 (1/4): 3-4

Martens, G. von, 1844 – Italien. Zweiter band. Italisches Leben. *Scheible, Rieger & Sattler*, Stuttgart.

Martin A.R., 2019 – Evidencia de la reproducción de *Zygonyx torridus* (Kirby, 1889) (Odonata, Libellulidae) en un tramo de río de carácter geotermal. *Arquivos Entomolóxicos*, 21: 133-144.

Massa B. & La Mantia T., 2007 – Forestry, pasture, agriculture and fauna correlated to recent changes in Sicily. *Forest@*, 4(4): 418-438.

Naselli-Flores L, Barone R, Zunino M., 1998 – Distribution patterns of freshwater zooplankton in Sicily (Italy). *Verhandlungen des Internationalen Verein Limnologie*, 26: 1973-1980.

Ott J., 2001 – Expansion of Mediterranean Odonata in Germany and Europe – consequences of climatic changes. In: "Fingerprints" of climate change. Adapted behaviour and shifting species ranges. Walther G.R., Burga C.A. & Edwards P.J. (eds.). *Kluwer Academic/Plenum Publishers*, New York, 89-111.

Palumbo F., 1858 – Escursione entomologica nelle Madonie. *La Palingenesi*, 1: 1-12.

Palumbo F., 1871 – Neurotteri della Sicilia. *Biblioteca del Naturalista Siciliano*, 9: 1-28.

Pavesi M. & Utzeri C., 1995 – Odonata. In: Arthropoda di Lampedusa, Linosa e Pantelleria (Canale di Sicilia, Mar Mediterraneo). Massa B. (ed.). *Il Naturalista Siciliano*, 19: 151-162.

Pirotta R., 1879 – Libellulidi italiani. *Annali del Museo civico di Storia Naturale di Genova*, 14: 401-489.

QGIS Development Team, 2024 – QGIS geographic information system. Open Source Geospatial Foundation Project. <http://qgis.osgeo.org>

Raebel E.M., Merckx T., Feber R.E., Riordan P., Macdonald D.W. & Thompson D.J., 2012 – Identifying high quality pond habitats for Odonata in lowland England: implications for agri-environmnet schemes. *Insect Conservation and Diversity*, 5: 422-432.

Riservato E., Festi A., Fabbri R., Grieco C., Hardersen S., La Porta G., Landi F., Siesa M.E. & Utzeri C., 2014 – Odonata - atlante delle libellule italiane- preliminare. *Edizioni Belvedere*, Latina.

Riservato E., Fabbri R., Festi A., Grieco C., Hardersen S., Landi F., Utzeri C., Rondinini C., Battistoni A. & Teofili C., 2014 – Lista Rossa IUCN delle libellule Italiane. *Comitato Italiano IUCN e Ministero dell'Ambiente e della Tutela del Territorio e del Mare*, Roma.

Sánchez A., J. Pérez, Jiménez E. & Tovar C., 2009 – Los Odonatos de Extremadura. *Consejería de Industria, Energía y Medio Ambiente*, Cáceres.

Sánchez-Bayo F. & Wyckhuys K.A.G., 2019 – Worldwide decline of the entomofauna: a review of its drivers. *Biological Conservation*, 232: 8-27.

Simaika J. & Samways M., 2011 – Comparative assessment of indices of freshwater habitat conditions using different invertebrate taxon sets. *Ecological Indicators*, 11 (2): 370-378.

Sindaco R., Savoldelli P. & Bombonati D., 2018 – Le libellule (Insecta: Odonata) di interesse comunitario in Piemonte: lo stato attuale delle conoscenze. *Rivista Piemontese di Storia Naturale*, 39: 373-388.

Soinski M., 2015 – Erster entwicklungsnachweis von *Zygonyx torridus* für Sizilien (Odonata, Libellulidae). *Libellula*, 34 (1/2): 85-89.

Stork N.E., 2018 – How many species of insects and other terrestrial arthropods are there on Earth? *Annual Review of Entomology*, 63: 31-45.

Surdo S., 2015 – Osservazioni di *Zygonyx torridus* (Kirby 1889) (Insecta Odonata) in Italia. *Il Naturalista Siciliano*, XXXIX: 439-440.

Surdo S., 2017 – First record of *Lindenia tetraphylla* (Vander Linden, 1825) and rediscovery of *Orthetrum nitidinerve* (Selys, 1841) Sicily (Insecta: Odonata), Fragmenta Entomologica, 49 (2): 185-189.

Surdo S., 2019 – Citizen science: Sicilian naturalistic news. *Il Naturalista Siciliano*, XLIII (2): 253-257.

Surdo S. & Barbera A., 2024 – Checklist Odonata of Wetlands in southwestern Sicily (Italy): Pantano Leone, Capo Feto, Margi Spanò, Nespolilla and Milo. *Biodiversity Journal*, 15 (2): 391-397.

Surdo S., Cusimano C. & Lo Duca R., 2023 – Nuovi dati sull'espansione dell'occhione *Burhinus oedicnemus* in Sicilia. Una riflessione sulla citizen science. *Rivista Italiana di Ornitologia*, 93 (1): 29-32.

Surdo S. & Verducci D., 2023 – Update of the Leatherback sea turtle *Dermochelys coriacea* (Vandelli, 1761) and Green turtle *Chelonia*

mydas (Linnaeus, 1758) observations in Italy (Reptilia Testudines). *Biodiversity Journal*, 14 (4): 851-865.

Trizzino M., Audisio P., Bisi F., Bottacci A., Campanaro A., Carpaneto G.M., Chiari S., Hardersen S., Mason F., Nardi G., Preatoni D.G., Vigna Taglianti A., Zauli A., Zilli A. & Cerretti P., 2013 – Gli artropodi italiani in Direttiva Habitat: biologia, ecologia A., riconoscimento e monitoraggio. *Quaderni Conservazione Habitat*, 7.

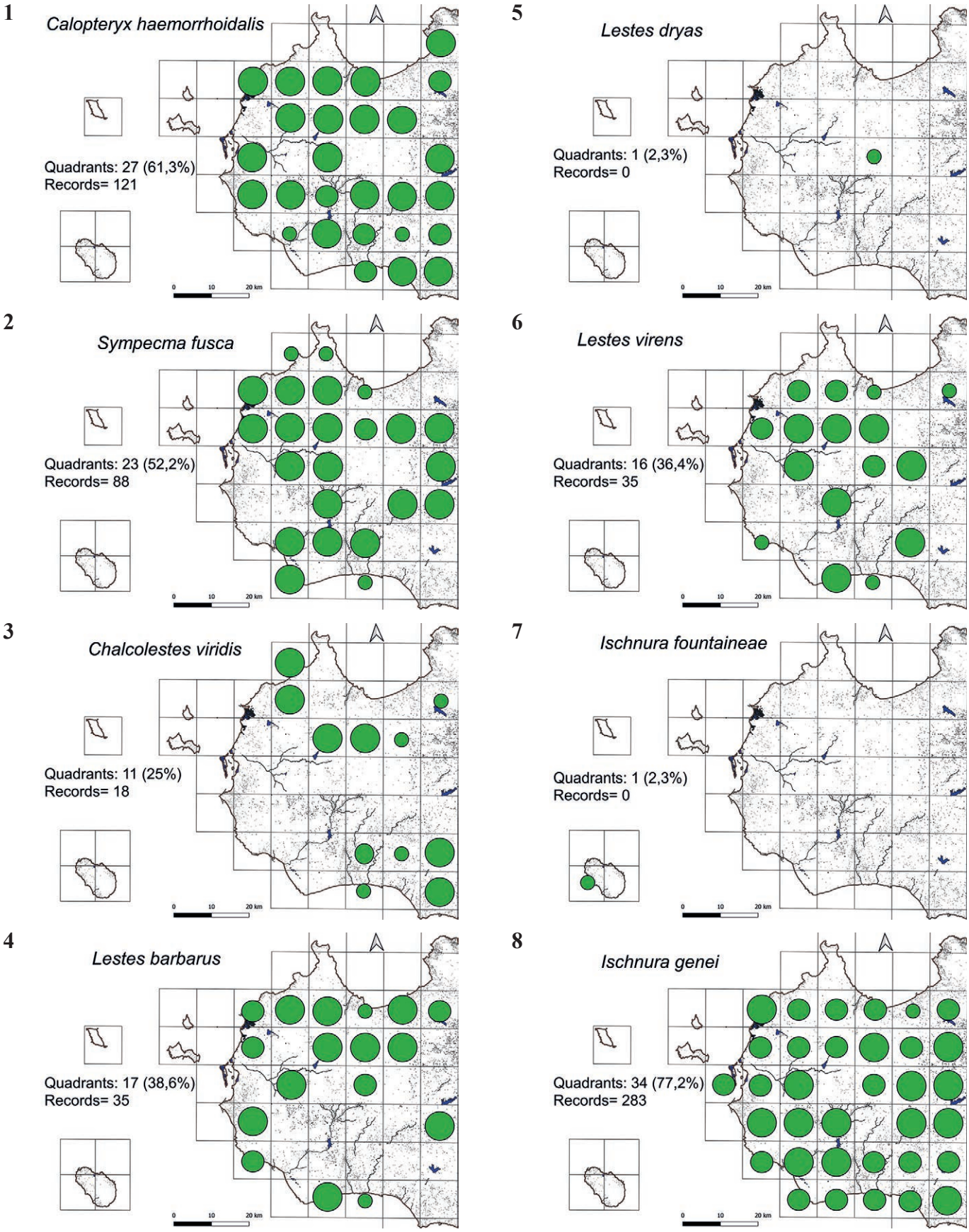
Troia A., Adragna F., Campisi P., Dia M.G., Ilardi V., La Mantia T., La Rosa A., Lo Valvo M., Muscarella C., Pasta S., Pieri V., Scuderi L., Sparacio I., Stoch F. & Marrone F., 2016 – I pantani di Anguillara (Calatafimi Segesta, Trapani): dati preliminari sulla biodiversità a supporto della tutela del biotopo. *Il Naturalista Siciliano*, 40 (2): 171-200.

Uboni C., Nadalon G. & Schröter A., 2015 – Evidence of breeding of *Selysiothemis nigra* in the regions of Friuli Venezia Giulia and Veneto, northeastern Italy (Odonata: Libellulidae). *Notulae odonatologicae*, 8 (5): 128-136.

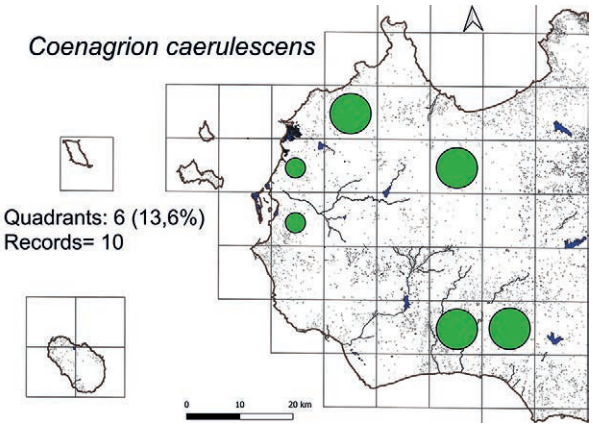
Wagner D.L., 2020 – Insect declines in the Anthropocene. *Annual Review of Entomology*, 65: 457-480.

Zandigiacomo P., Chiandetti I., Fiorenza T. & Pontarini R., 2020 – Interesting records of Odonata in Friuli Venezia Giulia (north-eastern Italy) in the three-year period from 2016 to 2018. *Gortania*, 42: 95-108.

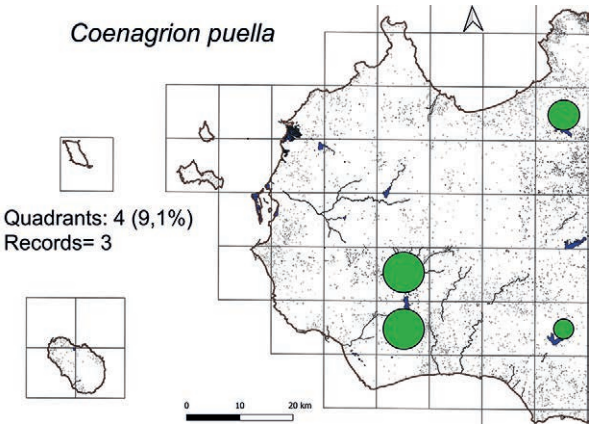
Appendix 1 – Distribution maps of odonates of western Sicily. Numbering of each map refer to the species list in the main text. Legend: Large Circle = Present study; medium circle = Bibliography + present study; small circle = Bibliography. The number in Records refers to author and/or unpublished reports and does not include bibliographic reports. / Mappe di distribuzione degli odonati della Sicilia occidentale. La numerazione delle singole mappe è riferita alla lista delle specie nel testo principale. Legenda: Pallino grande = Dati inediti; pallino medio = Dati inediti + Bibliografia; pallino piccolo = Bibliografia. Il numero riportato alla voce Records si riferisce alle segnalazioni dell'autore e inedite e non include quelle bibliografiche.



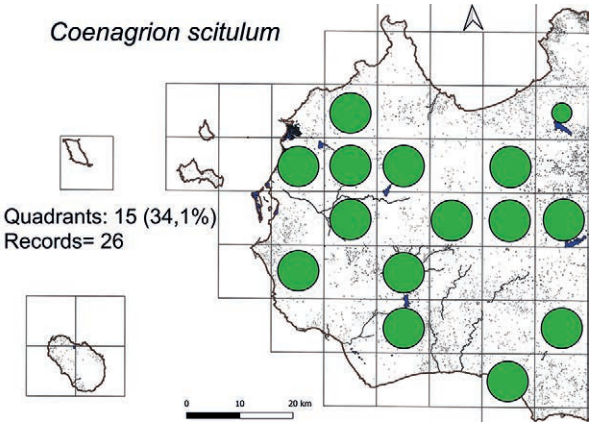
9



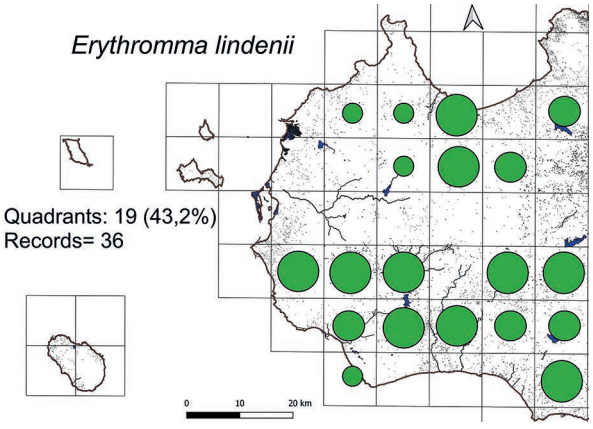
10



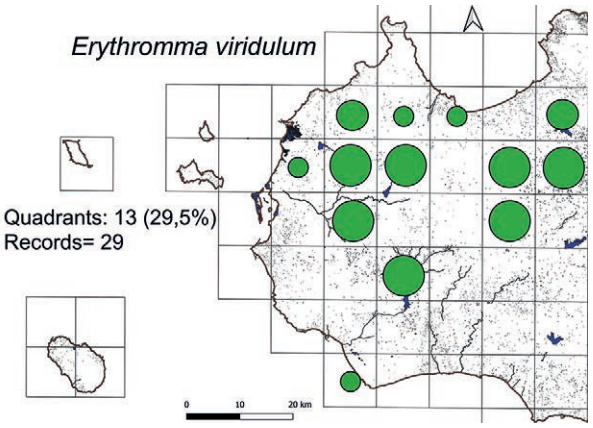
11



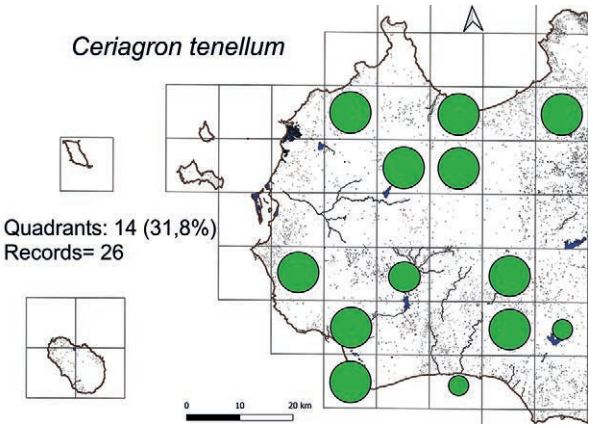
12



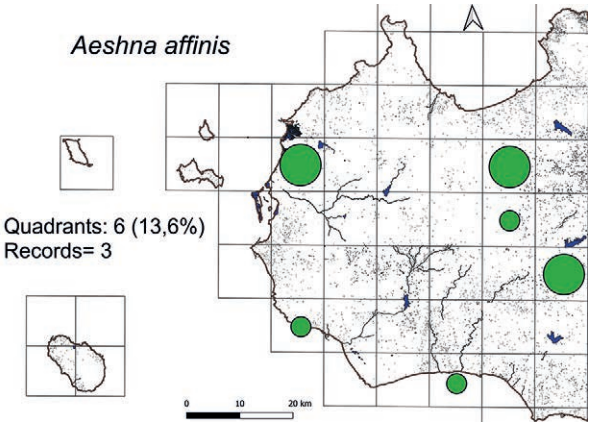
13



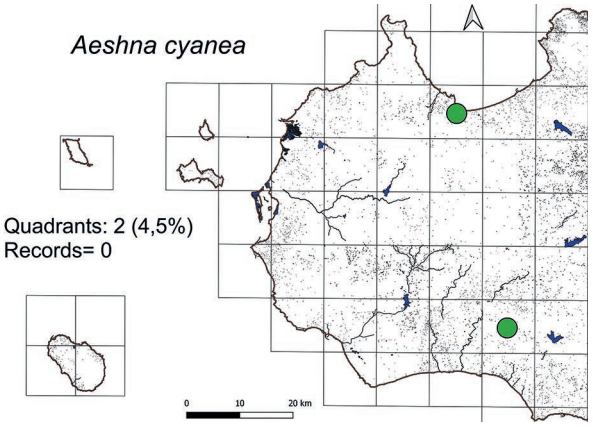
14



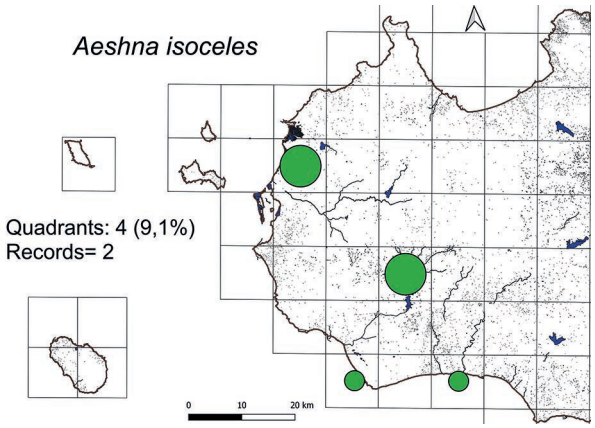
15



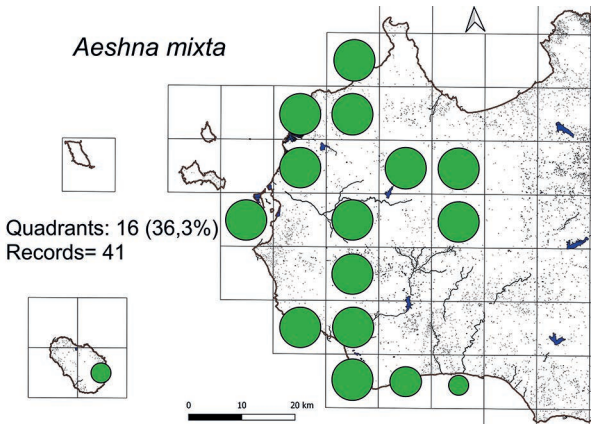
16



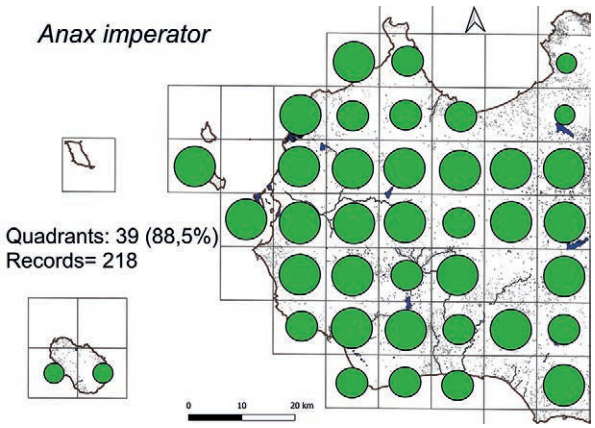
17 *Aeshna isoceles*



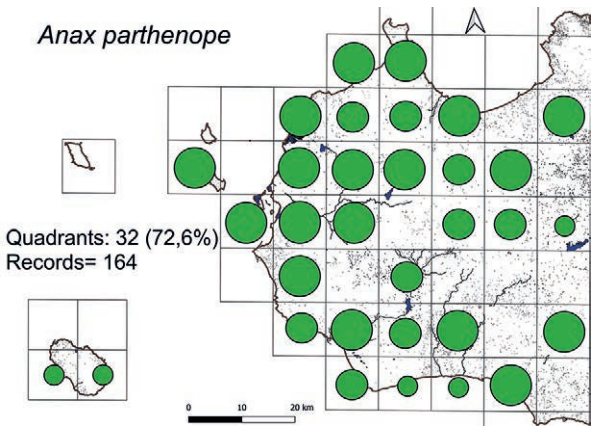
18 *Aeshna mixta*



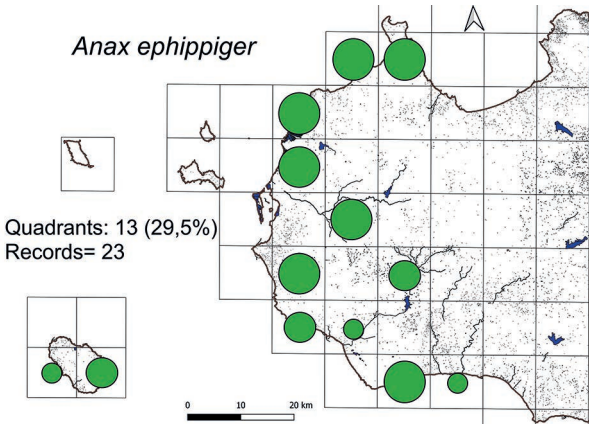
19 *Anax imperator*



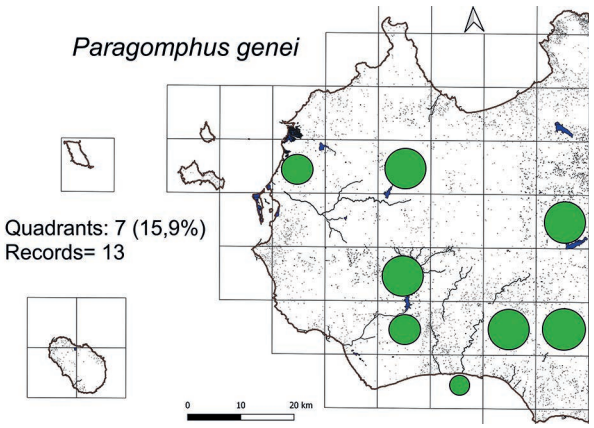
20 *Anax parthenope*



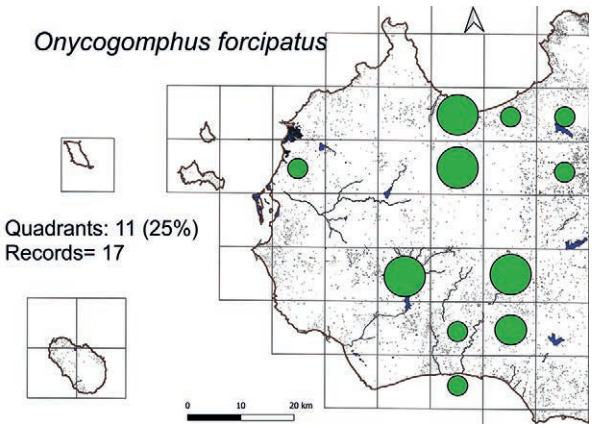
21 *Anax ephippiger*



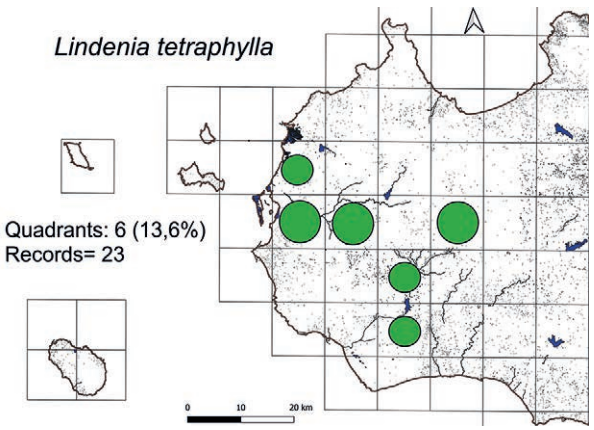
22 *Paragomphus genei*



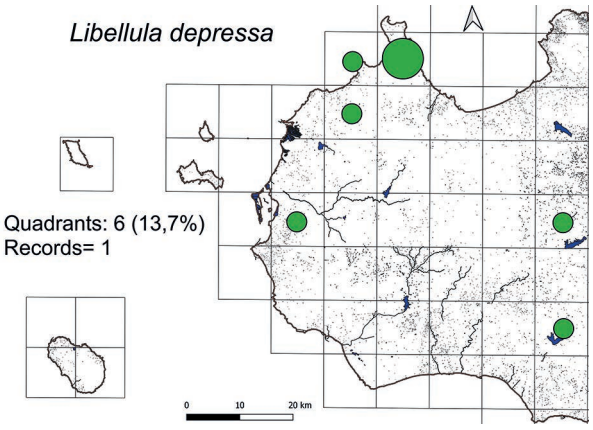
23 *Onycogomphus forcipatus*



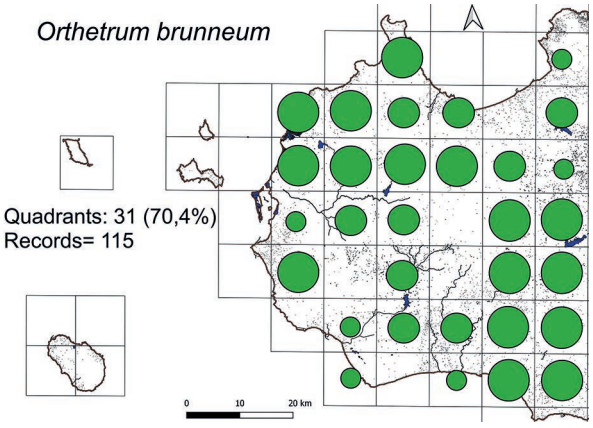
24 *Lindenia tetraphylla*



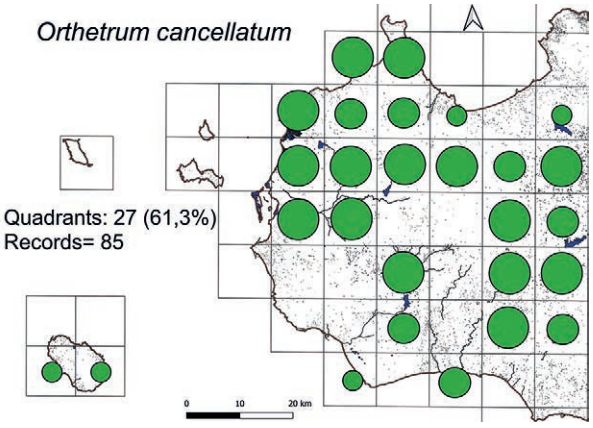
25 *Libellula depressa*



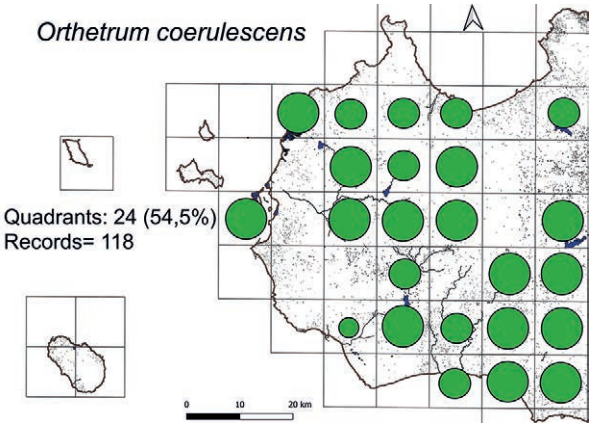
26 *Orthetrum brunneum*



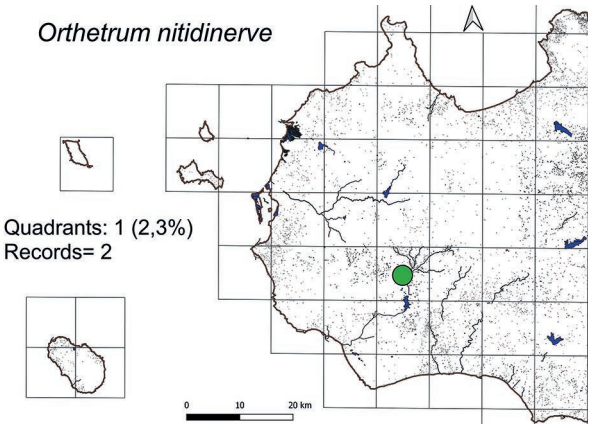
27 *Orthetrum cancellatum*



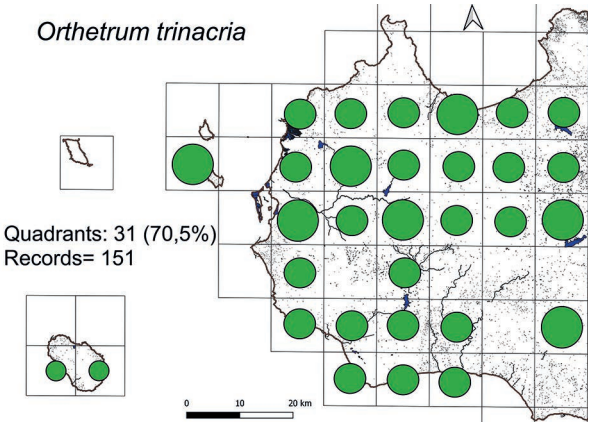
28 *Orthetrum coerulescens*



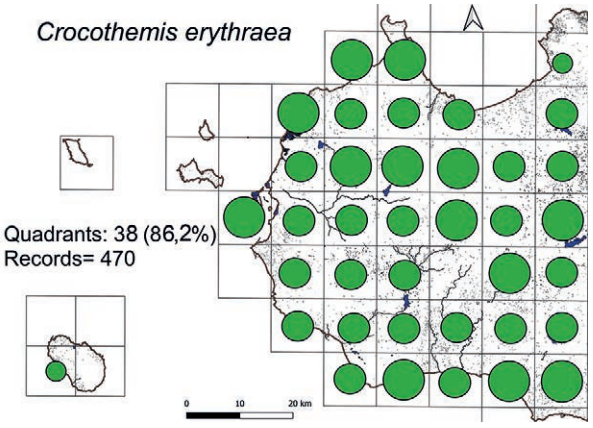
29 *Orthetrum nitidinerve*



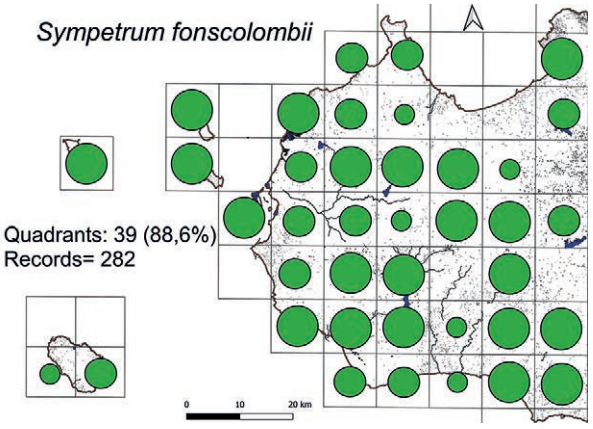
30 *Orthetrum trinacria*



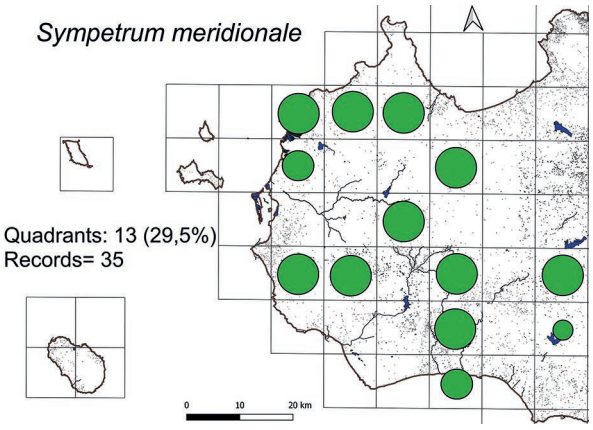
31 *Crocothemis erythraea*



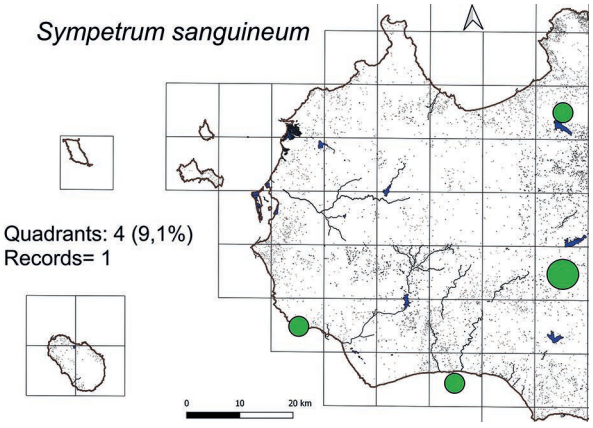
32 *Sympetrum fonscolombii*



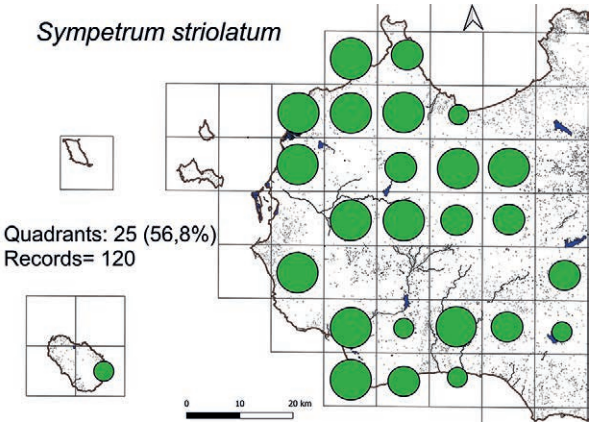
33 *Sympetrum meridionale*



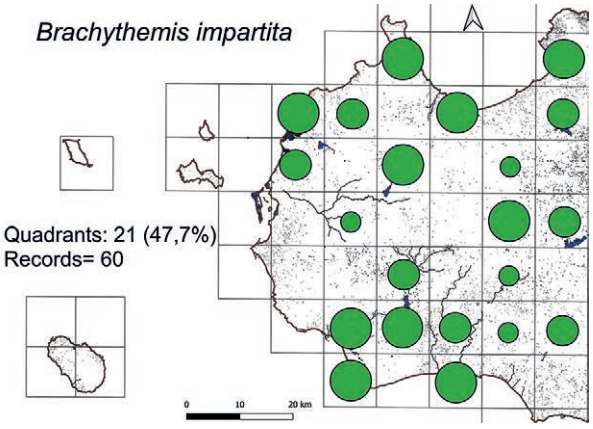
34 *Sympetrum sanguineum*



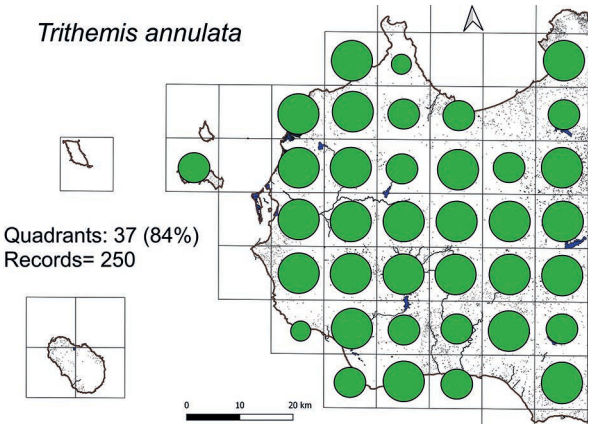
35 *Sympetrum striolatum*



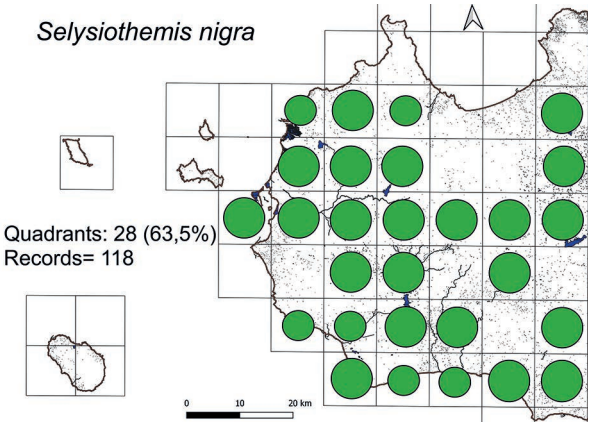
36 *Brachythemis impartita*



37 *Trithemis annulata*



38 *Selysiothemis nigra*



39 *Zygonyx torridus*