



AGRION

NEWSLETTER OF THE WORLDWIDE DRAGONFLY ASSOCIATION

PATRON: Professor Edward O. Wilson FRS, FRSE

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NEWSLETTER OF THE WORLDWIDE DRAGONFLY ASSOCIATION

AGRION is the Worldwide Dragonfly Association's (WDA's) newsletter, published twice a year, in January and July. The WDA aims to advance public education and awareness by the promotion of the study and conservation of dragonflies (Odonata) and their natural habitats in all parts of the world. AGRION covers all aspects of WDA's activities; it communicates facts and knowledge related to the study and conservation of dragonflies and is a forum for news and information exchange for members. AGRION is freely available for downloading from the WDA website at <http://ecoevo.uvigo.es/WDA/dragonfly.htm>. WDA is a Registered Charity (Not-for-Profit Organization), Charity No. 1066039/0.

Editor's notes

Keith Wilson [kdpwilson@gmail.com]

Conference News

The French Society of Odonatology (Société Française d'Odonatologie, SFO) and the Office for the Insects and their Environment (Office pour les insectes et leur environnement, OPIE) have announced that the Third European Congress on Odonatology (ECOO 2014) will be held in Montpellier, France, 7-10 July 2014 (see announcement on page 5).

The 2015 International Congress of Odonatology is scheduled to be held at La Plata City, 60 km south of Buenos Aires, Argentina in association with the Universidad Nacional de La Plata, Museo de La Plata and Instituto de Limnología. The timing for the Congress has not yet been finalised. Enquiries for funding support should be addressed to Dr. Vincent Kalkman, Dorpsstraat 84, 2343BB Oegstgeest, The Netherlands. E-mail: kalkman@naturalis.nnm.nl.

Facebook and Twitter

Just a reminder that WDA is now on Facebook and Twitter. The WDA Facebook website can be found at the link: [<https://www.facebook.com/WorldwideDragonflyAssociation>] and the WDA Twitter website may be found at the link: [<https://twitter.com/WorldDragonfly>].

Dr. Jan Taylor

Dr. Jan Taylor sadly passed away on 4 December 2013 after suffering from an aggressive form of stomach cancer.

Jan was an enthusiastic WDA member who often contributed to the AGRION newsletter. In the July, 2002 issue of AGRION Jan fondly recalled his odonate 'first experiences', which included the catching of his first and only *Somatochlora metallica* as a UK schoolboy, encountering Norman Moore's *Anax imperator* bomb-craters at Studland, Dorset, UK in what Jan describes: 'as the magical summer of 1947', his discovery of a colony of *Leucorrhinia dubia* in an acid swamp near the Royal Horticultural Society garden at Wisley, Surrey in 1954 (sadly this site was destroyed by the construction of the M25 motorway) and, in later life, in what Jan described: 'as the occasion that takes pride of place is the day I found my first *Petalura hesperia*', which he found at Dwellingup, western Australia, in December, 1988. He also expressed his strong desire to find *Lathrocordulia metallica*, which he was delighted to report encountering, after many years of searching, in the January, 2008 issue of AGRION at the Little Dandalup River, western Australia in December 2007 and in the July, 2008 issue of AGRION he reported finding it again at North Dandalup, near Perth during December 2007 and January 2008.

Jan Taylor was born in England in 1935 and studied zoology and entomology at Imperial College,

Cover photo: *Matrona basilaris basilaris* Guangdong, China (photo credit: Bergman Ng). Malte Seehausen has just published records of *Matrona basilaris* from late 19th Century Hong Kong in an IDF-Report (Seehausen, 2014). See article: 'Odonata recolonisation of Hong Kong's Forests' pages 8-20.

London. He initially worked for the Nature Conservancy Council (now Natural England) in East Anglia before studying the behaviour and ecology of grey squirrels while employed by the Ministry of Agriculture Food and Fisheries (MAFF), UK. In 1969 he moved to Australia and lectured at the Zoology Department of the University of Western Australia. He has written several books on time, evolution and ecology. In 2013 he published two odonate books titled: ‘*Dragonflies and Damselflies of Southwest Australia*’ and ‘*Dragonflies and Damselflies of the Pilbara, NW Australia.*’ Both were published using the Blurb self-publishing platform and are available from the Blurb bookstore website (www.blurb.com/bookstore).

Next issue of *AGRION*

For the next issue of *AGRION*, to be published at the beginning of July 2014, please send your contributions to Keith Wilson [kdpwilson@gmail.com] or Graham Reels [gtreels@gmail.com]. All articles, information and news items related to dragonflies or of interest to WDA members are most welcome and will be considered for publication. Please send all text and figure captions in a Word file by email, preferably, or on a disk by post. Please do not include artwork with the text but provide a separate file or files in soft copy form, ideally in a compressed format (e.g. ‘jpeg’ or ‘gif’), or as files on disk if sent by post.

If you have an odonate photo illustrating any rarely observed aspect of dragonfly biology, or an unusual species, or simply a stunning dragonfly shot, please submit it for consideration for publication on the front cover of *AGRION*.

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Members update

Change of address

Dr. Hidenori Ubukata, Shuku 92-1, Sakura-ku, Saitama city, 338-0814, JAPAN. [hidenori.ubukata@gmail.com]

Dr. John P. Simaika, RM 3001B, JS, Marais Bldg., Victoria Str., Dept. Conservation Ecology & Entomology, Faculty of AgriSciences, Stellenbosch University, Matieland 7602, South Africa.

Dr. Martins Kalnins, Dzervenu iela 9-12, Sigulda, LV-2150, Latvia.

Benny Hinnekint, Impedorp 13, B-9340 Ledo, Belgium [benny.hinnekin@telenet.be].

Alessandro Tabarroni, Mura Anteo Zamboni, 1 40126 Bologna, Italy.

Email from Mike Parr
Mike Parr [mjp9c@talktalk.net]

How did the mating system in dragonflies evolve?

One of the most difficult problems in evolutionary biology is HOW DID THE MATING SYSTEM IN DRAGONFLIES EVOLVE? The position of the male secondary genitalia allows the mating pair considerable aerial agility cf. most other insects. However it is difficult to imagine how this could have evolved – would intermediate stages have been possible?

Editors

This is a most interesting question Mike has posed. There has been a lot of speculation as to how the unique pairing system and sperm transfer mechanism evolved in odonates. The Editors invite and welcome reviews and suggestions from members on the topic which they would be happy to publish in *Agrion*. If the submissions are good there may be a follow-up invitation for the best suggestion to write a peer-reviewed paper for publication in IJO.



Photo: Paired, copulatory 'wheel' position, *Calopteryx haemorrhoidalis*, Morocco. Credit: Keith DP Wilson.



Photo: Paired, copulatory 'wheel' position, *Aeshna mixta*, UK. Credit: Keith DP Wilson.

Invitation from Samraoui Boudjéma
Samraoui Boudjéma [bsamraoui@yahoo.fr]

Boudjéma has posed the question: '**How I became an odonatologist**' and invites members to write an article on the subject for publication in *Agrion*.



3rd European Congress on Odonatology

ECOO 2014 July 7-10

Montpellier, France

First announcement

Dear Colleagues and Odonatists,

The French Society of Odonatology (SFO) and the Office for the Insects and their Environment (OPIE) are pleased to announce that the 3rd European Congress on Odonatology (ECOO 2014) will be held in Montpellier, Southern France, on 7-10 July.

Lectures and posters will deal preferably with the Odonata from the Western Palearctic, on various subjects: we already propose sessions on faunistic & biodiversity studies, ecology & life histories, ethology, conservation & management, phylogeny, taxonomy, odonomics... some more sessions could be proposed if they receive at least three lecture proposals. We will soon be able to provide you with a Registration form and an Abstract form. We invite you to fill them in as soon as possible in order to make easier the organisation of the congress.

During ECOO 2014, you will be able to appreciate not only sharing the latest knowledge on European dragonfly fauna but also an Odonatological book fair and a Photographic exhibition. Further, you will experience a "Breaking ice party", two afternoon field excursions in the direct vicinity of Montpellier and a Congress dinner. From 11 July, a Post-congress tour will be organised throughout the entire French Mediterranean.

Thanks to sponsors and to the grants for previous ECOO which were held in Porto and Belgrade, we are able to offer the possibility to a few people to join us at lower costs. To receive a grant, a participant must give a lecture.

We will soon make a second announcement with further details, a page will be opened on the SFO website www.libellules.org and one on Facebook too.

The French team looks forward to seeing you again and to welcoming all new participants.



BOOK REVIEW

Field Guide to the damselflies of New Guinea
Vincent Kalkman and Albert Orr
Brachytron 16 Supplement ISSN 1386-3460:
available via nabestelling@brachytron.nl
€14.50 (outside the Netherlands)

Graham Reels [gtreels@gmail.com.]



This award-winning book provides a fascinating introduction to the remote and hitherto rather obscure New Guinean Zygoptera fauna, written by two well-known odonatologists. The Leiden-based Vincent Kalkman has made several fruitful field visits to New Guinea in recent years, while Albert Orr has previously authored and illustrated the first (and to date only) guide books on the nearby, but substantially different, odonate faunas of Borneo and Peninsular Malaysia. *Field Guide to the damselflies of New Guinea* is a slim paperback volume of some 120 pages. The English text comes at the front of the book, and a Bahasa Indonesia translation of it is provided after the species illustrations and photographic plates. The book is appended by a checklist giving known species distributions in New Guinea and adjacent islands.

The text is concise and informative, striking a fine balance between encouraging the beginner and satisfying the experienced odonatologist. One learns at the outset that some 285 species of damselfly in eight families are known from New Guinea, comprising a striking 62% of the overall known odonate fauna of 420 species. Some 70% of New Guinean damselflies are associated with running waters, and most of these are endemic. This is clearly a highly distinctive fauna. After the brief but useful introductory sections, the field guide text, augmented with clear, simple keys and tables, provides sufficient information to identify all known New Guinean damselflies to genus, and most to species.

This is all made much easier by the nearly 300 colour drawings and over 250 line drawings, either of the whole insect or of key diagnostic features such as male terminal appendages and thoracic and abdominal markings, prepared by Albert Orr. These beautiful illustrations are superbly executed and really bring the species to life, particularly such immediately eye-catching taxa as the argiolestid *Wahnesia saltator* with its remarkably expanded distal abdomen, or the aptly-named platycnemidid *Archboldargia scissorhandsi* (described by Vincent Kalkman) with its extraordinary grasping terminal appendages. A short section of fine photographic plates by Stephen Richards gives a tantalising taster as to what several of the species look like in life.

Although undoubtedly a highly desirable addition to any dragonfly enthusiast's library, the greatest value of *Field Guide to the damselflies of New Guinea* lies in its potential for facilitating further study of this neglected fauna, not least by the people who live there. The inclusion of a Bahasa text, and the fact that more than 500 copies of the book (more than 40% of the print run) are being donated to New Guinean universities, shows how seriously the authors and publishers take this issue. This is no fancy coffee table adornment: it is intended to be used, and used thoroughly, in New Guinea's demanding field conditions.

As testimony to the ground-breaking merit of this book, earlier this year the authors deservedly won the prestigious Whitley Award, presented annually in Sydney since 1979 for outstanding publications containing new information about the fauna of the Australasian region. The award is given by the Royal Zoological Society of New South Wales, a venerable Australian institution founded in 1879 and granted a royal charter in 1908. This is surely a more compelling argument in the book's favour than anything I can say about it. Let us hope that a companion volume on New Guinean Anisoptera will follow in the not-too-distant future.



New Book

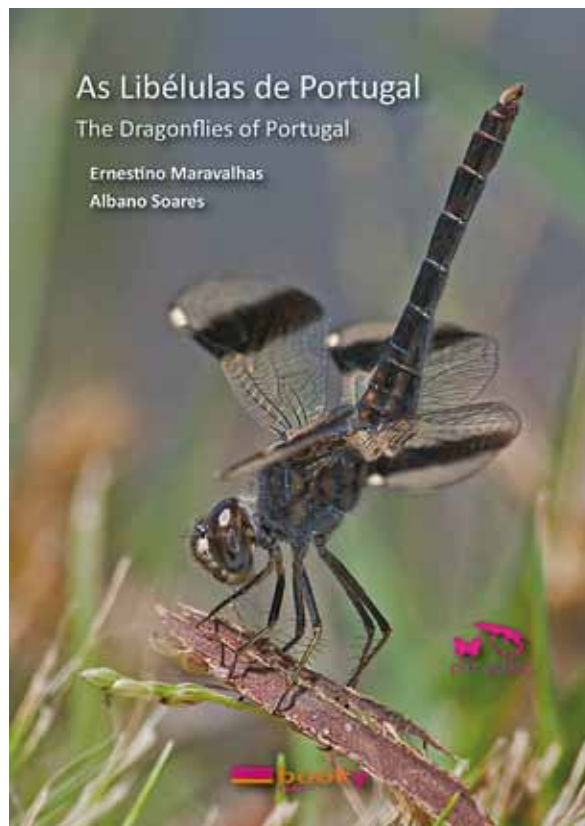
The Dragonflies of Portugal As Libélulas de Portugal

Authors: Ernestino Maravalhas and Albano Soares

In English and Portuguese.
Paperback, November 2013.
336 pages, 600+ colour photos,
colour illustrations, colour distribution maps

Available from online booksellers at NHBS (UK),
Apollo Books (Denmark) and
Internetbuchhandlung Rüdiger Biermann (Germany)

This is the first book to cover the dragonflies known from Portugal. It aims to provide a comprehensive identification guide for both the general naturalist as well as for the scientist and conservationist. *The Dragonflies of Portugal / As Libélulas de Portugal* has more than 600 photos covering the 67 species known so far from Portugal. For each species there is a concise text, a map and photos of living specimens in their natural environment. Further there are numerous photos of details that are important help for identification.



Odonata recolonisation of Hong Kong's Forests

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This paper was presented at the 17th International Symposium of Odonatology held in Hong Kong, 30th July-5th August 2006 but has never previously been published

Abstract

Has Hong Kong got its full complement of odonates? Are forest dwelling odonates actively colonising Hong Kong? These two questions are explored. Following the development of mature woodland in Hong Kong many Guangdong forest bird species have colonised the territory during the past thirty years; presumably after many years of absence. The natural vegetation of Hong Kong, given its location, climate and geology, would have been dominated by subtropical, monsoon rain forest, but deforestation practices, which took place during the widespread settlement of the area during the Song Dynasty (960-1279), has meant the territory has largely been devoid of woodland for several hundred years until comparatively recently. Since 1945, extensive areas of woodland have gradually returned to Hong Kong; most of them located in designated Country Parks, which account for more than 40% of the total land area. Despite the lack of original forest Asahina (1965,



Figure 1. 'Barren and tree-less' Victoria Peak, Hong Kong Island viewed from Mt. Gough ca 1870.

1984, 1985) nevertheless catalogued some 65 species of Odonata, following surveys completed in the early nineteen-sixties and in the mid nineteen-eighties. Later, Wilson (1997) enumerated 109 species after survey work undertaken during 1991 to 1997. The Agriculture, Fisheries and Conservation Department established a Dragonfly Working Group in 2001, which has conducted comprehensive surveys of odonates throughout Hong Kong, taking the total number of species known from Hong Kong up to 112¹. In neighbouring Guangdong similar fieldwork has been undertaken as part of a programme of South China ecological studies, since 1997, by a team of ecologists organized and funded by the Kadoorie Farm and Botanic Garden Corporation. Further fieldwork has been conducted in Guangdong by undergraduate and postgraduate students from the South China Agricultural University. In combination the latter two groups have obtained considerable information on the distribution of Odonata from protected areas throughout Guangdong. Although taxonomic studies on the specimens collected have not yet been fully completed the information gathered thus far nevertheless permits comparisons between the odonate fauna of Hong Kong and Guangdong, which is provided here. Guangdong is shown to support an extremely rich fauna (ca 250 species) with more species than any other Chinese province. There are some stark contrasts to Hong Kong. For example there are many species of *Sympetrum* in north Guangdong but few in south Guangdong and none in Hong Kong indicating north Guangdong occupies a separate biogeographic region to south Guangdong (including Hong Kong). This is reflected in other animal and plant group studies. The biogeography of Guangdong and Hong Kong is briefly discussed. Several odonate families, containing species with a preference for forested streams, are poorly represented in Hong Kong when compared with Guangdong e.g. the zygopteran families Calopterygidae, Chlorocyphidae and Euphaeidae. Surprisingly, given Hong Kong's small relative size, there are some odonate species recorded in Hong Kong, which have not been found in Guangdong. These species are reviewed together with their conservation status. Recent discoveries of several new forest-dwelling species in Hong Kong indicate odonates may be actively recolonising from south Guangdong. The potential for further odonates to recolonise Hong Kong both by natural and man-assisted means is considered.

¹ The figure of 112 relates to 2006. As of December, 2013 117 species have now been recorded from Hong Kong.

Introduction

The natural vegetation in Hong Kong prior to human settlement would have been subtropical monsoonal broad-leaved forest dominated by oaks and laurels. Following initial occupation during the Song Dynasty (969-1279) forest cover was progressively cleared until virtually none remained. From the 1840s onwards European visitors described the landscape of Hong Kong as 'barren', 'bare', 'bleak', and 'sterile' (Dudgeon & Corlett, 1994). Vegetation consisted of coarse grass, with a few scattered shrubs and stunted pine trees (ibid), see Figure 1. Development of scrub and natural recovery of forest on mountain hillsides, particularly in the New Territories, was largely prevented each year by burning practices. Even today many hillsides are burned during the dry season; often as a consequence of the Ching Ming and Cheung Yeung festivals, during which ancestral graves are visited. A few original forest remnants may have survived in remote, moist ravines in scattered mountainous districts throughout the New Territories. Ng Tung Chai and Sunset Peak are good examples of mature woodland, which contain small patches of primary forest. Since the nineteen-fifties many areas of secondary forest have been established by the Agriculture, Fisheries and Conservation Department, and its predecessors, through re-forestation schemes. One of the best examples of native secondary forest has been part planted and part naturally regenerated at Tai Po Kau and is known as the Tai Po Kau Forest Reserve (see Figures 2 & 3). Secondary forests, throughout Hong Kong and the New Territories, have also developed in extensive mountainous water catchment areas surrounding large reservoirs, which were established from the early 20th century to supply water to Hong Kong's burgeoning population. Development within these catchment areas has not been permitted, which has encouraged the development of mature secondary forests. These forested catchments are now managed as Country Parks and today over 40% of Hong Kong is protected under the Country Park system.



Figures 2 & 3. Regenerated secondary forest at Tai Po Kau Forest Reserve, New Territories, Hong Kong.

Geography

The Tropic of Cancer runs transversely through the centre of Guangdong, which is situated between latitudes 20°01' - 25°03' N and longitudes 109°04' - 117°02' E. It has a total land area of ca 177,600 km², which is about three quarters, the size of the United Kingdom (241,590 km²). It is bordered by Guangxi Zhuang Autonomous Region to the west, Hunan and Jiangxi provinces to the north and Fujian province to the east. It has the longest coastline of any Chinese mainland province with a length ca 3,368 km and there are numerous offshore islands. The main Xijiang tributary, which is ca 2,122 km long, has its origins in the west in North Vietnam, Guizhou and Yunnan, and is the third longest river in China. It converges with the North River (Beijiang) west of Guangzhou. To the south of Guangzhou a complex river delta (Pearl River delta) has formed with major feeds from the Xijiang to the west, and the Pearl River (Zhujiang) flowing from Guangzhou, which is in turn fed by the East River (Dongjiang), which has its confluence with the Pear River east of Guangzhou. Macao lies at the western mouth of the Pearl River Delta and Hong Kong is positioned at the eastern mouth. Macao has a land area of just 27.3 km² and Hong Kong covers ca 1,100 km². Both Macao and Hong Kong together cover less than 1% of Guangdong's area.

The rich alluvial flood plains associated with the Pearl River delta in south and central Guangdong is considered the most productive agricultural centre in the country. A large proportion of these wetlands are utilised for aquaculture purposes. The production of carps and mullet in polyculture pond systems is the main activity. Surrounding the delta and main river valleys are many hilly areas. The original vegetation of these hills was broadleaved forest dominated by laurels (Lauraceae) and oaks (Fagaceae - beeches, chestnuts and oaks) but most of the woodland has now been replaced by pine (*Pinus massoniana*) and scrub. Overall, hills above 500 m constitute 31% of the area of Guangdong. At the northern boundary, the highest mountain, Shikengkong (1,902 m), is located in the southern part of the Nanling Mountain range. The coast, east of the delta, including Hong Kong, is also quite

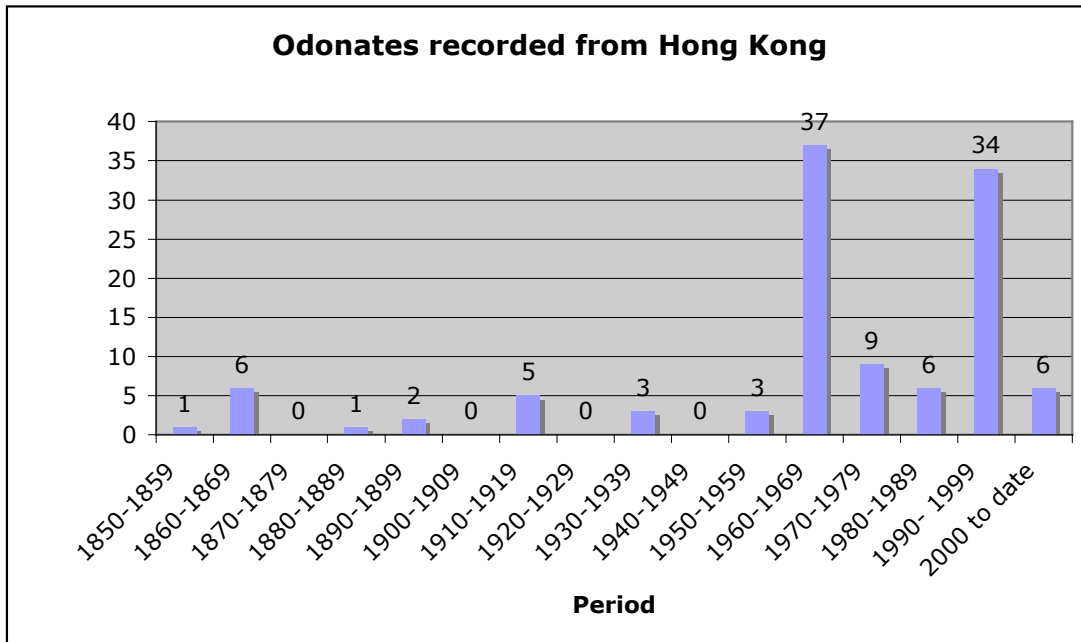


Figure 4. Number of odonate species first recorded from Hong Kong each decade from 1850 to 2006.

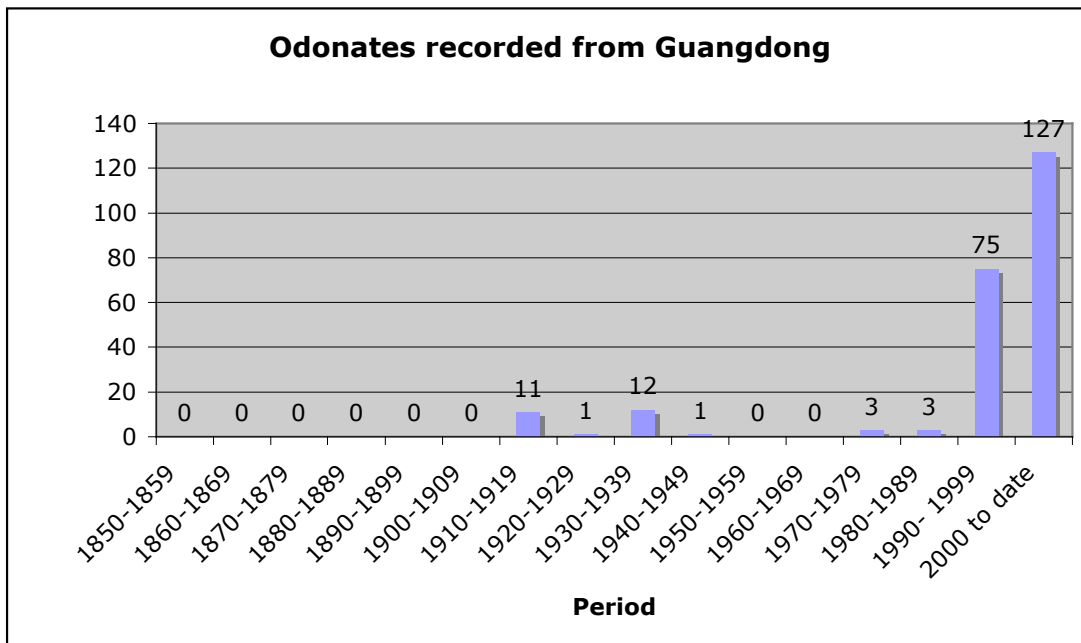


Figure 5. Number of odonate species first recorded from Guangdong each decade from 1850 to 2006.

mountainous and has several sizable mountains exceeding 1,000 m. In Hong Kong the highest mountain is Tai Mo Shan at 957 m. The maximum height found in Macao is 174 m.

Guangdong has two main monsoonal seasons comprised of a long, hot wet season (summer) and a short, cool dry season (winter). The average annual rainfall ranges from 1,500 mm to 2,300 mm with nearly 75-80% of the total rainfall falling between May and September. Mean annual temperatures are about 22°C throughout the province with temperatures reduced to an annual mean of 19°C in the mountainous north.

Hong Kong odonate recording

There has been a long history of odonate recording in Hong Kong with the first record, *Euphaea decorata*, dating back to 1854 (Selys, 1854). A full account of the history of odonate recording in Hong Kong up to 1997 is provided by Wilson (1997) and more recent information can be found in Wilson (2003; 2004) and Tze-wai et al., (2011). Asahina (1965; 1987, 1988) provided the first comprehensive accounts of the Hong Kong odonate fauna followed by Wilson (1995; 1997, 2003, 2004). The numbers of species recorded during each decade since 1850 are depicted in Figure 4. The are two main peaks which correspond to the intensive field work and subsequent

publications of Asahina (1965) and Wilson (1995, 1997).

Guangdong odonate recording

The history of odonate recording from Guangdong is almost as long as Hong Kong's with extensive records and descriptions made by Ris, which were published in Ris (1912). Several new descriptions and records were made during the nineteen-twenties (Ris, 1927), nineteen-thirties (Needham, 1930; Schmidt, 1931; May, 1933; Navás, 1935) and nineteen-forties (Schmidt, 1948) but since 1948 no new additions were made until Chao's work on gomphids (Chao, 1982). Since the 1990s many species descriptions have been made from Guangdong and numerous records reported from Guangdong by Sui & Sun (1984). Nevertheless no comprehensive reports have been produced on the odonates of Guangdong until the Kadoorie Farm and Botanic Garden Corporation reported the findings of their extensive South China surveys programme (Fellowes et al., 2002a-d, 2003a-d; Chan et al., 2004a-b). Further surveys were undertaken by Professor Xu from the South China Agricultural University, which have added considerable knowledge of Guangdong odonate fauna (Wilson & Xu, 2007; Wilson & Xu, 2008 & Wilson & Xu, 2009). The numbers of species recorded during each decade since 1850 is depicted in Figure 5. The vast majority of records have been made since 1990.

Kadoorie Farm and Botanic Garden Corporation Surveys

Odonates were collected by a team assembled by the Hong Kong based Kadoorie Farm and Botanic Garden Corporation (KFBG) during field trips conducted between 1997 and 2002. The author Keith DP Wilson (KW) and Graham T Reels collected the majority of odonates, with assistance from Michael Lau and Billy Hau. The sites surveyed are listed in Table 1. The programme was conducted in collaboration with the Guangdong Forestry Department and the South China Agricultural University. KFBG has published reports on the surveys conducted by the South China surveys teams undertaken in Guangdong (Fellowes et al., 2002a-d, 2003a-d; Chan et al., 2004a-b).

South China Agricultural University Surveys

Dragonflies were collected by teams of undergraduate and postgraduate students led by Prof. Xu Zaifu (XZ), Professor of Entomology, South China Agricultural University, during the period 2001-2005. KW accompanied XZ during some of the surveys completed and identified all the specimens collected. The sites surveyed are listed in Appendix 1. The detailed results of these surveys and descriptions of new species were published (Wilson & Xu, 2007, 2008 & 2009).

Comparison of the Guangdong and Hong Kong odonate faunas

The only Guangdong zygopteran family absent from Hong Kong is Synlestidae. Within the suborder Anisoptera six families are represented in Guangdong and two of these are absent from Hong Kong comprising Chlorogomphidae and Cordulegasteridae.

The families² Diphlebiidae, Calopterygidae, Chlorocyphidae, Euphaeidae, Megapodagrionidae, Gomphidae and Chlorogomphidae are well represented in south China. South China is also home to the Platystictidae genus *Sinosticta* which is only known from Hainan, Hong Kong and Guangdong. In total 86 species of Zygoptera and ca 165 species of Anisoptera have been recorded from Guangdong, Hong Kong and Macao. Seventeen species have been recorded from Hong Kong, which have not been recorded from Guangdong and one species has only been recorded from Macao (*Prodasineura verticalis*). The overall total of 251 odonates exceeds any other provincial total for China. Guangxi has the second highest Chinese total with 74 zygopterans (Wilson & Reels, 2003) and a total of 202 odonates (Wilson, 2005). Fujian has the third highest recorded number of zygoptera with 66 out of a total number of 199 odonates (Zhang, 1999). Approximately 34% of the combined Guangdong, Hong Kong and Macao fauna is made up of Zygoptera, which is similar to neighbouring Hainan with 35% (Wilson & Reels, 2001) and Guangxi with 37% (Wilson & Reels, 2003; Wilson, 2005). For comparison the Thai odonate fauna is comprised of 43% Zygoptera out of a total of 308 species (Paulson, 2005). Thailand has proportionally much higher numbers of the tropical platycnemid genus *Coelliccia* with 13 species as compared with two species from Guangdong's. In general the proportion of Zygoptera in the fauna is lower with increasing latitude. The proportion of Zygoptera, ca 34%, for Guangdong is similar to Europe which has ca 35%.

²The families recognised in this article follow Schorr et al (2006). Following extensive molecular phylogenetic reconstruction studies the genus *Macromia* is now recognised within the family Macromiidae and both the genera *Idionyx* and *Macromidia* have been removed from Corduliidae but their true family status remains uncertain (Dijkstra et al., 2013a). In addition the damselfly genus *Philoganga* has now been removed from Diphlebiidae and is recognised in the family Philogangidae, the genus *Philosina* has been removed from Megapodagrionidae and placed in Philosinidae, both the genera *Agriomorpha* and *Rhipidolestes* have also been removed from Megapodagrionidae and placed together in a family of uncertain status, *Onychargia* has been removed from Coenagrionidae and placed in Platycnemididae and the genus *Prodasineura* has been removed from the family Protoneuridae, which has been sunk, and placed in the family Platycnemididae (Dijkstra et al., 2013b).

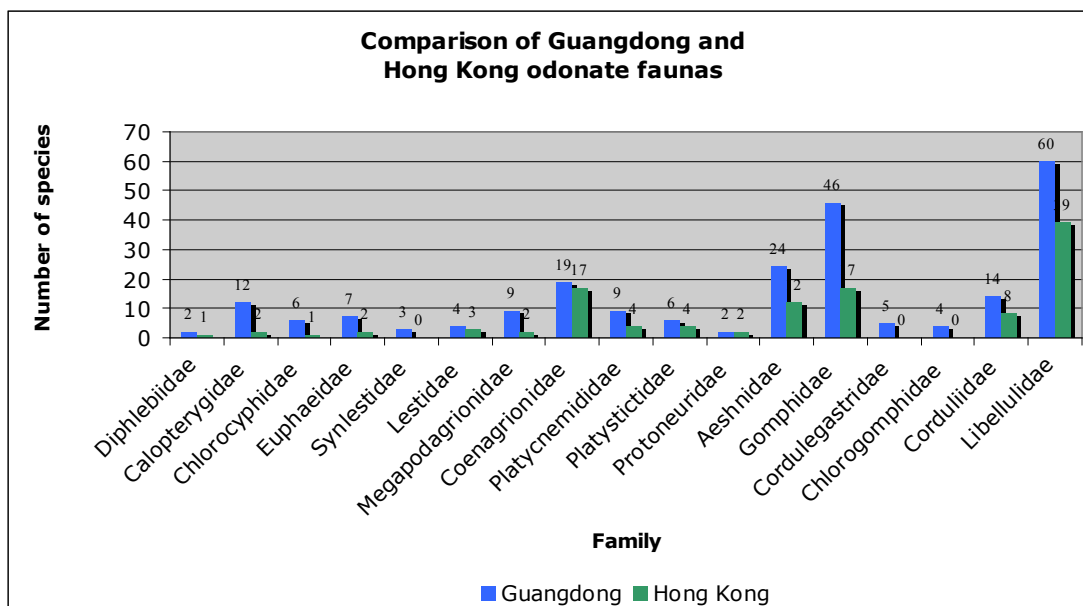


Figure 6. Graph illustrating number of species within each family for Guangdong and Hong Kong

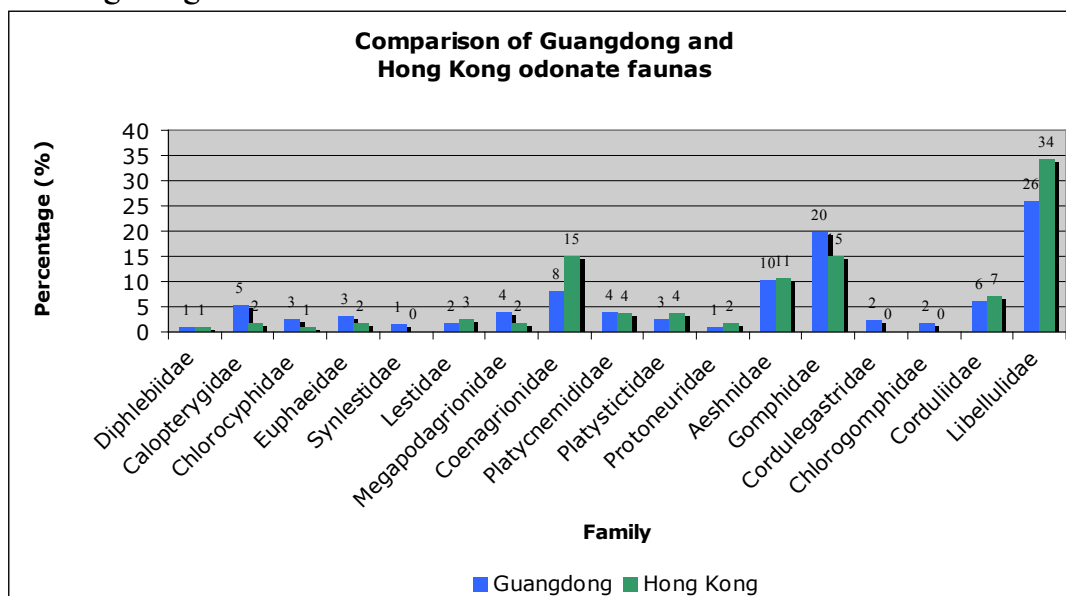


Figure 7. Graph illustrating percentage of species within each family for Guangdong and Hong Kong

Wilson (1997) estimated the fauna of Hong Kong was comprised of mainly Oriental or tropical species with ca 6.5% of Palaearctic origin. Two of these Palaearctic species include Brauer's late nineteenth century records of *Cercion hieroglyphicum* and *Ischnura asiatica* (Brauer, 1865), which have not been recorded from Hong Kong since. With the exception of a few coenagrionids and libellulids, notably representatives of the genus *Sympetrum*, the odonate fauna of Guangdong is also tropical in nature. No species of *Sympetrum* are found in Hong Kong or S Guangdong but as many as 10 species are recorded from N Guangdong, between latitudes 24°N to 25°N. At subfamily level the make-up of the fauna of Hong Kong and Guangdong looks similar. Hong Kong has 37 (33%) Zygoptera and 76 (67%) Anisoptera, whereas 79 Zygoptera (34%) and 153 (66%) Anisoptera have been recorded from Guangdong. However, a comparison of the numbers of species representatives in each family reveals notable differences between the Hong Kong and Guangdong faunas (see graph Figure 6). There are approximately twice as many odonates recorded from Guangdong as from Hong Kong i.e. 113 for Hong Kong as compared with 232 for Guangdong. If the Hong Kong fauna had similar representation from each family to Guangdong then roughly half the numbers of species should occur. This is clearly not the case for many families. Calopterygidae, Chlorocyphidae, Megapodagrionidae and Gomphidae are significantly under represented in Hong Kong and Coenagrionidae and Libellulidae are over represented when compared with the Guangdong fauna. The pattern is clearly revealed in Figure 7, which shows the percentage composition for each family for Hong Kong and Guangdong.

The majority of species belonging to the families, which are under represented in Hong Kong, are forest dwelling stream specialists whereas the over represented families contain many widespread species, which prefer lentic habitats. The faunal composition reflects Hong Kong's historical lack of forest cover and, despite the recent regeneration of forest, the fauna is typical of open, lentic habitat. Many of the stream specialists, which occur in Guangdong, but not Hong Kong, are rare species with restricted distributions. However, there are a few common and widespread, forest dwelling lotic species in Guangdong, which could be expected to colonise, or recolonise Hong Kong, if they could make their way past the extensive urban areas of Shenzhen surrounding Hong Kong. These species include the calopterygids *Calopteryx melli*, *Matrona basilaris*³ and *Vestalis velata* and the chlorocyphid *Rhinocypha fenestrella*.

Recent forest dwelling odonate colonisers to Hong Kong

It is probable that several species, which have only recently been recorded from Hong Kong, have only just established themselves. Of course it is possible that low numbers may have survived in refugia during the long period of deforestation and somehow avoided detection but it is also likely that a high proportion of the recently recorded Anisoptera species have only just colonised or recolonised. A list of forest-dwelling species recorded in Hong Kong since 1990 is provided in Table 1 below. Excellent photographs of these species, taken by Bergman Ng in Hong Kong, are provided at Figures 8-30. Of these taxa only the weak flying platystictids and *Rhipidolestes*, which can exist in small areas of habitat, are likely to have survived in Hong Kong during the long period of deforestation, perhaps clinging on in sparsely vegetated mountain ravines. The remaining taxa, comprised of recently recorded anisopterans, are all strong flyers and highly dispersive, and are likely to have colonised or recolonised from adjacent Guangdong forests in recent years.

Megapodagrionidae

Rhipidolestes janetae Wilson, 1997* - (Fig. 8)

Platystictidae

Drepanosticta hongkongensis Wilson, 1997 - (Fig. 9)

Protosticta beaumonti Wilson, 1997 - (Fig. 10)

Sinosticta ogatai (Matsuki & Saito, 1996) - (Fig. 11)

Aeshnidae

Cephalaeschna klotsi Asahina, 1982 - (Fig. 12)

Gynacantha japonica Barteneff, 1909 - (Fig. 13)

Planaeschna skiaperipola Wilson & Xu, 2008

Polycanthagyna erythromelas (Mclachlan, 1896) - (Fig. 14)

Gomphidae

Anisogomphus koxingai Chao, 1954 - (Fig. 15)

Fukienogomphus choifungae Wilson & Tam, 2006 - (Fig. 16)

Gomphidia kelloggi Needham, 1930 - (Fig. 17)

Labrogomphus torvus Needham, 1931 - (Fig. 18)

Gomphidae continued

| *Lamelligomphus hainanensis* (Chao, 1953) - (Fig. 19)

| *Megalogomphus sommeri* (Selys, 1854) - (Fig. 20)

| *Melligomphus guangdongensis* (Chao, 1994) - (Fig. 21)

| *Sieboldius alexanderi* Chao, 1955 - (Fig. 22)

| *Stylogomphus chunliuae* Chao, 1954 - (Fig. 23)

Corduliidae

| *Macromia berlandi* Lieftinck, 1941** - (Fig. 24)

| *Macromia katae* Wilson, 1993** - (Fig. 25)

| *Macromia urania* Ris, 1916** - (Fig. 26)

| *Macromidia ellenae* Wilson, 1996⁺ - (Fig. 27)

| *Idionyx claudia* Ris, 1912⁺ - (Fig. 28)

Libellulidae

| *Onychogomphus testacea tonkinensis* Martin, 1904 - (Fig. 29)

| *Zygonyx asahinai* Matsuki & Saito, 1995 - (Fig. 30)

Table 1 and Figures 8-30. Forest loving species recorded in Hong Kong from 1990 to 2006. Note since 2006 the forest dwelling gomphid *Heliogomphus retroflexus* has been recorded from Sha Lo Tung, Hong Kong on 1 July 2009 by Mahler Ka (LK Cheng/KDP Wilson pers com., 15 Jul 2009). *Now placed in Rhipidolestidae. **Now placed in Macromiidae. ⁺Now removed from Corduliidae but considered of uncertain status (*incertae sedis*) or belonging to Synthemiidae (see Footnote 2).

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³ Malte Seehausen has just published records of *Matrona basilaris* from late 19th Century Hong Kong in an IDF-Report (Seehausen, 2014).

Fig. 8



Fig. 9



Fig. 10



Fig. 11



Fig. 12



Fig. 13



Fig. 14



Fig. 15



Fig. 16



Fig. 17



Fig. 18



Fig. 19



Fig. 20



Fig. 21





Fig. 22



Fig. 23



Fig. 24



Fig. 25



Fig. 26



Fig. 27



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Appendix 1. List of sites surveyed in Guangdong Province.

Site	Coordinates	Area (km ²)	Altitude (m)	Status	Dates surveyed
Baiyong, Yangchung County, SW Guangdong	22°24'N, 111°38'E	37	200-1,042	P	3 v 1998; 1-4 v 2002
Chebaling National Nature Reserve, Shixing County, NE Guangdong	24°14'-24°46'N, 114°09'-114°16'E	76	330-1,256	N	10-12 v 1996; 7-11 iv 1999; 15-17 viii 2000; 20-23 vii 2001; 19-21 iv 2002; 25-26 v 2002; 27-28 vii 2002
Chengjia Nature Reserve, Yangshan County, NW Guangdong	24° 47' N, 112° 49' E	79	700	P	4-5 vii 2000; 25 vii 2002
Dachouding Nature Reserve, Huaji County, NW Guangdong	24°10' N to 112°23'- 112°27'E	27.3	625-1,626	Ci	15-19 iv 2001
Dawuling, Xinyi County, SW Guangdong	22°14'-22°17'N, 111°08'-111°17'E	34.4	800-1,704	P	1-5 xi 2001; 2 v 2002; 30 vi 2002; 3 vii 2002
Dinghushan, Zhaoqing City, C Guangdong	23°10'-23°11'N, 112°31'-112°34'E	11.6	140-1000	M & B	15-20 iv 1992, 5-8 vi 1992; 12-16 vi 1993; 10-16 vi 1994; 1-4 vi 1995; 6 v 1998; 6 iv 2000; 12 v 2002; 11-12 viii 2005.
Fengxi Nature Reserve, Dapu County, E Guangdong	24°40'N, 116°45'E	10.9	200-800	P	28-29 vii 2003
Gaozhou Reservoir, Gaozhou City, SW Guangdong	22°09'N, 111°00'E	1002			4-5 v 2002
Guanyinshan Nature Reserve, Fogang County, C Guangdong	23°57'N, 113°32'E	28	350-1,219	P	10-12 viii 2000
Heishiding Nature Reserve, Fengkai County, W Guangdong	23°27'-23°30'N, 111°53, 112°00'E	42	150-927	P	4-8 vii 2002
Heweishan Forest Farm, Yangchun City, SW Guangdong	21°53'N, 111°07'E	160	to 1,337	Co	4-5 v 1998
Liuqihe, Conghua City, C Guangdong	23° 45' N, 113° 51' E	93	To 1,147	F	13-14, iv 2002; 24-28 vi 2002
Lungdoushe, Shixing County, N Guangdong	24°41'N, 113°51'E				28 vii 2002
Luofushan, Boluo County, C Guangdong	23°20'N, 114°00'E	98	100-1,281	P	8 viii 2004
Luokeng Nature Reserve, SW Guangdong	24°31'N, 113°20'E	294	to 1,587	P	18 ix 2002
Nanling National Nature Reserve, N Guangdong (includes Babaoshan, Chengjia, Dadingshan, Henglongbei, Jiuchongshan, Longtanjiao, Maoping, Pengshan, Shikengkong, Shiziping and Xiaohuangshan areas plus Mangshan in adjacent Hunan province)	24°38'-25°08'N, 112°40'-113°15'E	584	300-1,902	N	25 vi 2000 - 7 vii 2000; 23-25 vii 2003; 9-10 viii 2005
Nankunshan, Longmen County, C Guangdong	23°35'N, 113°45'E	17.5	200-1,100	N	8 vi 2002; 7 viii 2004
Qimuzhang Nature Reserve, Heyuan City, C Guangdong	23°42'N, 115°20'E	58.5	800-1,318	P	31 vii 2003
Qixingkeng, SW Guangdong	22°15'N, 112°02'E	6.9	100-856	Ci	24 xi 1998 - 1 xii 1998
Sanyue Nature Reserve, Huaiji County, NW Guangdong	24° 07' - 24° 14' N, 111°51'-111°59'E	67.6	240-1,290	Ci	21-24 iv 2001

Site	Coordinates	Area (km ²)	Altitude (m)	Status	Dates surveyed
Shimentai, Yingde City County, N Guangdong	24°22' - 24°31' N 113°05' - 113°31' E	823	320-1,587	P	12-14 viii 2000; 28-29 x 2001; 28-30 iii 2003; 6-8 viii 2003; 5-6 xi 2005; 3-4 xii 2005; 3-7 xi 2005; 5-6 xi 2005
Tianluhu Park, Taihe Town, C Guangdong (Guangzhou)	23°18', 113°21'E			F	23-24 vi 2003
Wutongshan National Forest Park, Shenzhen	22°15'N, 113°55'E	31	to 944	F	16-17 v 2001
Xiangtoushan, Huizhou City, SE Guangdong	23°23'N, 114°20'E	107		N	19 v 2002; 11 v 2004
Xiaokeng Forest Park, N Guangdong	24°42'H, 113°49'E				26 v 2002
Yunjishan, Xinfeng County, N Guangdong	24°04' N , 114°11'E	27	To 1,422	P	18-20 vii 2003

Ci = City-level Nature Reserve, Co = County Level Nature Reserve, F = National Forest Park, M & B = Man & Biosphere Reserve, N = National Nature Reserve, P = Provincial Nature Reserve, No = No protected area status.