Critical species of Odonata in Turkey, Iran and the Caucasus

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Abstract

An overview is given of the present knowledge and current research on the Odonata fauna of Turkey, Iran, and the Caucasus. The occurrence of endemic taxa and of rare and possibly threatened species is discussed. The use of water from various aquatic habitats is reviewed in order to gain insight in existing and potential problems, and a number of conservation measures are proposed. The creation of a few protected key areas for vulnerable species is considered to be the most effective measurement at short notice. Taking our restricted knowledge into account, it is concluded that only a general increase in the awareness of the necessity to deal with environmental problems, both with governmental organisations as well as with the public in the countries involved, may help solving problems regarding aquatic habitats.

Introduction

This paper deals with the odonatofauna of a large part of SW Asia covered by Turkey, Iran, Armenia, Georgia, Azerbaijan and of the Russian part of the Caucasus (Fig. 1). Two series of mountain belts dominate this region: in the north the Pontic Alps, the Caucasus and the Elburz mountains, and in the south the Taurus and the Zagros mountains. The region harbours a large variety of habitats, ranging from alpine meadows and deciduous forests in the northern parts to arid central Turkey and the deserts of central and southeastern Iran. The faunal composition differs from that of the vast plains of Siberia in the north, and of the deserts of Syria and Saudi Arabia in the south.

So far 121 species of Odonata are known to occur in the region with certainty; the majority of these have a mainly Palaearctic distribution. Some species are predominantly distributed in Africa and only just reach southern Turkey through the Levant, and southern Iran through the Arabian Peninsula. Various species with a mainly Oriental distribution are found in South Iran and, to a lesser extent, also along the Mediterranean coast of southern Turkey. Surprisingly, only a few records of these species are available from the area in between. Many of the species with a restricted range (endemics) have related taxa occurring in the Palaearctic (Kalkman et al. 2003).

Present knowledge and current research

The taxonomy of the species in this region is relatively well known; for an overview see Heidari & Dumont (2002) and Kalkman et al. (2003). The knowledge of the distribution of the Odonata within the region varies. Turkey and Armenia have received considerable attention but the knowledge of the odonatofauna of the other countries is far from complete.

Dumont (1977) summarized all information about the Odonata of Turkey available at that time. More recent information about taxonomy and distribution is given in an annotated checklist (Kalkman et al. 2003). The European part of Turkey (Thrace) has recently been well explored (Hacet & Aktaç 1994, 1997), and a great deal of new information about the Odonata of Turkey has been pub-

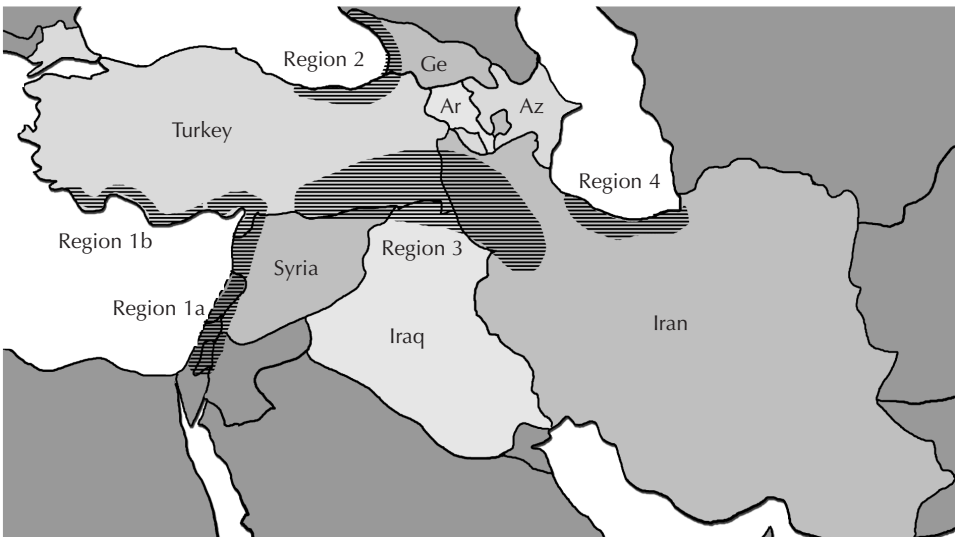

Figure 1: Subregions in SW Asia important for species with a restricted distributional range. See the text for recent extensions of the range of *Coenagrion ponticum* and *C. australocaspicum*. — Ar: Armenia; Az: Azerbaijan; Ge: Georgia

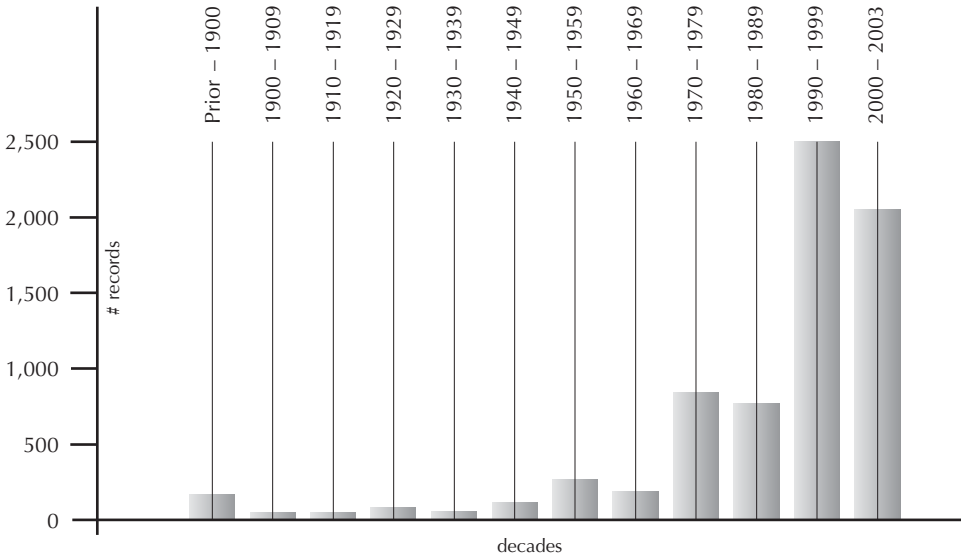

Figure 2: Number of Odonata records from Turkey collected per decade.

lished in the fifth supplement of 'Libellula'. Figure 2 shows the increase in the number of records from Turkey and Figure 3 shows the distribution of these records over the country. Research on the Odonata of Turkey as described by van Pelt & Kalkman (2004) has resulted in an internet site <www.libellen.org/epallage>, on which various articles and distribution maps, flight-histograms and photographs of almost all species are to be found. A key to the adults of the Odonata of Turkey and a revision of the genus *Cordulegaster* are in progress. The current co-operation of various West European odonatologists aims at the publication of an atlas on the Odonata of Turkey in the forthcoming years.

The fauna of Iran has been far less explored. After the review on the odonate fauna of Iran by Schmidt (1954) only a few additional records have been published. To illustrate the need for further fieldwork, nine new species for Iran were collected during only four days fieldwork (Dumont & Heidari 1996). An annotated checklist of the odonatofauna of Iran, including a small number of new records, was recently published (Heidari & Dumont 2002).

Akramowski (1948) reviewed the odonate fauna of Armenia, yet after the publication of a supplement (Akromowski 1964) research on Odonata in Armenia seems to have come to a stop. Akramowski still showed his interest in Odonata afterwards, demonstrated by a paper on Odonata protection in 1975 and corre spondence with other odonatologists, but no further faunistic data were published. Recently, Marc Tailly and Vasil Ananian have conducted fieldwork in Armenia, and the first results of this research can be found on <http://users.pandora.be/tailly/armenodon/armeniandragonflies.htm>. This website also includes an updated checklist and maps of all species. An article on recent findings is published by Tailly et al. (2004). Figure 4 shows the distribution of all known records from that country.

Information on the odonate fauna of Georgia and especially Azerbaijan is scarce. Apart from the scattered descriptions of new taxa from the area by A.N. Bartenev between 1909 and 1934, three papers by Shengelia (1953, 1964, 1975) are available, dealing with the fauna of Georgia. As the information is presented in the Georgian or Russian language it is less accessible to international science. More recently two small papers on Georgia were published by Beutler (1987) and Reinhardt (1992). Hardly any published information is available from the territory of Azerbaijan, except on the region of Nachichevan (Akramowski 1939), yet some Azeri records can be found in a compilation of the aquatic fauna of the entire Caucasus by Kasymov (1972), including references to earlier work on aquatic invertebrates by Kasymov and others. A publication of Azeri odonates, mainly collected during a short survey in June 2002 has recently been published, adding several species to the list for the eastern Caucasus (Dumont 2004). Ketenchiev & Haritonov (1998) published a list of Odonata reported from the NW, SW, NE and SE sections of the Caucasus in which the SW section represents Georgia and the SE section represents Azerbaijan. Information on the northern half of the Caucasus is scarce partly due to the unstable political situation in this region. Much of what is known can be found in Bartenev (1925, 1930a, 1930b), Artobolevski (1929, 1930), Ketenchiev & Haritonov (1998, 1999), Popova (1997), Stain (1998) and Koz'minov (1999). At the moment at least 78 species are known to occur in the northern Caucasus. In this area both boreal species like *Aeshna juncea* (Linnaeus, 1758) and *A. caerulea* (Ström, 1783) occur as well as southern species such as *Selysiothemis nigra* (Vander Linden, 1825) and *Lindenia tetraphylla* (Vander Linden, 1825).

Critical species

The 2003 IUCN Red List of threatened species (IUCN 2003) includes five species distributed in the region:

as endangered [EN]:
Calopteryx syriaca Rambur, 1842, *Cordulegaster* (*insignis*) *mzymtae*
as vulnerable [VU]:
Onychogomphus assimilis, *O. macrodon*, *Brachythemis fuscopalliata*

According to Kalkman et al. (2003), *C. syriaca* does not occur in Turkey, and is therefore not included here.

A list of so-called critical species, i.e. species for which SW Asia is of major importance, is presented in Table 1. These species are listed here because either: (1) they are included in the IUCN list by Moore (1997); (2) their distributional range falls roughly 25%, 50%, or more within the region; or (3) they are endemics and have a restricted range. Apart from two well defined taxa (*Calopteryx splendens waterstoni* and *Cordulegaster insignis mzymtae*), subspecies are not taken in account in order to avoid taxonomic problems. The taxonomic status of *Leucorrhinia circassica* Bartenev, 1929, a taxon that is only known from the original description and that was described from the mountain Atshischgho in the NW Caucasus, is uncertain. The differences with *L. dubia* (Vander Linden, 1825) presented in the

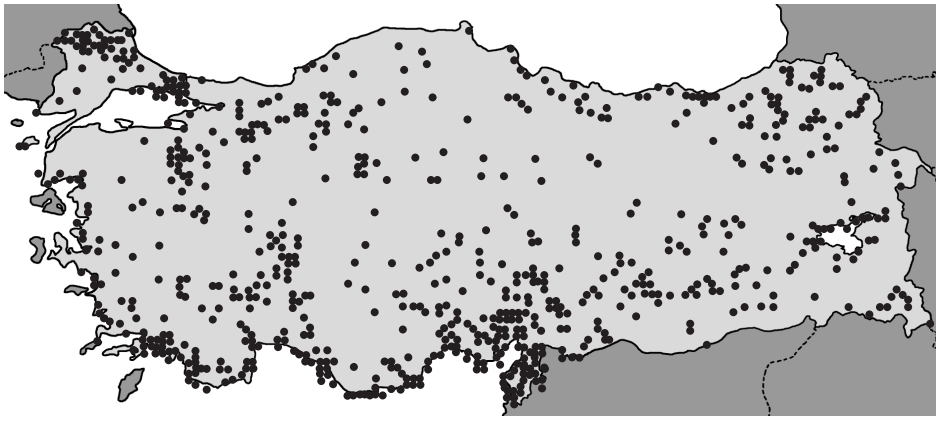

Figure 3: Localities in Turkey from which Odonata records are available.

original description are minor. The variability of *L. dubia* in the adjacent Russian territory is rather large and it is perhaps better to consider the specimens as conspecific with this species. *Lindenia inkiti* Bartenev, 1929 from Georgia is here considered to be conspecific with *L. tetraphylla*. None of these taxa with a doubtful taxonomic status is included in Table 1.

Species with a restricted distributional range are more or less confined to four subregions (Fig. 1). The odonate fauna of subregion 1 (a and b), and to a lesser extent also of subregion 2, is well known, unlike that of subregions 3 and 4 (Table 1). It is not unlikely that species here listed as endemic to subregion 3 or 4 will prove to be more widespread (see also below), or even that new species with a restricted range will be discovered in these areas.

The species of Odonata occurring in subregion 1 are mainly distributed along the coast of the Mediterranean Sea. In this more developed area the intensive use of water (also for agriculture and tourism) represents a threat for all odonates; many of the species occurring in this area may therefore have declined in numbers. Of the species from this area, listed in Table 1, *Coenagrion syriacum* and *Gomphus davidi* also reproduce in man-made stagnant waters and are still common in parts of the Adana delta. The same goes for *Brachythemis fuscopalliata*, a species on the IUCN Red List. *Ceriagrion georgifreyi* is a species of seepage-fed habitats and it is likely that it has declined more strongly. *Onychogomphus macrodon* is probably the most threatened species in the subregion. It is confined to a small area, roughly from northern Israel to southern Turkey. According to Schneider (1987), the record for Iran (Blom 1982; see also Heidari & Dumont 2002) is based on a misidentified male of *O. forcipatus* (Linnaeus, 1758). The paucity of recent records, in spite of an increase in research, suggests that this species has declined both in numbers and in localities. Its preferred habitat, larger rivers, is especially influenced by irrigation projects, sand and gravel mining and the creation of barrage lakes.

Subregion 2, the heavily forested area along the northeastern Black Sea coast of Turkey (Pontic Alps), is only extensively used by humans and is in fact a National Park (Milli Park). It harbours many springs, spring-fed lakes, brooks and rivers,

Table 1. Species for which SW Asia is of importance. The second column gives for each species the reason for inclusion. IUCN: present on the Red List of threatened species (IUCN 2003); 25/50%: roughly 25/50 percent or more of the distributional range is covered by the region; LR: limited range with the number of the subregion where they occur; NA: not applicable. The third column indicates the distributional range of each species, largely based on Tsuda (2000) and partly on Ketenchiev & Haritonov (1998): AFG: Afghanistan; ARM: Armenia; AZB: Azerbaijan; BGR: Bulgaria; CYP: Cyprus; GEO: Georgia; GRC: Greece; HUN: Hungary; IND: India; IRN: Iran; IRQ: Iraq; ISR: Israel; JOR: Jordan; KGS: Kyrgyzstan; KZS: Kazakhstan; LBN: Lebanon; MKD: Macedonia; NEC: NE Caucasus; NWC: NW Caucasus; PAK: Pakistan; RUM: Rumania; RUS: former USSR; SYR: Syria; TUR: Turkey; TRM: Turkmenistan; TJS: Tajikistan; UZB: Uzbekistan. The forth column (Kd) indicates the status of the present knowledge on the distribution of the species in SW Asia, the fifth column (Khp) indicates the status of the present knowledge on the habitat preference.

Taxon	Reason	Range	Kd	Khp
Calopterygidae				
Calopteryx (*splendens*) *waterstoni* (Schneider, 1984)			good	good
	LR2	TUR, GEO		
Euphaeidae				
Epallage fatime (Charpentier, 1840)			good	good
	50%	AFG, ARM, AZB, BGR, CYP, GEO, GRC, HUN, IRN, ISR, JOR, MKD, NEC, NWC, PAK, TRM, TUR		
Coenagrionidae				
Ceriagrion georgifreyi Schmidt, 1953			good	poor
	25%, LR1a&b	GRC, SYR, TUR		
Coenagrion australocaspicum Dumont & Heidari, 1995			very poor	very poor
	100%, LR4	AZB, IRN, NEC		
persicum Lohmann, 1993			very poor	very poor
	100%, LR3	IRN		
ponticum (Bartenev, 1929)			fair	fair
	100%, LR2	GEO, TUR, AZB		
syriacum [1] (Morton, 1924)			fair	fair
	25%, LR1a&b	ISR, LBN, SYR, TUR		
vanbrinkae Lohmann, 1993			poor	very poor
	100%, LR3	ARM, IRN, TUR		
Ischnura intermedia Dumont, 1974			fair	poor
	50%	IRN, SYR, TUR, TRM		
Platycnemididae				
Platycnemis dealbata Selys in Selys & Hagen, 1850			good	fair
	50%	AFG, ARM, AZB, GEO, IND, NEC, NWC, IRN, IRQ, ISR, JOR, LBN, SYR, TUR, TJS, UZB		
kervillei (Martin, 1909)			good	fair
	25%	IRQ, ISR, LBN, SYR, TUR		

Taxon	Reason	Range	Kd	Khp
Aeshnidae				
Caliaeschna microstigma (Schneider, 1845)			good	good
	50%	ALB, ARM, BGR, CYP, GRC, IRN, IRQ, ISR, MKD, NEC, NWC, RUS, TUR, TRM		
Gomphidae				
Gomphus davidi Selys, 1887			good	fair
	25%, LR1a	ISR, JOR, LBN, SYR, TUR		
kinzelbachi Schneider, 1984			poor	very poor
	50%, LR3	IRN, IRQ		
schneideri Selys, 1850			fair	fair
	50%	ARM, AZB, GEO, GRC, IRN, IRQ, TUR		
Onychogomphus assimilis (Schneider, 1845)			fair	fair
	50%, IUCN	ARM, GEO, IRN, TUR, TRM		
flexuosus (Schneider, 1845)			fair	fair
	50%	AFG, ARM, IRN, IRQ, ISR, KGS, KZS, NEC, NWC, RUS, SYR, TUR, TJS, UZB		
lefebvrei (Rambur, 1842)			fair	good
	25%	IRN, IRQ, ISR, LBN, NEC, NWC, SYR, TUR, TRM, TJS, UZB		
macrodon (Selys, 1887)			fair	poor
	25%, IUCN, LR1a,	ISR, JOR, LBN, SYR, TUR		
Cordulegastridae				
Cordulegaster insignis Schneider, 1845			good	good
	50%	ARM, AZB, GEO, GRC, BGR, KGS, RUM, TJS, TUR, IRN		
insignis mzymtae [2] Bartenev, 1929			good	good
	100%, IUCN	GEO, TUR, NWS		
picta (Selys, 1854)			good	good
	50%	AZB, GRC, BGR, NEC, NWC, KZS, TUR		
vanbrinkae Lohmann, 1993			very poor	very poor
	100%, LR4	IRN		
Libellulidae				
Brachythemis fuscopalliata (Selys, 1887)			good	fair
	25%, IUCN	IRN, IRQ, ISR, SYR, TUR		
Libellula pontica Selys, 1887			fair	fair
	50%	ARM, IRN, IRQ, ISR, KGS, SYR, TUR		
Sympetrum arenicolor Jödicke, 1994			poor	very poor
	NA	IRN, IRQ, KGS, KZS, SYR, TJS, TUR, TRM, UZB		
haritonovi Borisov, 1983			poor	fair
	NA	TJS, UZB, KGS, AFG, TUR		

[1] *Coenagrion syriacum* is endemic to the coastal area of southern Turkey, Lebanon, Syria and Israel. It is therefore assumed that records from Azerbaijan and NE Caucasus pertain to *C. ponticum*.

[2] *Cordulegaster mzymtae* is considered to be a subspecies of *C. insignis* (Kalkman et al. 2003).

and endemics to the area are probably not threatened. *Cordulegaster insignis mzymtae* is widespread and at least occurs from Ordu, northern Turkey northwards to its type locality just north of the border between Russia and Georgia. It can be found near springs and along small brooks. *Coenagrion ponticum* is locally very abundant at lakes with vegetation of *Equisetum fluviatile*, and has also been found near small rivers at sea level. The actual habitat preferred at such localities remains unclear, but the species probably lives in parts where the current is lower, allowing for more aquatic vegetation. The species appears to be more widespread and not strictly confined to area 2, as it was recently found in stagnant water in the eastern foothills of the Caucasus in Azerbaijan (Dumont 2004). *Calopteryx splendens waterstoni* is common at lower altitudes in brooks and small rivers draining into the Black Sea, yet this habitat is more prone to pollution. Its distributional range falls almost completely within the boundaries of Turkey.

Subregion 3 covers a large, almost unexplored area, partly due to the unstable political situation. *Coenagrion vanbrinkae* was described on the basis of specimens from Turkey and Iran, and no new records have been published since. Recently collected specimens from Armenia agree well with the original description (M. Tailly et al. 2004). If this taxon is indeed separable from *C. ornatum* at the specific level, records of the latter from eastern Turkey may also refer to *C. vanbrinkae* and the species may prove to be more widespread than known at present. *C. persicum* and *Gomphus kinzelbachi* are known from respectively one (Iran) and two (Iran and Iraq) localities (Kalkman et al. 2004). More information on the taxonomic status and a redescription of the former is needed. Information on the distributional patterns and preferential habitats of all species from subregion 3 is needed. As the area is not densely populated and devoid of economic developments, the species from area 3 listed here in Table 1 are probably not under any particular threat. To what extent deforestation is of influence is unclear.

Subregion 4 is a lowland area along the southern coast of the Caspian Sea and includes the heavily forested northern slopes of the Elburz mountain chain. *Cordulegaster vanbrinkae* probably is confined and *Coenagrion australocaspicum* is largely confined to this area. *C. australocaspicum* has been described from the Anzali wetland at the southwestern part of the Caspian Sea, and it has also been found about 200 km eastwards near Chalus. Recently it was found northwards along the west coast of the Caspian Sea near the Samur river at the border between Dagestan (Russia) and Azerbaijan (Dumont 2004). Its habitat requirements include shallow stagnant lakes and wetlands, as well as streamlets with abundant littoral vegetation. Its abundance within its distributional range is still largely unknown. *C. vanbrinkae* is only known from the holotype, a single male collected at an altitude of 1,200 m a.s.l. above Chalus, north Iran. As this species pertains to the *C. boltonii* species-group, it probably lives in small swift running brooklets with plenty of mud allowing females to oviposit. It is not unlikely that this species is widespread in the area and not under any particular threat. Its distributional range is considered to be small as it is most probably vicariously distributed with *C. picta*, a species known from the Kura valley in Azerbaijan. The area more eastwards of Teheran, i.e. near Meshad, northeastern Iran, is probably too arid to sustain the brooks preferred by *C. vanbrinkae* (G.J. van Pelt unpubl.).

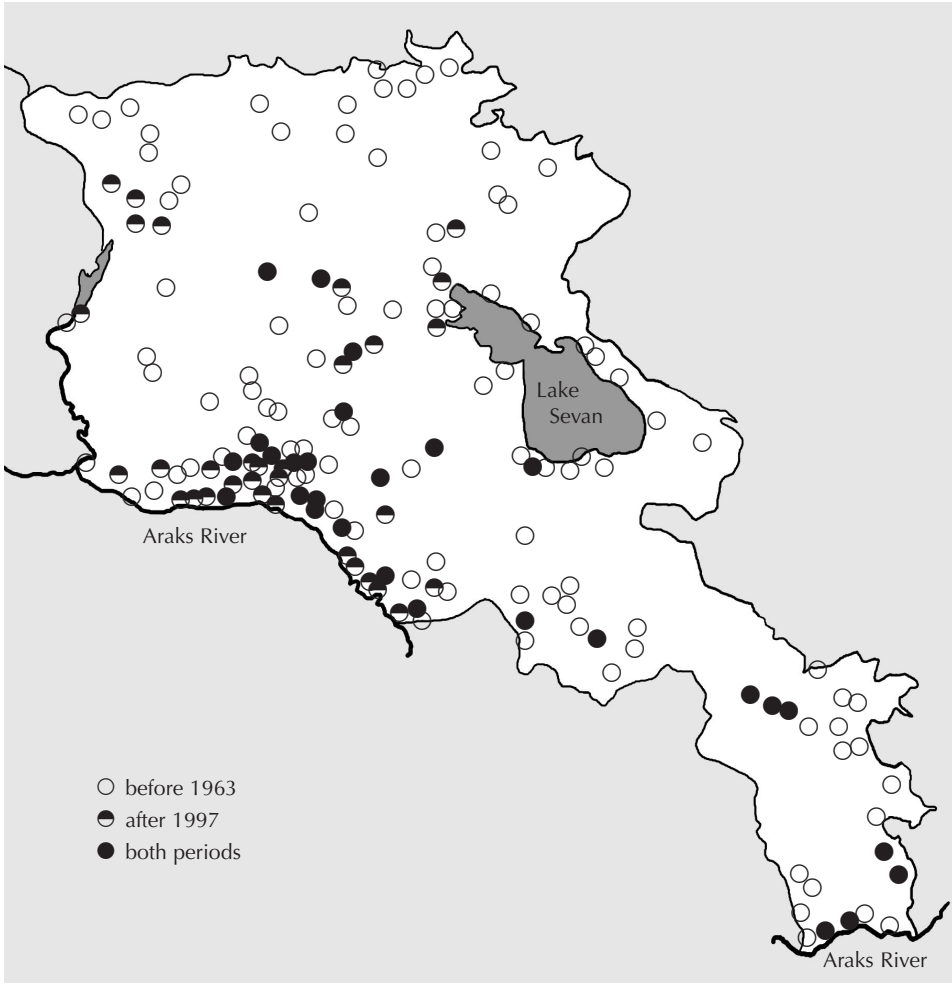

Figure 4: Localities in Armenia from which Odonata records are available.

The use of water and some conservation measures

Apart from specific conservation measures to protect possibly threatened and rare odonate species (see the end of this section), it appears appropriate to review the use of aquatic habitats by man in order to determine whether this causes serious problems that need to be addressed.

Although in most of the region, especially in the northern parts, there is enough precipitation to prevent any water shortage, in the more arid parts the problems with water shortages are complex and are, of course, influenced by political and economical decision making. The destruction of natural habitats in response to the increasing demand for water is probably the main cause for changes in the composition of the odonate fauna, while pollution is mainly of local influence. As our

knowledge of the use of water within the region is predominantly based on field observations of the various authors, the account below on the use of water from the various types of aquatic habitats can by no means be complete, yet we consider our observations to be accurate.

Smaller springs

Water coming from smaller natural springs is generally used for drinking and irrigation purposes. As the water from these springs is often taken via a polyvinyl tube and the springs are seldomly vaulted over, unlike e.g. in Greece, this kind of water usage does not lead to great problems for the odonate fauna involved. Following the general flow of water in irrigated areas: dug small irrigation channels often fall temporarily dry and hardly constitute suitable habitats for Odonata, yet particular spots may consistently receive enough water to sustain populations of certain species, e.g. *Sympetrum pedemontanum* (O.F. Müller in Allioni, 1766). By the replacement of dug channels by concrete ones the water flow is better regulated, but to what extent this influences the presence of odonates is unknown.

Especially in Turkey, but also in northern Iran near Teheran, many picnic sites have been created in forested areas at higher altitudes. The springs present there are often used for drinking water, cleaning and car washing during holidays and the weekends. In general, no cleaning activities take place afterwards in these areas, and as a result the springs regularly become polluted by waste from the visitors. The positioning of waste baskets in these areas may lead to a greater awareness by the public and to a better understanding of the necessity to protect the environment. Inhabitants of temporary settlements outside their own area of origin, however, show a tendency to disregard the natural environment more easily. In the arid parts of the region, springs that are regularly used for watering sheep, goats and cattle, often become devoid of natural vegetation and the water becomes polluted by faeces. The positioning of drinking troughs at some distance from the actual spring may partly solve this problem.

A particular example is formed by the building of a large hotel in the Kızılcahamam Milli Park, Ankara province, Turkey, which drains so much water from the mountains surrounding it that all natural springs in that area have fallen dry, at least when visited in 1998. It was frustrating for the second author to note that no *Cordulegaster* species was to be found in this so-called Soğuk su ("cold water") Milli Park, and hardly any other odonates (van Pelt 2004).

Larger springs

Water coming from large springs is often used for drinking water, the generation of hydro-electricity and irrigation purposes. Normally the water is led via concrete channels to the actual place of use, sometimes rather distant from the spring. The generation of hydro-electricity causes large fluctuations of the water level in the original streambed by way of changes in the use of water in the power plant. Recently, and increasingly, larger springs are also used for the creation of trout farms, especially in Turkey. In these cases most, if not all, of the water is led

through concrete channels into the basins in which trout are reared. The water leaving trout farms is polluted with surplus nutrients. In general, the creation of a trout farm leads to the complete destruction of the natural habitat, and it would be appear sensible to leave at least part of the original, natural water flow undisturbed during the creation and after the completion of new trout farms. At least in some parts of Turkey, especially in the more arid parts where not many natural springs are present, it is highly recommended to regulate trout farming via environmental acts and regional planning.

Ponds and small lakes

The use of water present in ponds and small lakes is mainly restricted to watering cattle and to irrigation purposes, whether or not via a pumping system. In general, this kind of water usage does not appear too disturbing for the inhabiting odonate species. Yet, especially in more arid parts of the region, there is a risk that these natural water resources would fall complete dry. Grazing and drinking by cattle leads to the partial destruction of the natural vegetation along the shorelines. A partial demarcation of shorelines would leave these parts undisturbed. It is apparent that at least some species have increased in parts of Armenia and Turkey due to the creation of fish ponds and expansion of irrigation system, yet this normally involves only the less threatened species.

The remarks regarding picnic sites under the section on smaller springs applies to those near mountain lakes as well.

Larger lakes and swamps

Water present in larger ponds and lakes is predominantly used for irrigation purposes and often distributed via electrically powered pumping systems. Again this kind of water usage does not appear too disturbing for the inhabiting odonate species, yet large parts of swampy areas may become completely dry during water shortages, especially in flatter parts of the region. Various aquatic habitats, especially the Ereğli swamps in central Turkey, are under serious threat by dehydration and recurrent periods of drought. The entry of water via existing irrigation channels during these periods will partly reduce the impact of the dehydration. The damming of rivers and the increasing demand for irrigation water has also had profound influence on the Armenian lakes of Arpilich and Sevan. At the former the creation of a dam has resulted in fluctuating water levels and the subsequent loss of the once rich aquatic vegetation. The water level of the latter has fallen nineteen meters since 1933 resulting in the loss of marsh habitat and changes in the quality of the water (Anonymous 1999; Balian et al. 2002).

Rivers

Rivers are prone to pollution, sand and gravel mining, and larger water fluctuations due to irrigation projects and the creation of barrage lakes. Pollution is mainly a problem in the more populated areas without proper sewer systems and sewage

works. The creation of a barrage system in the Tigris-Euphrates has resulted in the disappearance of large stretches of river and resulted in large stagnant lakes. The value of these lakes for Odonata is low as the lakes have rocky and often steep shores. Unfortunately such projects are still being executed. In NE Turkey large parts of the Çoruh valley will disappear in the forthcoming years resulting in a major loss of habitat for *Onychogomphus assimilis*. Mining at the Armenian sites of Alaverdi (in the northeast) and Kajaran (in the south) endangers large stretches of rivers through with pollution with heavy metals. Gold mining with the use of cyanide forms a threat to the wetlands of the Armenian Ararat valley.

Protected key areas

The creation of a few protected key areas for vulnerable species would be the most effective conservation measure at short notice. In Turkey two important areas come to mind. The first is the area surrounding lake Köyceğiz. Whereas the area is not under any particular threat about 50 species of Odonata have been found there, comprising almost half of the odonate fauna of Turkey (Kalkman et al. 2004). Although only one species – *Ceriagrion georgifreyi* – with a restricted distributional range is found here, the area is inhabited by various species that are rarely found elsewhere in Turkey, e.g. *Brachytron pratense* (O.F. Müller, 1764), *Lindenia tetraphylla* and *Somatochlora flavomaculata* (Vander Linden, 1825), and it is unique in its combination of Palaearctic, Afrotropical and Oriental faunal elements. The second subregion, between Tarsus and Kahramanmaraş, is home to a number of endemics. The establishment of a protected key area for these vulnerable species, especially for *Onychogomphus macrodon*, is highly desirable. The middle course of the Ceyhan river appears to be the most suitable stretch of stream for such an effort. As already suggested by Akromowski (1975) the protection of stretches of the Armenian Metsamor river seems worthwhile. This river is home to a number of species that are more or less confined to the low parts of Armenia, e.g. *Platycnemis dealbata* and *Coenagrion vanbrinkae*, and includes a population of the locally rare *Erythromma lindenii* (syn. *Cercion*) (Selys, 1840). The water quality of this river is secured as it is fed by underground sources. As for the other countries in the region, our present knowledge is too poor to point out which areas should be protected, yet the wetlands along the southern shore of the Caspian Sea deserve special attention.

Epilogue

Taking our restricted knowledge into account, it appears an almost impossible task to give advise on the implementation of protection measures in order to preserve rare and vulnerable odonate species in the region involved. As only a few persons living in the area are interested in Odonata, the authors have been forced to rely on their own observations. For the determination of effective measurements for the protection of Odonata and their habitats it is necessary to be aware of the way the (local) governments deal with the problems involved, yet our experience with this is restricted to a few personal contacts. Therefore, apart from fieldwork, our

main priority should be to find, help and stimulate odonatologists and environmentalists in the region. Yet, as the study on Odonata is not directly related to primary scientific research in the countries involved, i.e. it is not directly related to agricultural research, it is our great concern that a discussion on protective measurements will remain academic without the involvement of the people in the region itself.

At the long run, only a general increase in the awareness of the necessity to deal with environmental problems, both with governmental organisations as well as with the public, may help solving the problems described in this article.

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